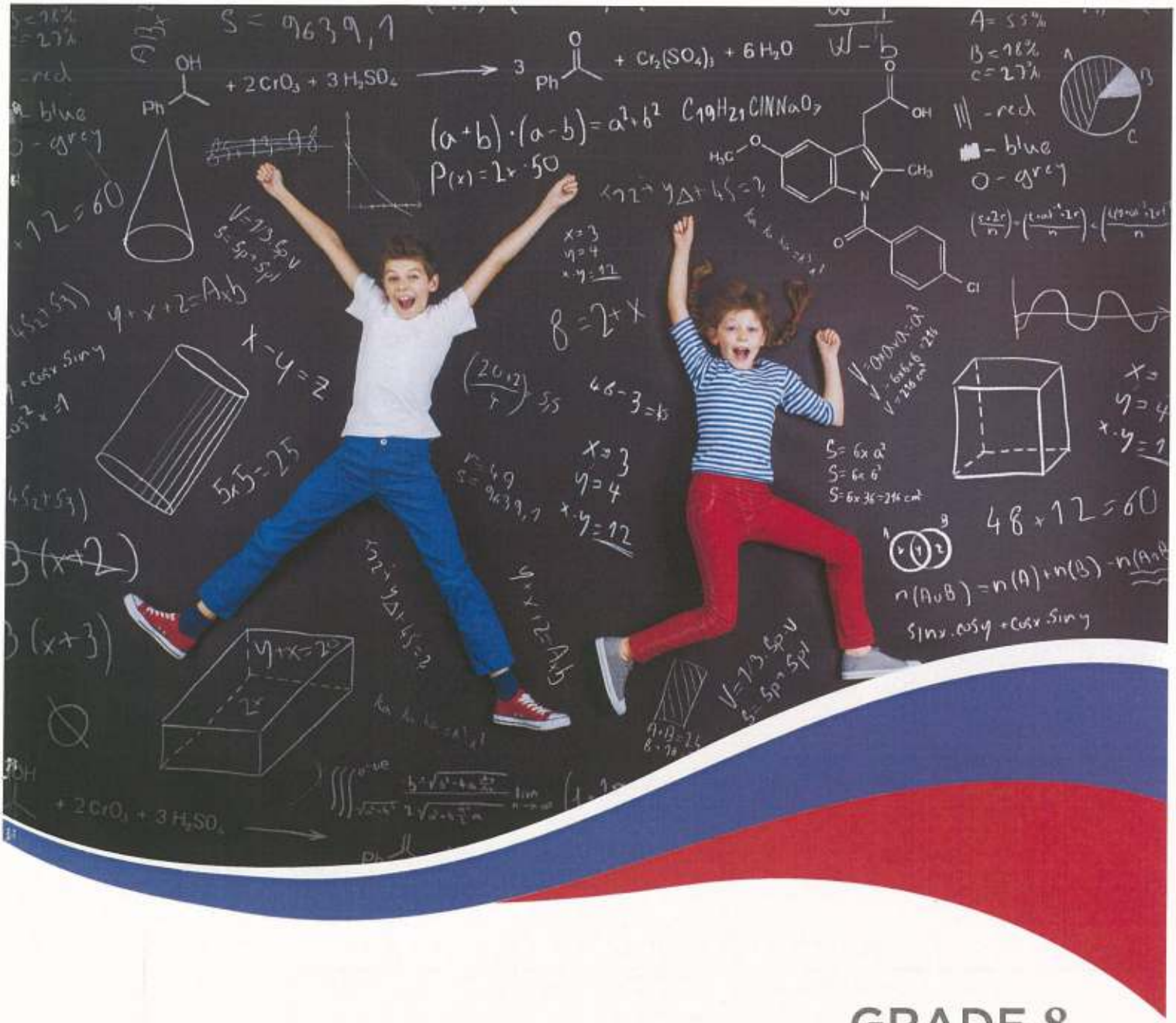


GRADE 8

MATHEMATICS OLYMPIAD

Official Guide

International Olympiad Foundation

International Olympiad Foundation

Grade VIII

CONTENTS

SECTION 1: MATHEMATICAL REASONING

1. Playing With Numbers

Numbers in General Form

In general, any two digit number pq made of digits p and q can be written as,

$$pq = 10 \times p + q = 10p + q$$
$$qp = 10 \times q + p = 10q + p$$

Similarly,

For a 3-digit number pqr made of digits p, q and r can be written as,

$$pqr = 1000\ p + 100q + r$$

Example 1: Ravi took a number pq. He reversed the digits of the number and added the original number and obtained 187. If $p > q$, then find the values of p and q.

Solution: $pq = 100p + q$

After reversing the digits, $qp = 100q + p$

$\therefore \quad pq + qp = (10p + q) + (10q + p)$

$= 11p + 11q = 11(p + q)$

$\Rightarrow \quad 11(p + q) = 187$

$\Rightarrow \quad p + q = 17$ [17 can be obtained by adding 9 and 8 only].

$\because p > q, \therefore p = 9, q = 8.$

Example 2: Sangam takes a number 'ab' and reversed its digits. Afterwards, he subtracted the new number from the original number to obtain 27 as a result. Find a and b, if, $ab > ba$.

Solution: $ab = 10a + b$

After reversing the digits, $ba = 10b + a$

$\therefore \quad ab - ba = (10a + b) - (10b + a)$

$ab - ba = 9(a - b) = 72$

$\Rightarrow \quad a - b = 8$ ...(i)

$\therefore a = 9, b = 8$ only satisfies the above equation (i).

Example 3: If we take a number 'abc' and interchange the first and last digits to obtains 'cba', then,

$$abc - cba = 198$$
$$abc + cba = 88p$$

are obtained. Find p, a, b and c.

Solution: $abc = 100\ a + 10\ b + c$

$cba = 100\ c + 10\ b + a$

$\therefore \quad abc - cba = 99\ (a - c) = 198$

$\Rightarrow \quad (a - c) = 2$ ...(i)

$abc + cba = 88p = 101(a+c) + 20b = 800 + 80 + p$

$\Rightarrow \qquad 20b = 80$

$\Rightarrow \qquad b = 4,\ a + c = \dfrac{800 + p}{101}$ ...(ii)

p, a, c are natural numbers. Therefore, $p = 8, a + c = \dfrac{808}{101} = 8$ ...(iii)

$a = 5, c = 3, b = 4$ [From (i), (ii), (iii)].

$\therefore\ a = 5, b = 4, c = 3, p = 8.$

Letters For Digits

Here, some mathematical puzzles are solved using general techniques.

Example 4: Determine a, b, c, if,

$$\begin{array}{r} 4\,a \\ +\,9\,8 \\ \hline c\,b\,3 \end{array}$$

Solution: $4a = 40 = a$

$98 = 90 + 8$

$\therefore\ 4a + 98 = 138 + a$

$a + 8$ gives 3 on addition, if, $a = 5$

On addition 1, is left as a carry which is added with $(4 + 9)$.

$\therefore \qquad cb = 4 + 9 + 1 = 14$

$\therefore \qquad c = 1, b = 4, a = 5$

Example 5: $\begin{array}{r} 7\,a \\ \times\,6 \\ \hline a\,a\,a \end{array}$, Find a.

Solution: $7a = 70 + a.$

$\therefore \qquad (70 + a) \times 6 = 420 + 6a$

$\because\ a$ is a natural number, and, $(420 + 6a)$ give $(a\ a\ a)$ as a result.

$\therefore\ a = 4$

Example 6: Find a, b, c, if,

$$\begin{array}{r} a\,8\,3 \\ \times\,c\,9 \\ \hline a\,0\,4\,a \\ +\,1\,5\,b\,b\,0 \\ \hline c\,c\,a\,0\,a \end{array}$$

Solution: $3 \times 9 = 27$

$\therefore\ a = 7$

$\therefore$
$$\begin{array}{r} 783 \\ \times c9 \\ \hline 7047 \\ +15bb0 \\ \hline cc707 \end{array}$$

$\because 4 + b$ gives such a number whose unit's place digit is zero.

$\therefore b = 6$. Now,
$$\begin{array}{r} 7047 \\ +15660 \\ \hline 22107 \end{array}$$

$\therefore c = 2$

Tests of Divisibility

1. **Divisibility by 10:** Numbers whose units place is zero are divisible by 10, otherwise, not.
2. **Divisibility by 2:** If the one's digit of a number is 0,2,4,6,8 then the number is divisible by 2.
3. **Divisibility by 3 and 9:**
   (i) A number N is divisible by 9, if, the sum of its digits is divisible by 9.
   (ii) A number N is divisibility by 3, if, the sum of its digits is divisible by 3.
4. **Divisibility by 5:** If the one's digit of a number is 0 or 5, then the number is divisible by 5.
5. **Divisibility by 11:** A number *abcdefg* is divisible by 11, if,
$$(a + c + e + g) - (b + d + f) = 0,$$

Multiple Choice Questions

1. What is the next number in the series 5, 10, 26, 50, 122, ...
   (a) 129 (b) 170 (b) 204 (d) 138
2. A number is divisible by 63 if it is divisible by:
   (a) 7 (b) 9
   (c) both 7 and 9 (d) both 3 and 7
3. What is the sum of first 15 natural numbers?
   (a) 122 (b) 106 (c) 105 (d) 120
4. 7,835 + 2b1 = 8126, then the value of b will be :
   (a) 9 (b) 8 (c) 7 (d) 3
5. What is the sum of first 20 odd numbers?
   (a) 350 (b) 400 (c) 355 (d) 420
6. $\begin{array}{r} 182 \\ \times 22 \\ \hline a00a \end{array}$, the value of '$a$' will be :
   (a) 2 (b) 3 (c) 4 (d) 8
7. What will be the last digit of 7^{333} ?
   (a) 1 (b) 7 (c) 3 (d) 9
8. Which of the following numbers is divisible by 11?
   (a) 1221 (b) 1223 (c) 1332 (d) 1343
9. $\begin{array}{r} 73x5 \\ -2y77 \\ \hline 4518 \end{array}$, the value of $(x + y)$ will be :
   (a) 16 (b) 17 (c) 18 (d) 15
10. $\begin{array}{r} aa \\ \times aa \\ \hline b8b \end{array}$, the value of (ab) will be : $(1 \le a, b \le 9)$
    (a) 32 (b) 16
    (c) 8 (d) 4
11. 763*312, which number should the * be replaced to make the number divisible by 9?
    (a) 7 (b) 5
    (c) 8 (d) 6

12. 76215*, the replacement of * by a number gives a number which is divisible by 11, the number will be :
(a) 8 (b) 7 (c) 6 (d) 9

13. $\begin{array}{r} ABC \\ ABC \\ +ABC \\ \hline BBB \end{array}$, the values of A, B, C are digits from 1 to 9. What will be value of B?
(a) 8 (b) 4 (c) 1 (d) 3

14. What will be the sum of first 22 natural numbers, which, are even?
(a) 506 (b) 406 (c) 484 (d) 253

15. One candle was guaranteed to burn for 6 hours, the other for 2 hours. They were both lit at same time. After some time one candle was twice as long as the other. For how long had they been burning?
(a) 3 hours (b) 6 hours
(c) $\frac{4}{3}$ hours (d) $\frac{3}{2}$ hours

16. Which is a 3-digit numbers, such that all its digits are prime and the 3 digits are the factors of the number?
(a) 735 (b) 537 (c) 435 9 (d) 245

17. Complete the square given below, and find the value of the sum of missing numbers. The sum of the magic square is 34.

5			
16		7	
	13		6
2		9	

(a) 68 (b) 39 (c) 78 (d) 84

18. Three numbers are such that their sum is 10 and their product is maximum. The product will be :
(a) 32 (b) 36 (c) 45 (d) 42

19. What will be the one's place digit of 6^{222}?
(a) 4 (b) 8
(c) 1 (d) 6

20. Find the smallest number which can be expressed as the sum of two cubes of natural numbers.
(a) 1729 (b) 1001 (c) 1728 (d) 1332

21. $\begin{array}{r} PAT \\ +EAT \\ \hline FEEA \end{array}$, where, P, A, T, E, F are digits from to what will be the value of F?
(a) 4 (b) 3 (c) 2 (d) 1

22. Sum of 3 numbers = product of 3 numbers. If the numbers are consecutive and natural. Find the triplet having least value, of their sum.
(a) 2, 3, 4 (b) 1, 2, 3
(c) 3, 4, 6 (d) 1, – 1, 0

23. The square of a number is having 5 at its units place and 2 at its tenths place, then the least natural number having these properties are :
(a) 5 (b) 15 (c) 25 (d) 4

24. The product 135 × 135 will be equal to :
(a) 19625 (b) 16925 (c) 18225 (d) 16235

25. Which of the following number is not a perfect squares ?
(a) 1024 (b) 441 (c) 1681 (d) 1282

26. $26 + 34 \times 17 \div 4 = 34$, which of the two signs should be interchanged to get the desired result?
(a) No change (b) ÷, +
(c) ×, ÷ (d) +, ×

27. Which is the least number divisible by 2, 3, 5 and 55 ?
(a) 110 (b) 550 (c) 660 (d) 330

28. What is the square number just greater than 60, which can be expressed as a sum of two successive triangular numbers?
(a) 72 (b) 64 (c) 81 (d) 100

29. What will be one's place digit for 9^{201}?
(a) 9 (b) 1 (c) 3 (d) 7

30. What is the value of P if P, Q, R are replaced by digits from 1 to 9? $PQ \times QP = RQPR$.
(a) 6 (b) 8 (c) 7 (d) 5

Answer Key

1. (b)	2. (c)	3. (d)	4. (a)	5. (b)	6. (c)	7. (b)	8. (d)	9. (b)	10. (c)
11. (b)	12. (b)	13. (b)	14. (a)	15. (c)	16. (a)	17. (c)	18. (b)	19. (d)	20. (a)
21. (d)	22. (b)	23. (a)	24. (c)	25. (d)	26. (c)	27. (d)	28. (b)	29. (a)	30. (b)

Hints and Solutions

1. **(b)** 5, 10, 26, 50, 122, ...

   $(2)^2+1, (3)^2+1, (5)^2+1,$

   $(7)^2+1, (11)^2+1, (13)^2+1$

   $\therefore$ Next number $= (13)^2 + 1 = 170$

2. **(c)** $63 = 7 \times 9$

   $\therefore$ If a number is divisible by B, then it should be divisible by both 7 and 9.

3. **(d)** Sum of first 'n' natural numbers $= \frac{n(n+1)}{2}$

   $\therefore$ Sum of first 15 natural numbers

   $$= 15 \times \frac{(15+1)}{2}$$

   $$= 15 \times 8 = 120$$

4. **(a)**
   $$\begin{array}{r} {\scriptstyle x} \\ 7835 \\ +2b1 \\ \hline 8126 \end{array}$$

   Let 'x' be the carry, resulting from sum of b and 3.

   $$8 + 2 + x = 11 \Rightarrow x = 1$$

   $\therefore \quad 3 + b = 12$

   $\Rightarrow \quad b = 9$

5. **(b)** Sum of 'n' odd natural numbers (first) $= n^2$

   $\therefore$ Sum of first 20 odd natural numbers $= (20)^2$

   $= 400$

6. **(c)** $182 \times 22 = 4004$

   $\therefore \quad a = 4$

7. **(b)** $7^1 = 7$

   $7^2 = 49$

   $7^3 = 343$

   $7^4 = 2401$

   $7^5 = 16807$

   $\therefore$ After leaving 43 exponents 7^n repeats its unit digit.

   $\therefore$ 7^{4n} has 1 as its units place digit.

   $\therefore$ 7^{332} has 1 as units place digit.

   $\therefore$ 7^{333} has 7 as its units place digit.

8. **(d)** If, sum of digits at odd place

   = Sum of digits at even place.

   Then , the number will be divisible by 11.

   $\therefore$ 1343 is not divisible by 11.

9. **(b)**
   $$\begin{array}{r} 4518 \\ +2y77 \\ \hline 73x5 \end{array}$$

   When 8 and 7 are added, 1 is carry.

   $\therefore \quad x = 7 + 1 + 1 = 9$

   The carry of sum $(5 + y)$ should be 1.

   $\therefore \quad 5 + y = 13$

   $\Rightarrow \quad y = 8$

   $\therefore \quad x + y = 17$

10. **(c)**
    $$\begin{array}{r} aa \\ \times aa \\ \hline a^2\,a^2 \\ a^2\,a^2\times \\ \hline a^2\,2a^2a^2 \end{array} \qquad \begin{array}{r} ax \\ \times aa \\ \hline b8b \end{array}$$

    $\Rightarrow \quad a^2 + a^2 = 8$

    $\Rightarrow \quad 2a^2 = 8$

    $\Rightarrow \quad a = 2, b = 4$

    $\therefore \quad a \times b = 8$

11. **(b)** For a number to be divisible by 9, its digits sum should be divisible by 9.

$\therefore\ 7+6+3+*+3+1+2=22+*.$

$\therefore$ 5 should be written on place of * to make the number divisible by 9.

12. **(b)** 76215*

$\Rightarrow$ Sum of digits at odd places

$= *+1+6 = *=7$

Sum of digits at even places $= 5+2+7$

$= 14$

For divisibility with 11,

$*+7=14$

$\Rightarrow \quad *=7$

13. **(b)** $3c = x$ B, where, x is the carry,

$\therefore\ x+3B = y\,B$, where y is the carry.

$\therefore\ y+3A = B.$

$\therefore\ C=8, B=4, A=1.$

$$\begin{array}{r} y\ x \\ A\ B\ C \\ A\ B\ C \\ +\ A\ B\ C \\ \hline B\ B\ C \end{array}$$

14. **(a)** Sum of first 22 even natural numbers

$= (2+4+\ldots\ldots+44)$

$= 2(1+2+\ldots\ldots+22)$

$= 2\times\dfrac{22\times23}{2}$

$= 2\times11\times23$

$= 22\times23$

$= 506$

15. **(c)** Let the candles have burnt for 'x' hours,

$$\left(1-\frac{x}{6}\right)=2\times\left(1-\frac{x}{2}\right)$$

$\Rightarrow \quad x=\dfrac{4}{3}$ hours.

16. **(a)** 735 is a number having all its digits, a prime number and all the digits of 735 are the factors of 735.

17. **(c)**

5	x	e	d
16	y	7	c
a	13	b	6
2	2	9	f

We have to find, the value of

$(a+b+c+d+e)+(x+y+z)+f=x$

$\because$ Sum of numbers of any row/column = 34

$\therefore\ a+b+13+6=x+y+z+13$

$=e+b+7+9=c+d+6+f$

$=5+16+a+2=x+e+d+5$

$=16+y+7+c=2+z+9+f=34$

$\Rightarrow 2(a+b+c+d+e+f+x+y+z)$

$+19+13+16+6+23+5$

$+23+11=34\times8$

$\Rightarrow \quad 2x+116=272$

$\Rightarrow \quad x=78$

18. **(b)** Let the natural numbers be, y and z.

$\therefore \quad \dfrac{x+y+z}{3}\geq(xyz)^{\frac{1}{3}}$ [AM $\geq$ GM]

$\Rightarrow \quad \dfrac{10}{3}\geq(xyz)^{\frac{1}{3}}$

$\Rightarrow \quad xyz\leq\dfrac{1000}{27}$

$\Rightarrow \quad xyz\leq37.03$

$\therefore$ The limiting value of xyz is 37.03,

$\because$ The numbers x,y and z are natural.

$\therefore$ 37.03 cannot be obtained as a product.

$\because$ 37 is a prime number.

$\therefore$ 36 is the greatest number which can be obtained as a product of 3 natural numbers whose sum is 10.

19. **(d)** $60=1$

$6^1=6$

$6^2=36$

$6^3=216$

$6^4=1296$

$6^5=7776$

$\therefore$ It is observed that 6^n has 6 at its units place.

$\therefore$ 6^{222} has 6 as its unit's place digit.

20. **(a)** $1729 = (12)^3 + (1)^3 = (10)^3 + (1)^3$

$\therefore$ 1729 can be expressed as sum of two perfect natural cubes.

It is the smallest number to satisfy this condition, and, is known as Ramanujan's Number.

21. **(d)**
$$\begin{array}{r} y\,x \\ P\,A\,T \\ +\,E\,A\,T \\ \hline F\,E\,E\,A \end{array}$$

x, y are respective carries.

$$y + P + E + F\,E$$
$$x + 2A = y\,E$$
$$T + T = x\,A$$

$\Rightarrow P = 9, A = 8, T = 4, E = 6$ and $F = 1$

$\therefore$ $F = 1$

22. **(b)** $xyz = x + y + z$ ...(i)

We also know that,

$$\left(\frac{x+y+z}{3}\right)^3 \geq xyz$$

$$\left(\frac{x+y+z}{3}\right)^3 - (x+y+z) \geq 0$$

$$(x+y+z)\left(\frac{(x+y+z)^2}{9} - 1\right) \geq 0$$

$$(x+y+z)\left(\frac{(x+y+z)^2 - 9}{2}\right) \geq 0$$

$$(x+y+z)\,(x+y+z-3)\,(x+y+z+3) \geq 0$$

$\therefore$ Sum of 3 natural numbers > 3.

$\therefore$ From general interpretation,

$$1 + 2 + 3 = 1 \Rightarrow 2 \Rightarrow 3$$

$\therefore$ Required set of natural numbers = (1, 2, 3).

23. **(a)** $\because$ Last (unit) place digit = 5

$\therefore$ The least natural number whose perfect square is having 5, as its unit place digit will be equal to 5.

$\therefore$ $5^2 = 25$

24. **(c)** 135×135

Trick :

$135 \times 135 = 25$

Multiply the units place 5 and write the product, Add 1 to any one of the remaining digits at tenths place and write the product on tenths place.

$13 \times 14 = 182$

$\therefore$ $135 \times 135 = 18225$

25. **(d)** $\because$ Perfect squares should have 1, 4, 9, 6 and 5 as their units place digit.

$\therefore$ 1282 is not a perfect square.

26. **(c)** Interchange of $\times$, $\div$ will produce the desired result.

27. **(d)** Least number which is divisible by 2, 3, 5 and 55

= LCM 2, 3, 5 and 55

$= 66 \times 5$

$= 330$

28. **(b)** $60 <$ Sum of two triangular numbers = perfect square. The smallest number satisfying this condition is 64.

29. **(a)** $91 = 9$

$9^2 = 81$

$9^3 = 243 \times 3 = 729$

$9^4 = 6561$

$9^5 = 59049$

$\therefore$ $9^{4n} = 6561$

$\therefore$ 9^{200} has 1 as its units place digit.

$\therefore$ 9^{201} has 9 as its units place digit.

30. **(b)**
$$\begin{array}{r} P\,Q \\ \times\,Q\,P \\ \hline R\,Q\,P\,R \end{array}$$

$P = 8, Q = 7, R = 6$

$\therefore$ $P = 8$

2. Rational Numbers

Rational Numbers

A number in the form of a/b, where, 'a' and 'b' are integers, and $b \neq 0$, is called a rational number.

Example: $\frac{-1}{2}, \frac{3}{5}, \frac{4}{90}$, etc.

Equivalent Rational Numbers

Two rational numbers $\frac{m}{n}$ and $\frac{p}{q}$ are equivalent, if $m \times q = n \times p$.

Infinite number of rational numbers, each of which is equivalent to a given rational number, can be written. The equivalent rational numbers can be obtained by multiplying the numerator and denominator of the given rational number by the same non-zero integer.

$$\therefore \quad \frac{a}{b} = \frac{a \times p}{b \times p} \text{ (where, } p \neq 0\text{).}$$

A rational number, whose numerator and denominator has only one common factor equal to 1 is said to be standard form of a rational number.

Terminating and Non-Terminating Decimals

If the denominator of a rational number, has, no other factors than 2, or, 5 or both is called terminating decimal, otherwise, the decimal will be non-terminating decimal.

Example: $\frac{1}{5}, \frac{1}{25}, \frac{1}{50}, \frac{1}{100}$ are terminating decimals and $\frac{1}{70}, \frac{70}{85}, \frac{14}{75}, \frac{17}{55}$ are non-terminating decimals.

First reduce the rational number into its standard form while, checking for terminating or non-terminating decimal.

Example 1: Which of the following rational numbers is the smallest ?

(a) $\frac{-15}{7}$, (b) $\frac{-5}{28}$,

(c) $\frac{-25}{49}$, (d) $\frac{-35}{42}$.

Solution: LCM of denominators, *i.e.,* 7,28,49,42 is 588.

Now $\frac{-15}{7} = \frac{-15 \times 84}{7 \times 48} = \frac{-1260}{588}$

$\frac{-5}{28} = \frac{-5 \times 21}{28 \times 21} = \frac{-105}{588}$

$$\frac{-25}{49}=\frac{-25\times12}{49\times12}=\frac{-300}{588}$$

$$\frac{-35}{42}=\frac{-35\times14}{42\times14}=\frac{-490}{588}$$

$\because$ $\frac{-1260}{588}$ is the smallest of the four rational numbers.

$\therefore$ $\frac{-15}{7}$ is the smallest rational number among the given rational numbers.

Example 2: The sum of two rational numbers is $\frac{7}{8}$. If one of them is $\frac{1}{4}$, find the other number.

Solution: Let the other rational number be x.

$\therefore$ $$\frac{1}{4}+x=\frac{7}{8}$$

$\Rightarrow$ $$x=\frac{7}{8}-\frac{1}{4}=\frac{7}{8}-\frac{2}{8}=\frac{5}{8}$$

$\therefore$ Required rational number = 5/8.

Example 3: With what rational number should $\frac{-25}{343}$ be multiplied to get $\frac{5}{14}$ as quotient (product)?

Solution: Let required number be x,

$\therefore$ $$\frac{-25}{343}\times x=\frac{5}{14}$$

$\Rightarrow$ $$x=\frac{5}{14}\times\frac{-343}{25}=\frac{-49}{10}$$

$\therefore$ Required number = $\frac{-49}{10}$.

Example 4: Simplify :

$$\frac{7}{12}\times\frac{28}{3}-\frac{7}{10}\times\frac{5}{13}+\frac{2}{13}\times169$$

Solution: We have $\frac{7}{12}\times\frac{28}{3}-\frac{7}{10}\times\frac{5}{13}+\frac{2}{13}\times169$

$$=\frac{7}{12}\times\frac{28}{13}-\frac{7\times5}{10\times13}+26$$

$$=\frac{7\times14}{6\times13}-\frac{7}{26}+26=\frac{7}{26}\left(\frac{14}{3}-1\right)+26$$

$$=\frac{7}{26}\times\frac{11}{3}+26=\frac{77}{78}+26=\frac{77+2028}{78}=\frac{2105}{78}.$$

Properties of Rational Numbers

1. **Commutative Property of Addition:** If x and y are two rational numbers, then $x + y = y + x$.
2. **Associative Property of Addition:** If x, y and z be any three rational numbers, then
$$(x + y) + z = x + (y + z).$$
3. **Property of Zero:** If x be any rational number, then,
$$0 + x = x + 0 = x, \text{ and,}$$
$$0 \times x = x \times 0 = 0.$$
4. **Additive/Multiplicative Inverse Property:** If x be any rational number, then, $(-0$ is called the additive inverse of x, as.
$$x + (-x) = (-x) + x = 0.$$
If x $(x \neq 0)$ be any rational number, then, $\left(\frac{1}{x}\right)$ is called the multiplicative inverse of x, as.
$$x \times \frac{1}{x} = \frac{1}{x} \times x = 1.$$
5. **Commutative Property of Multiplication:** If x, y and z be three rational numbers, then,
$$x \times (y \times z) = (x \times y) \times z.$$
7. **Distributive Property:** If x, y and z be any three rational numbers, then,
$$x \times (y + z) = xy + xz, \text{ or, } x \times (y - z) = xy - xz.$$
8. **Property of 1:** If x be any rational number, then $x \times 1 = 1 \times x = x$.

Example 5: If x, y, z be any three rational numbers, then which of the following alternatives is not true?

(a) $(x - y) + z = (x + y) + (y + z) - y$ (b) $x \div (y \div z) = (x \div y) \div (y \div z)$

(c) $(x + y) \times z = (x - y) + (y \times z)$ (d) $(x + y) \div z = (x \div z) + (y \div z)$

Solution: Considering option (b) $x \div (y \div z) = (x \div y) \div (y \div z)$

$\therefore$ Option (b) is not true.

Example 6: $x \times 0 = 0 \times x$, is true, but

$x \div 0 = 0 \div x$, is true or false? Justify.

Solution: $x \times 0 = 0 \times x = 0$ is satisfied by property of zero, but, if,

$x \div 0 = 0 \div x$, then, in L.H.S., 0 comes in denominator, which violates the condition of rational number.

Rational Numbers between Two Rational Numbers

- Between any two rational numbers, there exists infinitely rational numbers.
- If 'a' and 'b' be two rational numbers, such that,
$$a < b, \text{ then,}$$
$$a < \frac{a + b}{2} < b.$$
- Unlike natural numbers and integers, rational numbers do not have successors and predecessors.

Example 7: Find two rational numbers between $\frac{2}{13}$ and $\frac{5}{3}$.

Solution: LCM of 3 and $13 = 3 \times 13 = 39$.

$$\therefore \quad \frac{2}{13} = \frac{2\times 3}{13\times 3} = \frac{6}{39}$$

$$\frac{5}{13} = \frac{5\times 13}{3\times 13} = \frac{65}{39}$$

Between two integers 6 and 65, there are, $65 - 6 - 1 = 58$ integers,

$\therefore$ We choose any two integers, say, 8, and 23, then,

$$\frac{6}{39} < \frac{8}{39} < \frac{23}{39} < \frac{65}{39}$$

$\therefore$ Two integers between $\frac{2}{13}$ and $\frac{5}{13}$ are $\frac{8}{39}$ and $\frac{23}{39}$.

Example 8: Find ten rational numbers between $\frac{2}{3}$ and 3.

Solution: LCM of 3 and $1 = 3 \times 1 = 3$.

$$\frac{2}{3} = \frac{2}{3}, \text{ and } \frac{3}{1} = \frac{3\times 3}{1\times 3} = \frac{9}{3}$$

Between two integers 2 and 9, there are, $9 - 2 - 1 = 6$ integers, but, we require 10 rational numbers.

$\therefore$ we multiply the common denominator by any natural number, which, is greater than 1, say. 3, then,

$$\frac{2}{3} = \frac{2\times 2}{3\times 2} = \frac{4}{6} \text{ and } \frac{3}{1} = \frac{9\times 2}{3\times 2} = \frac{18}{6}$$

$\therefore$ Ten integers between $\frac{2}{3}$ and 3 are

$$\frac{5}{6}, \frac{6}{6}, \frac{7}{6}, \frac{8}{6}, \frac{9}{6}, \frac{10}{6}, \frac{11}{6}, \frac{12}{6}, \frac{13}{6}, \text{ or } \frac{5}{6}, 1, \frac{7}{6}, \frac{4}{3}, \frac{3}{2}, \frac{5}{3}, \frac{11}{6}, 2 \text{ and } \frac{13}{6}$$

Multiple Questions

1. If $\frac{3}{5}$ of a number exceeds its $\frac{2}{7}$ by 44, then what is the number?
   (a) 144 (b) 148 (c) 140 (d)160

2. A bus is moving at an average speed of $60\frac{2}{5}$ km/hr. How much distance it will cover in $7\frac{1}{2}$ hour?
   (a) 423 km (b) 453 km
   (c) 443 km (d) 463 km.

3. The sum of two numbers is $\frac{-4}{3}$. If one of them is -5 then what is the other number?
   (a) $\frac{11}{3}$ (b) $\frac{-11}{3}$ (c) $\frac{16}{3}$ (d) $\frac{19}{3}$

4. In a school $\frac{5}{8}$ of the students are boys. If the number of girls are 270. What is the number of boys in the school?
(a) 440 (b) 450 (c) 420 (d) 400

5. A cord of length $58\frac{1}{2}$ m has been cut into 26 pieces of equal length. What is the length of each piece?
(a) $2\frac{1}{4}$ m (b) $\frac{32}{75}$ m (c) $\frac{64}{75}$ m (d) $\frac{8}{15}$ m

6. The product of two numbers is $\frac{-16}{75}$. If one of the number is $\frac{-15}{14}$ what is the other number?
(a) $\frac{16}{75}$ (b) $\frac{32}{75}$ (c) $\frac{64}{75}$ (d) $\frac{8}{15}$

7. What should be subtracted from $\frac{-5}{3}$ to get $\frac{5}{6}$?
(a) $\frac{-5}{2}$ (b) $\frac{-3}{2}$ (c) $\frac{3}{2}$ (d) $\frac{-5}{4}$

8. What is additive inverse of $\frac{-7}{9}$?
(a) $\frac{7}{9}$ (b) $\frac{-9}{7}$ (c) $\frac{9}{7}$ (d) 1

9. The sum of two rational numbers is – 3. If one of the number is $\frac{-10}{3}$. What is the other number?
(a) $\frac{1}{3}$ (b) $\frac{13}{3}$ (c) $\frac{19}{3}$ (d) $\frac{-19}{3}$

10. The cost of $7\frac{1}{2}$ metres of cloth is ₹ $78\frac{3}{4}$. What is the cost of one metre of cloth?
(a) ₹ $13\frac{1}{2}$ (b) ₹ $10\frac{1}{2}$ (c) ₹ $16\frac{1}{2}$ (d) ₹ $12\frac{1}{2}$

11. By what number should $\frac{-33}{8}$ be divided to get $\frac{-11}{2}$?
(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{3}{4}$ (d) $\frac{1}{3}$

12. By what rational number should we multiplying $\frac{-16}{63}$ to get $\frac{-4}{7}$.
(a) $\frac{7}{4}$ (b) $\frac{9}{4}$ (c) $\frac{3}{4}$ (d) $\frac{13}{4}$

13. What number should be added to $\frac{-7}{8}$ to get $\frac{4}{9}$?
(a) $\frac{75}{72}$ (b) $\frac{85}{72}$ (c) $\frac{83}{72}$ (d) $\frac{95}{72}$

14. What is reciprocal of $\left(\frac{1}{2}+\frac{1}{5}\right)$?
(a) $\frac{7}{10}$ (b) $\frac{10}{7}$ (c) $\frac{-7}{10}$ (d) $\frac{-10}{7}$

15. Which rational number is in between $\frac{-2}{3}$ and $\frac{-1}{4}$?
(a) $\frac{-5}{24}$ (b) $\frac{-5}{12}$
(c) $\frac{5}{12}$ (d) None of these

16. What is the reciprocal of $\left(\frac{1}{5}\times\frac{2}{5}\div\frac{4}{5}\right)$?
(a) $\frac{1}{10}$ (b) $\frac{1}{5}$ (c) 10 (d) 5

17. What should be added to $\frac{-3}{5}$ to get $\frac{-1}{3}$?
(a) $\frac{4}{5}$ (b) $\frac{2}{5}$ (c) $\frac{4}{15}$ (d) $\frac{8}{15}$

18. What is the additive inverse of $\left(\frac{3}{4}-\frac{2}{3}+\frac{1}{5}\right)$?
(a) $\frac{17}{60}$ (b) $\frac{-17}{60}$ (c) $\frac{60}{17}$ (d) $\frac{-60}{17}$

19. What is the value of $\frac{3}{4} \div \frac{5}{8} \times \frac{3}{7} + \frac{2}{9} - \frac{1}{3}$?

(a) $\frac{127}{315}$ (b) $\frac{117}{315}$

(c) $\frac{107}{315}$ (d) None of these

20. What is the value of

$$2 - \left[5 - \left\{4 - \frac{2}{3}\left(2 - \frac{2}{3}\right)\right\}\right]?$$

(a) 1 (b) –1 (c) 2 (d) –2

21. How many rational numbers lie between $\frac{1}{5}$ and $\frac{1}{3}$?

(a) One (b) Two
(c) Three (d) Infinite numbers

22. If x is a non-zero rational number, then what is the value of x^0?

(a) 1 (b) 0
(c) –1 (d) Not defined.

23. Which number is largest among

$$\frac{4}{-9}, \frac{-5}{12}, \frac{7}{-18}, \frac{-2}{3}$$

(a) $\frac{7}{-18}$ (b) $\frac{4}{-9}$ (c) $\frac{-5}{12}$ (d) $\frac{-2}{3}$

24. Which number is smallest among

$$\frac{-7}{12}, \frac{-5}{6}, \frac{13}{-18}, \frac{23}{-24}$$

(a) $\frac{-5}{6}$ (b) $\frac{-7}{12}$ (c) $\frac{-5}{6}$ (d) $\frac{23}{-24}$

25. Closure property of rational number will be value in:

(a) Addition (b) Subtraction
(c) Multiplication (d) All of these.

26. The difference between two numbers is 22 and their product is 240, what is the difference between their reciprocals ?

(a) $\frac{11}{120}$ (b) $\frac{-11}{120}$ (c) $\frac{11}{109}$ (d) $\frac{-11}{109}$

27. If $a : b = 2 : 3$, then what will be the value of $\frac{a+b}{a-b}$?

(a) $\frac{-3}{2}$ (b) $\frac{3}{2}$ (c) –5 (d) $\frac{-1}{5}$

28. If $a : b = 1:2$, then $\frac{(a+2)^2}{ab} =$

(a) $\frac{9}{2}$ (b) $\frac{9}{8}$ (c) $\frac{9}{4}$ (d) $\frac{1}{4}$

29. The sum of two numbers 'p' and 'q' is 16 and their product is 48, then, $\left(\frac{1}{p^2}\right)^2 + \left(\frac{1}{q^2}\right)^2 =$

(a) 2.06×10^{-4} (b) $\frac{3}{16}$

(c) 4.12×10^{-5} (d) 8.24×10^{-5}

30. The sum of two numbers is 24 and their difference is 10, then, $\frac{x}{y} =$ [$x = 1^{st}$ number, $y = 2^{nd}$ number].

(a) $\frac{27}{18}$ (b) $\frac{34}{14}$ (c) $\frac{118}{16}$ (d) $\frac{14}{34}$

Answer Key

1. (c)	2. (b)	3. (a)	4. (b)	5. (a)	6. (b)	7. (a)	8. (a)	9. (a)	10. (b)
11. (c)	12. (d)	13. (d)	14. (b)	15. (a)	16. (c)	17. (c)	18. (b)	19. (a)	20. (b)
21. (d)	22. (a)	23. (a)	24. (d)	25. (d)	26. (b)	27. (c)	28. (a)	29. (d)	30. (b)

Hints and Solutions

1. **(c)** Let the number be x.

$$\frac{3x}{5}-\frac{2x}{7}=44 \Rightarrow \frac{21x-10x}{35}=44$$

$$\Rightarrow x=\frac{44\times 35}{11}=4\times 35=140$$

2. **(b)** Distance = Speed × Time

$$=\frac{302}{5}\times\frac{15}{2}=151\times 3=453 \text{ km}$$

3. **(a)** $-5+x=\frac{-4}{3}\Rightarrow x=5-\frac{4}{3}=\frac{11}{3}$

4. **(b)** No. of girls $=-\frac{5}{8}=\frac{3}{8}$

Let x be the total no. of boys then

$$\frac{3}{8} \text{ of } x=270 \Rightarrow x=\frac{270\times 8}{3}$$

$$\Rightarrow \quad x=720$$

No. of boys $=720-270=450$

5. **(a)** Length of each piece $=\frac{58\frac{1}{2}}{26}=\frac{117}{2}\times\frac{1}{26}$

$$=\frac{9}{4}=2\frac{1}{4}\text{ m}$$

6. **(b)** Let the number be x.

$$\therefore \quad \frac{-15}{14}\times x=\frac{-16}{35}$$

$$\Rightarrow \quad x=\frac{-16}{35}\times\frac{14}{-15}=\frac{32}{75}$$

7. **(a)** Let x should be subtracted $\therefore \frac{-5}{3}-x=\frac{5}{6}$

$$\Rightarrow \quad =\frac{-5}{3}-\frac{5}{6}=\frac{-10-5}{6}$$

$$\Rightarrow \quad x=\frac{-15}{6}=\frac{-5}{2}$$

8. **(a)** If x is the additive inverse then $\frac{-7}{9}+x=0$

$$\Rightarrow \quad x=\frac{7}{9}$$

9. **(a)** $x+\left(\frac{-10}{3}\right)=-3$

$$\Rightarrow \quad x=\frac{10}{3}-3=\frac{10-9}{3}=\frac{1}{3}$$

10. **(b)** Cost of one metre of cloth $=\frac{78\frac{3}{4}}{7\frac{1}{2}}=\frac{\frac{315}{4}}{\frac{15}{2}}$

$$=\frac{315}{4}\times\frac{2}{15}=\frac{21}{2}=₹10\frac{1}{2}$$

11. **(c)** $\frac{-33}{8}\div x=\frac{-11}{2}$

$$\Rightarrow \frac{-33}{8}\times\frac{1}{x}=\frac{-11}{2}\Rightarrow x=\frac{-33}{8}\times\frac{2}{-11}$$

$$\Rightarrow \quad x=\frac{3}{4}$$

12. **(b)** $\frac{-16}{63}\times x=\frac{-4}{7}$

$$\Rightarrow \quad x=\frac{-4}{7}\times\frac{63}{-16}=\frac{9}{4}$$

13. **(d)** $\frac{-7}{8}+x=\frac{4}{9}\Rightarrow x=\frac{4}{9}+\frac{7}{8}=\frac{32+63}{72}$

$$\Rightarrow \quad x=\frac{95}{72}$$

14. **(b)** We have $\frac{1}{2}+\frac{1}{5}=\frac{5+2}{10}=\frac{7}{10}$

$\therefore$ Reciprocal of $\left(\frac{1}{2}+\frac{1}{5}\right)=\frac{10}{7}$

15. **(a)** $\frac{\left(\frac{-2}{3}+\frac{1}{4}\right)}{2}=\frac{\frac{-8+3}{12}}{2}=\frac{-5}{24}$

16. **(c)** $\frac{1}{5}\times\frac{2}{5}\div\frac{4}{5}=\frac{1}{5}\times\frac{2}{5}\times\frac{5}{4}=\frac{1}{10}$

$$\therefore \text{ Reciprocal } =\frac{1}{\frac{1}{10}}=10.$$

17. **(c)** Let x should be added.

$$\therefore \frac{-3}{5}+x=\frac{-1}{3} \Rightarrow x=\frac{3}{5}-\frac{1}{3}=\frac{9-5}{15}=\frac{4}{15}$$

18. **(b)** $\frac{3}{4}-\frac{2}{3}+\frac{1}{5}=\frac{45-40+12}{60}=\frac{17}{60}$

Additive inverse of $\frac{17}{60}$ is $\frac{-17}{60}$.

19. **(a)** $\frac{3}{4}\div\frac{5}{8}\times\frac{3}{7}+\frac{2}{9}-\frac{1}{3}$

$$=\frac{3}{4}\times\frac{8}{5}\times\frac{3}{7}+\frac{2}{9}-\frac{1}{3}=\frac{18}{35}+\frac{2}{9}-\frac{1}{3}$$

$$=\frac{162+70-105}{315}=\frac{232-105}{315}=\frac{127}{315}$$

20. **(b)** Here $2-\left[5-\left\{4-\frac{3}{2}\left(2-\frac{2}{3}\right)\right\}\right]$

$$=2-\left[5-\left\{4-\frac{3}{2}\left(\frac{4}{3}\right)\right\}\right]=2-[5-\{4-2\}]$$

$$=2-[5-2]=2-3=-1.$$

21. **(d)**

23. **(a)** LCM of 9, 12, 18, 3 = 36

$$\therefore \frac{4}{-9}=\frac{16}{-36};\frac{-5}{12}=\frac{15}{-36};\frac{7}{-18}=\frac{14}{-36}$$

$$\frac{2}{-3}=\frac{24}{-36}$$

24. **(d)** LCM of 12, 6, 18, 24 = 72

$$\frac{-7}{12}=\frac{-42}{72};\frac{-5}{6}=\frac{-60}{72}$$

$$\frac{13}{-18}=\frac{-52}{72};\frac{-23}{24}=\frac{-69}{72}$$

25. **(d)** Closure property of rational numbers is satisfied for addition, subtraction and multiplication.

Closure property : The sum of two rational numbers will be a rational of addition for rational number.

26. **(b)** $p-q=22, pq=240.$

$$\therefore \frac{1}{p}-\frac{1}{q}=\frac{q-p}{pq}=-\left(\frac{p-q}{pq}\right)=-\frac{22}{240}=\frac{-11}{120}$$

27. **(c)** Here $\frac{a+b}{a-b}$ Dividing Numerator and Denominator by b, we have,

$$\frac{\frac{a}{b}+\frac{b}{b}}{\frac{a}{b}-\frac{b}{b}}=\frac{\frac{2}{3}+1}{\frac{2}{3}-1}=\frac{\frac{5}{3}}{\frac{-1}{3}}=-5\left[\because \frac{a}{b}=\frac{2}{3}\right]$$

28. **(a)** $\frac{(a+b)^2}{ab}=\frac{a^2+b^2+2ab}{ab}$

$$=\frac{a^2}{ab}+\frac{b^2}{ab}+\frac{2ab}{ab}=\frac{a}{b}+\frac{b}{a}+2$$

$$=\frac{1}{2}+\frac{2}{1}+2 \qquad \left[\because \frac{a}{b}=\frac{1}{2}\right]$$

$$=\frac{9}{2}.$$

29. **(d)** $\left(\frac{1}{p^2}\right)^2+\left(\frac{1}{q^2}\right)^2=\frac{1}{p^4}+\frac{1}{q^4}$

$$=\frac{p^4+q^4}{p^4q^4}=\frac{(p^2+q^2)^2-2p^2q^2}{p^4q^4}$$

$$=\frac{\left[(p+q)^2-2\times 48\right]^2-2p^2q^2}{(pq)^4}$$

$$=\frac{[(16)^2-2\times 48]^2-2(48)^2}{(48)^4}$$

$$=8.24\times 10^{-5}$$

30. **(b)** Given $x+y=24$,

and $x-y=10$,

$$\therefore \frac{x+y}{x-y}=\frac{24}{105}.=12$$

$$\Rightarrow \frac{\frac{x}{y}+\frac{y}{y}}{\frac{x}{y}-\frac{y}{y}}=\frac{12}{5} \Rightarrow \frac{a+1}{a-1}=\frac{12}{5}$$

$$\Rightarrow 5a+5=129-12$$

$$\Rightarrow 7a=17$$

$$\Rightarrow a=\frac{17}{7}=\frac{x}{y}=\frac{34}{14}$$

3. Squares and Square Roots

Square

Square means product of the number with the number itself.

Example: $x^2 = x \times x$

$5^2 = 5 \times 5 = 25$

Perfect Square

A natural number is called a perfect square, if it is the square of some natural number.

Example 1: Find the number whose square is 1764.

Solution:

2	1764
2	882
3	441
3	147
7	49
7	7
	1

$1764 = 2 \times 2 \times 3 \times 3 \times 7 \times 7$

$= 2^2 \times 3^2 \times 7^2$

$= (42)^2$

Example 2: By what least number should 6300 be divided to get a perfect square number.

Solution: $6300 = 2 \times 2 \times 3 \times 3 \times 5 \times 5 \times 7$

To make 6300 a perfect square, it should be divided by 7. As 7 is alone in above prime factors.

Some Properties of Perfect Square

I. A number ending in 2, 3, 7, 8, is never a perfect square.
Example: 22, 113, 257, 218 are not perfect squares.

II. The squares of an even number is always even.
Example: $8^2 = 64$, $12^2 = 144$, $18^2 = 324$

III. The squares of an odd number is always odd.
Example: $7^2 = 49$, $11^2 = 121$, $27^2 = 729$

IV. For every natural member n, sum of first n odd natural number $s = n^2$
Example: 1 + 3 + 5 = Sum of first 3 odd numbers

V. Pythagorean Triplet = $3^2 = 9$
Three natural numbers a, b, c are said to form a Pythagorean Triplet (a, b, c) if

$$a^2 + b^2 = c^2$$

Example: (8, 15, 17) is a Pythagorean triplet as $8^2 + 15^2 = 17^2$.

$$64 + 225 = 289$$

Example 3: Find the Pythagorean triplet whose smallest number is 12.

Solution: For every natural number, $m > 1$.

$$(2m, m^2 - 1, m^2 + 1)$$

$$2m = 12 \Rightarrow m = \frac{12}{2} = 6$$

So, the numbers are $2m = 2 \times 6 = 12$

$$m^2 - 1 = 6^2 - 1 = 35$$

$$m^2 + 1 = 6^2 + 1 = 37$$

So, required Pythagorean triplet is (12, 3, 5, 3, 7)

Square Root of a Perfect Square by Prime Factorisation Method

1. Resolve the given number into prime factors.
2. Make pairs of similar factors.
3. In product of prime factors, we have to choose one factor out of every pair.

Example 4: Find the square root of 11025.

Solution: $\sqrt{11025}$

$$= \sqrt{5 \times 5 \times 3 \times 3 \times 7 \times 7}$$

$$= 5 \times 3 \times 7$$

$$= 105$$

Example 5: Find the least square number divisible by each one of 8, 9, 10 = 360

Solution: $360 = 2 \times 2 \times 2 \times 3 \times 3 \times 5$.

To make 360 a perfect square, we must multiply it by $2 \times 5 = 10$

Required number = $360 \times 10 = 3600$

Example 6: Evaluate $\sqrt{6241}$ using long division method.

Solution:

7	$\overline{62}\ \overline{41}$	79.
7	49	
149	1341	
9	1341	
158	××××	

$\sqrt{6241} = 79$

Example 7: By what least number should the given number 7623 be multiplied to get a perfect square.

Solution: $7623 = 3 \times 3 \times 7 \times 11 \times 11$

To make it a perfect square, it must be multiplied by 7.

Multiple Choice Questions

1. What is the value of x if $\sqrt{\frac{2x-1}{3}} = 5$?

   (a) 26 (b) 28 (c) 36 (d) 38

2. What is the greatest number of five digits which is a perfect square?

   (a) 99586 (b) 99 856
   (c) 99568 (d) 99865

3. What is the least number which must be subtracted from 6459 to make a perfect square?

   (a) 56 (b) 58
   (c) 59 (d) None of these

4. By what least number 384 be multiplied 50 that the product may be a perfect square?

   (a) 2 (b) 58 (c) 4 (d) 6

5. What is the smallest number of four digits which is a perfect square?

   (a) 1016 (b) 1024 (c) 1036 (d) 1048

6. What is the greatest number of four digits which is a perfect square?

   (a) 9801 (b) 9816 (c) 9824 (d) 9864

7. Find the least number which must be added to 2292 to make it a perfect square.

   (a) 10 (b) 11 (c) 12 (d) 14

8. Find the smallest number by which 557568 must be divided so that it become a perfect square.

   (a) 2 (b) 3 (c) 4 (d) 6

9. Find the smallest number by which 396 must be multiplied so that the product becomes a perfect square?

   (a) 3 (b) (c) 9 (d) 11

10. What is the least number which must be added to 6203 to obtain a perfect square ?

    (a) 32 (b) 34
    (c) 36 (d) 38

11. Find the smallest square number that is divisible by each of the number 8, 15 and 20.

    (a) 900 (b) 1600
    (c) 2500 (d) 3600

12. What is the least number that must be added to 1300 so as to get a perfect square?

    (a) 36 (b) 39 (c) 49 (d) 69

13. What is the length of the diagonal of a square whose perimeter is equal to the perimeter of an equilateral triangle of side 4 cm?

    (a) 4. 24 cm (b) 4.04 cm
    (c) 4.14 cm (d) 4.64

14. The product of two positive numbers is $29\frac{31}{49}$. and one of them is three times the other. Find the larger number.

    (a) $\frac{22}{7}$ (b) $\frac{66}{7}$ (c) $\frac{37}{7}$ (d) $\frac{68}{7}$

15. The area of a rectangular field whose length is three times its breadth is 348 m^2. What is the perimeter of the field?

    (a) 82.16 m (b) 84.16 m
    (c) 86.16 m (d) None of these

16. Which of the following is not a Pythagorean triplet?

    (a) (3, 4, 5) (b) (6, 8, 10)
    (c) (2, 3, 4) (d) (12, 35, 37)

17. The area of a square field is 60025 m^2. A man cycles along its boundary at 18 km/hour. In how much time will he return to the starting point?

    (a) 166 seconds (b) 176 seconds
    (c) 196 Seconds (d) None of these

18. What is the length of each side of a square whose area is equal to the area of a rectangle of length 13.6 m and breadth 3.4 meters?

    (a) 4.8 m (b) 5.8 m
    (c) 6.8 m (d) 7.8 cm

19. The perimeter of a square field is 76m. What is its area?

    (a) 324 m^2 (b) 289 m^2
    (c) 361 m^2 (d) 329 m^2

20. Which of the following is the square of an even number ?

    (a) 729 (b) 324 (c) 441 (d) 625

21. Which of the following is the square of an odd number?
(a) 2209 (b) 1444
(c) 2704 (d) 4096

22. Which of the following is not a perfect square?
(a) 1156 (b) 1764
(c) 1849 (d) 1349

23. What is the cost of erecting a fence around a square field whose area is I hectares if fencing costs ₹ 35 per meter.
(a) ₹ 28000 (b) ₹ 32000
(c) ₹ 36000 (d) ₹ 42000

24 In a cinema hall, the number of rows is equal to number of seats in each row, If the capacity of the hall is 2025. What is the number of seats in each row?
(a) 35 (b) 45 (c) 55 (d) 65

25. Which of the following is a Pythagorean triplet?
(a) (2,3,5) (b) (5,7,9)
(c) (6,9,11) (d) (8,15,17).

Answer Key

1. (d)	2. (b)	3. (c)	4. (d)	5. (b)	6. (a)	7. (c)	8. (d)	9. (d)	10. (d)
11. (d)	12. (d)	13. (a)	14. (b)	15. (c)	16. (c)	17. (c)	18. (c)	19. (c)	20. (b)
21. (a)	22. (d)	23. (d)	24. (b)	25. (d)					

Hints and Solutions

1. **(d)** Given $\sqrt{\frac{2x-1}{3}} = 5$

$\Rightarrow \quad \frac{2x-1}{3} = 25$

$\Rightarrow \quad 2x-1 = 75 \Rightarrow 2x = 76 \Rightarrow x = \frac{76}{2} = 38$

2. **(b)** The greatest number of five digits $= 99999$

3	$9\,\overline{99}\,\overline{99}$	316
3	9	
61	× 99	
1	61	
626	3899	
6	3756	
632	× 143	

$\therefore$ Required number $= 99999 - 143 = 99856$

3. **(c)**

8	$\overline{64}\,\overline{59}$	8
8	64	
16	××××	

$\therefore$ Required number $= 6459 - 59 = 6400$
Hence 59 must be subtracted.

4. **(d)**

2	384
2	192
2	96
2	48
2	24
2	12
2	6
2	3

$\therefore 384 = \underline{2 \times 2 \times 2} \times \underline{2 \times 2 \times 2} \times 2 \times 2 \times 3$

$\therefore$ Required number $= 6$

5. **(b)** Consider option (b)

2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
	2

Here $1024 = (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2)$

Clearly 1024 is the smallest number of four digits which is a perfect square.

6. **(a)** Greatest number of four digits = 9999

9	$\overline{99}\ \overline{99}$	99
9	81	
189	18 99	
9	17 01	
198	×198	

$\therefore$ Required number = 9999 − 198 = 9801

7. **(c)**

4	$\overline{22}\ \overline{92}$	48
4	16	
8	×692	

2292 + 12 = 2304 which is a perfect square.

8. (d)

7	$\overline{55}\ \overline{75}\ 68$	746
7	49	
144	×675	
4	576	
1486	9968	
6	8916	
1492	1052	

9. **(d)** $396 = 2 \times 2 \times 3 \times 3 \times 11$

To make a perfect square, 11 is multiplied to 396.

10. **(d)** 6203

$78 \times 78 = 6084$

$79 \times 79 = 6241$

$6241 - 6203 = 38$

38 must be added to 6203 to make a perfect square.

11. **(d)** Here LCM of 8, 15, 20 = 120.

and $120 = 2 \times 2 \times 2 \times 3 \times 5$

To make 120 a perfect square, it must be multiplied by $2 \times 3 \times 5 = 30$

$120 \times 30 = 3600$

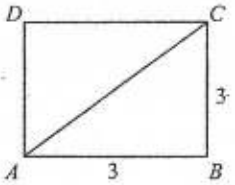
12. **(d)** $36 \times 36 = 1296$

$37 \times 37 = 1369$

69 must be added to make 1300 as perfect square.

13. **(a)** Perimeter of an equilateral triangle

$= 4 + 4 + 4 = 12$ cm



Perimeter of square = 12 cm

$\Rightarrow$ $4 \times$ side = 12

$\Rightarrow$ Side = 3 cm.

$\therefore$ Length of diagonal $= \sqrt{3^2 + 3^2}$

$= \sqrt{9+9}$

$= \sqrt{18} = 3\sqrt{2}$

$= 3 \times 1.414 = 4.24$ cm

14. **(b)** Let the numbers are x and $3x$.

$\therefore$ $x \times 3x = 29\frac{31}{49} = \frac{1452}{49}$

$\Rightarrow$ $x^2 = \frac{1452}{49 \times 3} = \frac{484}{49} \Rightarrow x = \frac{22}{7}$

$\therefore$ $3x = 3 \times \frac{22}{7} = \frac{66}{7}$

15. **(c)** Let breadth be x m

$\therefore$ Length = $3x$ m

Now $x \times 3x = 348 \Rightarrow x^2 = \frac{348}{3} = 116$

$\Rightarrow$ $x^2 = 116 \Rightarrow x = 10.77$

$\therefore$ $3x = 3 \times 10.77 = 32.31$

Perimeter = 2 (10.77 + 32.31) = 86.16 m

16. **(c)** Here $3^2 + 4^2 = 5^2$

$6^2 + 8^2 = 10^2$

$2^2 + 3^2 \neq 4^2$

$12^2 + 35^2 = 37^2$

$\therefore$ (c) is not a Pythagorean triplet.

17. **(c)** Speed of cycle = 18 km/hour

$= 18 \times \frac{5}{18} = 5$ m / sec

Area of square = 60025

Side of square $= \sqrt{60025} = 245$ m

Perimeter of square = 245 × 4 m

$\therefore$ Time taken $= \frac{245 \times 4}{5} = 196$ seconds

18. **(c)** Area of square = Area of rectangle
$= 13.6 \times 3.4$
$= 46.24$
$\therefore$ Side of square $= \sqrt{46.24} = 6.8$ m

19. **(c)** Perimeter of square = 76
$\Rightarrow 4 \times$ side $= 76 \Rightarrow$ side $= \frac{76}{4} = 19$
$\therefore$ Area of square $= 19^2 = 361$ m^2

20. **(b)** Here $729 = 27^2$, $324 = 18^2$,
$441 = 21^2$, $625 = 25^2$
or
Square of an odd number is an odd number.

21. **(a)** Here $2209 = 47^2$
$1444 = 38^2$
$2704 = 52^2$
$4096 = 64^2$
or
Square of an even number is an even number.

22. **(d)** $1156 = 34^2$
$1764 = 42^2$
$1849 = 4^32$
1349 is not a perfect square.

23. **(d)** Area of square = 9 hectares
$= 9 \times 10000$ m^2
Side of square = 300 m.
Perimeter of square $= 4 \times 300$
$= 1200$ m
Cost of fencing $= 1200 \times 35$
$= ₹ 42000$

24. **(b)** Let no. of rows = no of seats $= x$
$\therefore \; x^2 = 2025 \Rightarrow x = \sqrt{2025} = 45$

25. **(d)** $2^2 + 3^2 \neq 5^2$
$5^2 + 7^2 \neq 9^2$
$6^2 + 9^2 \neq 11^2$
$8^2 + 15^2 = 17^2$
$\therefore$ (d) is true.

4. Cube and Cube Roots

Cube

When a number is multiplied by its square, then the number is said to be cubed, and the product is called the cube of that number.

In general, cube of a natural number 'a' will be $a \times a \times a = a^3$.

A natural number is said to be a perfect cube if it is obtained by multiplying a natural number twice by itself, i.e., a natural number 'η' is a perfect cube if there exists a natural number such that

$$\eta = m \times m \times m = m^3.$$

Example 1: Is 1728,a perfect cube?

Solution: Here $1782 = \underbrace{2\times2\times2} \times \underbrace{2\times2\times2} \times \underbrace{3\times3\times3}$

In the prime factorisation of 1728, the prime factors can be grouped into triplets of equal factors and no prime factor is left over. Thus, 1728 is a perfect cube.

Example 2: Find the number of cubes of side 5 cm which can be generated by a cuboid of volume 500 cm^3.

Solution: Volume of cube $= 5 \times 5 \times 5 = 5^3 = 125\ cm^3$.

Let the number of cubes be x.

$\therefore \quad x \times 125 = 500$

$\Rightarrow \quad x = 4$

$\therefore$ Number of cubes that can be generated by a cuboid of volume 500 $cm^3 = 4$.

Cubes of Negative Integers and Rational Numbers

The cube of a negative integer will be negative if 'p' is a natural number, then,

$$(-p)^3 = -p^3$$

Example 4: Find the cube of $\left(\frac{-11}{12}\right)$.

Solution: $\left(\frac{-11}{12}\right)^3 = \frac{-1331}{1728}$

Example 5: Evaluate : $\left(\frac{64}{125}\right)^{2/3}$

Solution: Since $\left(\frac{64}{125}\right)^{1/3} = \frac{4}{5}$

$\therefore \quad \left(\frac{64}{125}\right)^{2/3} = \left(\frac{4}{5}\right)^2 = \frac{16}{25}$

Cube Roots

A natural number m is the cube root of a natural number n, if, $m^3 = n$.

The cube root of a number n is denoted by the symbol $\sqrt[3]{n}$.

Cube Root Using Ones Digit

Observing the unit digits of the number and their cubes, we find that, these units digits are either the same or ten's complements. (Remember, complement of 2 in 10 is 8 and vice versa, complement of 3 in 10 is 7 and vice versa, etc.,)

The numbers ending with 0 or 1 or 4 or 5 or 6 or 9 have their respective cubes ending with the same digit.

Example 6: Find the cube root of 9261.

Solution: Since the perfect cube 9261 ends in 1, the cube root must end in 1. Further, it is a 4-digit number. So, its cube root must be a 2-digit number.

Also, $20^3 = 8000, 30^3 = 27000$

$\therefore$ The cube root of 9261 must be equal to 21.

Cube Root By Prime Factorisation

Example 7: What is the smallest number by which 20577 should be divided so that the quotient is a perfect cube? Find the cube root of the quotient.

Solution: $20577 = 3 \times 19 \times 19 \times 19$

$\therefore$ the quotient should be equal to $19 \times 19 \times 19$

$\therefore$ Required number $= 3$

$\therefore$ Cube root of quotient $= \sqrt[3]{\dfrac{19 \times 19 \times 19 \times 3}{3}} = 19$

Example 8: Evaluate :

$$\sqrt[3]{-16} \times \sqrt[3]{363} \times \sqrt[3]{\frac{1}{2662}} \times \sqrt[3]{99}$$

Solution: Here $\sqrt[3]{a} \times \sqrt[3]{b} \times \sqrt[3]{c} \times \sqrt[3]{d} = \sqrt[3]{abcd}$.

$$\therefore \quad \sqrt[3]{-16} \times \sqrt[3]{363} \times \sqrt[3]{\frac{1}{2662}} \times \sqrt[3]{99}$$

$$= \sqrt[3]{\left(\frac{-16 \times 363 \times 99}{2662}\right)}$$

$$= \sqrt[3]{\frac{(2 \times 2 \times 2 \times 2) \times (3 \times 11 \times 11 \times 11) \times (3 \times 3 \times 11)}{(2 \times 11 \times 11 \times 11)}}$$

$$= \sqrt[3]{\frac{2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 11 \times 11 \times 11}{11 \times 11 \times 11}}$$

$$= 6$$

Example 9: Two numbers are in the ratio 5 : 6. The sum of their cube is 21824. Find the number.

Solution: Let the numbers be $5a$ and $6a$.

$\therefore \quad (5a)^3 + (6a)^3 = 21824$

$\Rightarrow \quad 341\, a^3 = 21824$

$\Rightarrow \quad a^3 = \frac{21824}{341} = 64$

$\Rightarrow \quad a = 4$

$\therefore$ Numbers are 5×4 and 6×4, or,

Numbers are 20 and 24.

Multiple Choice Questions

1. Which of the following numbers is a perfect cube?
   (a) 256 (b) 243 (c) 1331 (d) 250
2. What will be the volume of a cube having edge length 12m? (in m^3)
   (a) 1728 (b) 1628 (c) 2248 (d) 1848
3. What is the smallest number by which 576 is divided that quotient is a perfect cube?
   (a) 8 (b) 9 (c) 4 (d) 72
4. If, $1^3 + 2^3 + 3^3 = (1 + 2 + 3)^2$, $1^3 + 2^3 + 3^3 + 4^3 = (1 + 2 + 3 + 4)^2$, then,
   $1^3 + 2^3 + 3^3 + 4^3 + 5^3 + 6^3 + 7^3$
   (a) 900 (b) 441 (c) 784 (d) 484
5. Observing the pattern in Q. 4, Find the sum:
   $1^3 + 3^3 + 5^3 + 7^3 + 9^3$
   (a) 1225 (b) 2025 (c) 825 (d) 1625
6. Simplify : $[\sqrt{12^2 + 16^2}]^3$
   (a) 400 (b) 8000
   (c) 64000 (d) 512000
7. Simplify : $\left(\frac{64}{125}\right)^{2/3}$
   (a) $\frac{4}{5}$ (b) $\frac{8}{25}$ (c) $\frac{16}{25}$ (d) $\frac{4}{25}$
8. A natural number is of the form $(3n + 2)$. Its cube will be of the form :
   (a) $3n$ (b) $3n + 1$
   (c) $3n + 2$ (d) None of these
9. A rational number, $p < 1$, then,
   (a) $p^3 > 1$ (b) $p^3 < 0$
   (c) $p^3 < p$ (d) $p^3 > p$
10. A real number 'p' is such that $p > 1$, then
    (a) $p^3 < 1$ (b) $p^3 > p$
    (c) $p^3 > p$ (d) $p^3 < 0$
11. Three numbers are in ratio 2 : 3 : 4 and sum of their cubes is 2673. The sum of these numbers are.
    (a) 27 (b) 26
    (c) 28 (d) 29
12. $\left(\frac{4913}{343}\right)^{\frac{1}{3}} = ?$
    (a) $\frac{25}{7}$ (b) $\frac{17}{7}$
    (c) $\frac{27}{7}$ (d) $\frac{37}{7}$
13. Simplify : $\sqrt[3]{0.008} + \sqrt[3]{0.343} - \sqrt{0.25}$
    (a) 0.4 (b) 0.5
    (c) 0.8 (d) 0.7
14. Which of the following is not a perfect cube?
    (a) 2744 (b) 704969
    (c) 513 (d) 343
15. The length of edge of a cube whose volume is 74.088 m^3.
    (a) 4.52 m (b) 4.62 m
    (c) 4.22 m (d) 4.2 m

16. What is the smallest number by which 3087 may be multiplied so that the product is a perfect cube?
(a) 2 (b) 3
(c) 7 (d) None of these

17. What is the smallest number by which 8788 must be divided so that the duotient is a perfect cube?
(a) 2 (b) 3
(c) 4 (d) 6

18. What is the smallest number by which 392 may be divided so that the duotient is a perfect cube?
(a) 7 (b) 8
(c) 49 (d) None of these

19. Which of the following is a cube of odd numbers ?
(a) 2197 (b) 512 9
(c) 216 (d) 1278

20. Which of the following is a cube of even numbers?
(a) 343 (b) 2197
(c) 1278 (d) 4913

21. Which of the following is a perfect cube?
(a) 441 (b) 514 (c) 412 (d) 343

22. What is the value of $\sqrt[3]{\frac{216}{2197}}$?
(a) $\frac{3}{13}$ (b) $\frac{6}{13}$ (c) $\frac{7}{13}$ (d) $\frac{8}{13}$

23. The value of $x^3 y^2$, if $x = 3, y = -3$ will be :
(a) 729 (b) 81
(c) 343 (d) 243

24. Find the least number which should be added to 500, in order to make the 500, a perfect cube.
(a) 128 (b) 63
(c) 12 (d) 229

25. What is the least number which should be subtracted from 1370, in order to make the resultant, a perfect square?
(a) 29 (b) 39
(c) 49 (d) 370

26. $\sqrt[3]{0.000000064} = ?$
(a) 0.004 (b) 0.002
(c) 0.0004 (d) 0.00004

27. $19^3 - 19^3$ will have – as its one of the factors
(a) 19 (b) 9
(c) 10 (d) None of these.

28. $21^3 + 27^3$ will have – as its one of the factors
(a) 21 (b) 27
(c) 48 (d) None of these

29. Which is the least number which should be added to 1720,in order to make it a perfect cube?
(a) 269 (b) 8
(c) 469 (d) 58

30. $1^3 + 2^3 + 3^3 + 4^3 + \ldots\ldots n^3 = \left[n\left(\frac{n+1}{2}\right)\right]^2$,
where 'n' is a natural number, then
$1^3 - 2^3 + 3^3 - 4^3 + 5^3 - 6^3 + 7^3 - 8^3 + 9^3 - 10^3 =$
(a) 3025 (b) 1225
(c) 1800 (d) 2425

Answer Key

1. (c)	2. (a)	3. (b)	4. (c)	5. (a)	6. (b)	7. (c)	8. (c)	9. (c)	10. (b)
11. (a)	12. (b)	13. (a)	14. (c)	15. (d)	16. (b)	17. (c)	18. (c)	19. (a)	20. (c)
21. (d)	22. (b)	23. (d)	24. (c)	25. (b)	26. (a)	27. (c)	28. (c)	29. (b)	30. (b)

Hints and Solutions

1. **(c)** Here $256 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$
$243 = 3 \times 3 \times 3 \times 3 \times 3$
$1331 = 11 \times 11 \times 11$
$250 = 2 \times 5 \times 5 \times 5$
Clearly 1331 is a perfect cube.

2. **(a)** Volume of cube $= (12)^3 = 1728\ m^3$

3. **(b)** We have
$576 = \underline{2 \times 2 \times 2} \times 3 \times \underline{2 \times 2 \times 2} \times 3$
$\therefore$ 576 should be divided by 9, to get a prefect cube.

4. **(c)** $1^3 + 2^3 + 3^3 + 4^3 + \ldots\ldots + 7^3$
$= (1 + 2 + 3 + 4 + 5 + 6 + 7)^2$
$= (28)^2$
$= 784.$

5. **(a)** $1^3 + 2^3 + 3^3 + \ldots\ldots + 9^3$
$= (1 + 2 + 3 \ldots\ldots + 9)^2$
$\Rightarrow (1^3 + 3^3 + 5^3 + 7^3 + 9^3) + 2^3 (1^3 + 2^3 + 3^3 + 4^3)$
$= (45)^2 = 2025$
$\Rightarrow x + 2^3 (1 + 2 + 3 + 4)^2 = 2025$
$\Rightarrow x = 2025 - 8 \times 100 = 1225$

6. **(b)** Here $12^2 + 16^2 = 400$
$\therefore (\sqrt{12^2 + 16^2})^3 = (400)^{3/2} = (20)^3 = 8000$

7. **(c)** $\left(\frac{64}{125}\right)^{2/3} = \left(\frac{4}{5}\right)^{3 \times \frac{2}{3}} = \left(\frac{4}{5}\right)^2 = \frac{16}{25}$

8. **(c)** $(3n + 2)^3 = 27n^3 + 8 + 3 \times 3n \times 2(3n + 2)$
$= 27n^3 + 8 + 18n\,(3n + 2)$
$= 27n^3 + 54n^2 + 36n + 8$
$= 3\,(9n^3 + 18n^2 + 12n + 2) + 2$
$= 3n + 2$

9. **(c)** If, $0 < p < 1$,
then, $p^3 < p$.

10. **(b)** If, $p > 1$
then, $p - 1 > 0$
$\therefore p^3 > p$

11. **(a)** Given $(2k)^3 + (3k)^3 + (4k)^3 = 2763$
$\Rightarrow 99\,k^3 = 2763$
$\Rightarrow k^3 = 27$
$\Rightarrow k = 3$
$\therefore$ Numbers are 6, 9, 12.
$\therefore$ Their sum $= 6 + 9 + 12 = 27$

12. **(b)** $\sqrt[3]{\frac{4913}{343}} = \frac{17}{7}$

13. **(a)** We have $(0.008)^{\frac{1}{3}} + (0.343)^{\frac{1}{3}} - (0.25)^{\frac{1}{2}}$
$= 0.2 + 0.7 - 0.5$
$= 0.9 - 0.5$
$= 0.4$

14. **(c)** 513 is not a perfect cube.

15. **(d)** $4.2\text{m} = (74.088\text{m}^3)^{1/3}$

16. **(b)** Here $3087 = 3 \times 3 \times 7 \times 7 \times 7 = 3^2 \times 7^3$.
$\because$ 3087 has two 3 as its factors, but one 3, is short to make 3087, a perfect cube.
$\therefore$ 3 should be multiplied to 3087 to produce a perfect cube.

17. (c) $8788 = 2 \times 2 \times 13 \times 13 \times 13$.
$\therefore$ 8788 should be divided by (2×2), i.e., 4 to produce quotient as a perfect cube.

18. **(c)** $392 = 2 \times 2 \times 2 \times 7 \times 7$
$\therefore$ 392 should be divided by (7×7), i.e., 49 to produce quotient, i.e., 8 as a perfect cube.

19. **(a)** $2197 = 13^3$.
$\because$ The number, i.e., 2197 is odd.
$\therefore$ Its cube root should be odd.

20. **(c)** $\because$ 1278 is even
$\therefore$ Its cube root should be even.

21. **(d)** $343 = 7 \times 7 \times 7$
$\therefore$ 343 is a perfect cube.

22. **(b)** $\sqrt[3]{\frac{216}{2197}} = \left(\frac{6}{13}\right)^{3 \times \frac{1}{3}} = \frac{6}{13}$

23. **(d)** $x^3 y^2 = (3)^3 \times (-3)^2 = (3)^5 = 243$

24. **(c)** $500 = 2 \times 5 \times 5 \times 5 = 2 \times 5^3$

$\therefore 500 > 5^3$

$\therefore \quad 6^3 = 216, 7^3 = 343, 8^3 = 512$

$\therefore$ 12 should be added to make the sum, a perfect cube.

25. **(b)** $1370 = 2 \times 5 \times 137$

$1370 > 10^3 = 1000$

$\therefore \quad 11^3 = 1331, 12^3 = 1728$

$\therefore \quad 1370 - 1331 = 39$

$\therefore$ Required number = 39

26. **(a)** $(64 \times 10^{-9})^{\frac{1}{3}} = 4 \times 10^{-3} = 0.004$

27. **(c)** $19^3 - 19^3$ will have $(19 - 19)$ has one of its factors

$\therefore$ 10 will be a factor of $(19^3 - 19^3)$

28. **(c)** $21^3 + 27^3$ has $(21 + 27)$ as its one of the factors

$\therefore$ 48 will be a factor of $(21^3 + 27^3)$

29. **(b)** $1720 > 1000 = 10^3$

$\therefore 11^3 = 1331, 12^3 = 1728$

$\therefore 1728 - 1720 = 8$ should be added to 1720 to make the sum, a perfect cube.

30. **(b)** $1^3 + 2^3 + 3^3 + \ldots\ldots + n^3 = \left[\frac{n(n+1)}{2}\right]^2$

$\therefore (1^3 + 2^3 + 3^3 + 4^3 + \ldots\ldots + 10^3)$

$- 2(2^3 + 4^3 + 6^3 + \ldots\ldots + 10^3)$

$= 1^3 - 2^3 + 3^3 - 4^3 + \ldots\ldots 10^3$

$\Rightarrow \left(\frac{10 \times 11}{2}\right)^2 - 2 \times 2^3 \left(\frac{5 \times 6}{2}\right)^2$

= required sum.

$\Rightarrow$ Required sum $= (55)^2 - 8 \times (15)^2$

$= 3025 - 8 \times 225$

$= 1225$

5. Exponents and Powers

Powers

The power of a number tells how many times to use the number in a multiplication.

It is written as a small number to the right and above the base number.

Example: $82 = 8 \times 8 = 64$

- $a^n = \dfrac{a \times a \times a \times a \times \ldots\ldots \times a}{n \text{ times}}$
- It is read as 'a raised to the power n'.
- $a^0 = 1$, where, a is any real number $(a \neq 0)$.

Exponent

An exponent refers to the number of times a number is multiplied by itself.

Example: 23 means $2 \times 2 \times 2 = 8$

23 is not equal to $2 \times 3 = 6$

- If a is a non-zero rational number and m and n are natural numbers, then

1. $a^m \times a^n = a^{m+n}$ [product law of exponents]
2. $(a^m)^n = a^{mn}$ [power law of exponents]
3. $a^m \div a^n = a^{m-n}$ [quotient law of exponents]
4. $(a \times b)^m = a^m \times b^m$
5. $\left(\dfrac{a}{b}\right)^m = \dfrac{a^m}{b^m} (b \neq 0)$

- If 'a' is a non-zero rational number and m is a positive integer, then,

$$a^{-m} = \frac{1}{a^m}, \text{ or, } (a^{-m})^{-1} = a^m$$

- a^{-m} is the reciprocal of a^m.

Example 1: Simplify : $\left(\dfrac{-2}{3}\right)^{-1} \div \left(\dfrac{2}{3}\right)^3 \times \left(\dfrac{3}{2}\right)^{-2}$.

Solution: $\left(\dfrac{-2}{3}\right)^{-1} = -\left(\dfrac{2}{3}\right)^{-1}, \left(\dfrac{3}{2}\right)^{-2} = \left(\dfrac{2}{3}\right)^2$

$$\therefore -\left(\frac{2}{3}\right)^{-1} \div \left(\frac{2}{3}\right)^3 \times \left(\frac{2}{3}\right)^2 = -\left(\frac{2}{3}\right)^{-1-3+2} = -\left(\frac{2}{3}\right)^{-2} = -\left(\frac{4}{9}\right)^{-1} = -\left(\frac{9}{4}\right)$$

Example 2: Simplify : $(5^{-1} + 3^{-1}) \times \left(\dfrac{1}{8}\right)^{+1} - (6^{-1} + 2^{-1}) \times (4)^{-1}$

Solution: $(5^{-1} + 3^{-1}) \times \dfrac{1}{8} - (6^{-1} + 2^{-1}) \times (4)^{-1}$

$$= \left(\frac{1}{5} + \frac{1}{3}\right) \times \frac{1}{8} - \left(\frac{1}{6} + \frac{1}{2}\right) \times \frac{1}{4} = \frac{8}{15} \times \frac{1}{8} - \frac{2}{3} \times \frac{1}{4} = \frac{1}{15} - \frac{1}{6} = \frac{2-5}{30} = \frac{-1}{10}$$

Example 3: Find the value of $\left[\left\{\left(\frac{-1}{3}\right)^2\right\}^{-2}\right]^{-1}$.

Solution: We have $\left(\frac{-1}{3}\right)^2 = \frac{1}{9}, \left(\frac{1}{9}\right)^{-2} = \left(\frac{1}{81}\right)^{-1} = 81$

$$(81)^{-1} = \frac{1}{81}$$

$$\therefore \quad \left[\left\{\left(\frac{-1}{3}\right)^{+2}\right\}^{-2}\right]^{-1} = \frac{1}{81}$$

Example 4: Express 0.0006542 in the standard form.

Solution: Here, the number is less than 1.

4 places = The number of places the decimal point will have to be moved to get a number between 1 and 10.

Thus, $0.0006542 = 6.542 \times 10^{-4}$.

Example 5: Express the number of seconds in 5 years in standard form. (Do Not consider year).

Solution: Number of seconds in one hour $= 60 \times 60$

$\therefore$ Number of seconds in one day $= (60 \times 60) \times 24$

$\therefore$ Number of seconds in one year $= \{(60 \times 60) \times 24\} \times 365$

$\therefore$ Number of seconds in 5 years $= 60 \times 60 \times 24 \times 365 \times 5$

$= 157680000$

$= 1.5768 \times 10^8$ seconds

Example 6: Simplify :

$$(7.3)^{-3} \times \left(\frac{29.2}{4}\right)^{-1} \div (7.3)^7 + (14.6)^2 \div (14.6)^{-3}$$

Solution: $(7.3)^{-3} \times \left(\frac{29.2}{4}\right)^{-1} \div (7.3)^7 + (14.6)^{2-3}$

$= (7.3)^{-3} \times (7.3)^{-1} \div (7.3)^7 + (14.6)^5$

$= (7.3)^{-4-7} + (14.6)^5$

$= (7.3)^{-11} + (14.6)^5$

$= \left(\frac{1}{7.3}\right)^{11} + (14.6)^5$

Example 7: Find the value of $\frac{x}{y}$, if, $x = 4.9 \times 10^{-5}$, $y = 7 \times 10^{-8}$

Solution: Here $x = 4.9 \times 10^{-5}, y = 7 \times 10^{-8}$

$$\therefore \quad \frac{x}{y} = \frac{4.9 \times 10^{-5}}{7 \times 10^{-8}} = 0.7 \times (10)^{-5-(-8)}$$

$$= 0.7 \times (10)^3$$

$$= 700$$

Example 8: If x is a rational number and a, b, c are any integers, then prove

$$x^{a-b} \div x^{c-b} \times x^{c-a} = 1$$

Solution: $x^{(a-b)-(c-b)} \times x^{c-a} = (x)^{a-c} \times (x)^{c-a}$

$$= (x)^{(a-c)+(c-a)}$$

$$= x^0 = 1$$

Multiple Choice Questions

1. What is the value of $[(5^{-1} \times 3^{-1})^{-1} \div 6^{-1}]$?

   (a) 60 (b) 80 (c) 90 (d) 110

2. What is the value of $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2}$?

   (a) 26 (b) 27 (c) 28 (d) 29

3. What is the value of p for which

   $$\left(\frac{4}{9}\right)^4 \times \left(\frac{4}{9}\right)^{-7} = \left(\frac{4}{9}\right)^{2p-1} ?$$

   (a) 1 (b) 0
   (c) -1 (d) -2

4. If $5^{2x+1} \div 25 = 125$. What is the value of x?

   (a) 1 (b) 2
   (c) 3 (d) 4

5. By what number should $\left(\frac{-3}{2}\right)^{-3}$ be divided so that the duotient is $\left(\frac{9}{4}\right)^{-2}$?

   (a) $\frac{3}{2}$ (b) $\frac{-3}{2}$ (c) $\frac{-1}{3}$ (d) $\frac{1}{2}$

6. What is the value of $(4^{-1} + 8^{-1}) \div \left(\frac{2}{3}\right)^{-1}$?

   (a) $\frac{3}{2}$ (b) $\frac{1}{4}$ (c) $\frac{1}{8}$ (d) $\frac{1}{16}$

7. What is the value of $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2}$?

   (a) 27 (b) 25 (c) 29 (d) 31

8. By what number should $\left(\frac{1}{2}\right)^{-1}$ be multiplied so that the product is $\left(\frac{-5}{4}\right)^{-1}$?

   (a) $\frac{2}{5}$ (b) $\frac{-2}{5}$ (c) $\frac{1}{5}$ (d) $\frac{-1}{5}$

9. By what number should $(-6)^{-1}$ be multiplied so that the product becomes 9^{-1}?

   (a) $\frac{-1}{3}$ (b) $\frac{2}{3}$ (c) $\frac{-2}{3}$ (d) $\frac{1}{3}$

10. What is the standard form of 0.00000000837?

    (a) 8.37×10^9 (b) 8.37×10^{-9}
    (c) 83.7×10^{-8} (d) 837×10^{-7}

11. What is the value of x for which.

    $$\left(\frac{7}{12}\right)^{-4} \times \left(\frac{7}{12}\right)^{3x} = \left(\frac{7}{12}\right)^5 ?$$

    (a) -1 (b) 1 (c) 2 (d) 3

12. The value of $(3^{-1} + 4^{-1})^{-1} \div 5^{-1} = ?$

    (a) $\frac{7}{10}$ (b) $\frac{7}{15}$ (c) $\frac{7}{5}$ (d) $\frac{60}{7}$

13. If $(2^{3x-1}+10) \div 7 = 6$ then what is the value of x?
(a) 0 (b) 1 (c) -2 (d) 2

14. What is the usual form of 0.000467×10^4?
(a) 4.67 (b) 46.7 (c) 0.467 (d) 0.0467

15. If $\left(\frac{5}{4}\right)^{-2} \div \left(\frac{-5}{4}\right)^{-3} = \left(\frac{-4}{5}\right)^{x}$, Find x?
(a) -1 (b) 1 (c) 2 (d) -2

16. What will be the value of $\left[(2)^{\frac{1}{2}}\right]^{4x}$, where $x = -0.5$?
(a) 2 (b) $\frac{1}{4}$ (c) $\frac{1}{2}$ (d) 4

17. Express 1 micron in standard form.
(a) $\frac{1}{100000}$ m (b) 1×10^{-6} m
(c) $\frac{1}{100000}$ m (d) 1×10^{-5}m

18. The value of $(5^{-3}+5^{-2}+5^{-1}+5^{0})$ is :
(a) 5^{-4} (b) 2.248
(c) 1.248 (d) 3.248

19. If $5^{2p}+5^{p}+5^{0}=651$, then $p=$
(a) 2 (b) 3 (c) 4 (d) 5

20. If $\frac{5^3}{5^2} \div \frac{3^5}{2^5} \times \frac{2^x}{3^x} = 0.0578$, then $x=$
(a) 2 (b) 3 (c) 4 (d) 6

21. $(32)^{2x+1} = (8)^{-x}(4)^{-4}$, the value of x will be:
(a) 1 (b) -1 (c) 2 (d) -2

22. By what number $(23)^{-3}$ should be multiplied so that the product becomes $(69)^{-1}$?
(a) $\frac{529}{4}$ (c) $\frac{529}{7}$ (c) $\frac{529}{3}$ (d) $\frac{529}{6}$

23. $(5^{-1}+6^{-1}) \div 22 = k^{-1}$, then k will be equal to:
(a) 20 (b) 30
(c) 40 (d) 60

24. The distance between earth and the sun is 15×10^7 km. Express this distance in metres.
(a) 15×10^{11} m (b) 1.5×10^{9} m
(c) 1.5×10^{11} m (d) 1.5×10^{8}m

25. Simplify :
$$\left(\frac{25}{16}\right)^4 \div \left(\frac{225}{144}\right)^{-3}$$
(a) $\left(\frac{5}{4}\right)^2$ (b) $\left(\frac{5}{4}\right)^{14}$ (c) $\left(\frac{5}{4}\right)^{12}$ (d) $\left(\frac{5}{4}\right)^3$

26. $(6+3) \times 9^{-1} \div 3^{-1} + 2^{-2} =$
(a) $\frac{5}{4}$ (b) $\frac{7}{4}$ (c) $\frac{13}{4}$ (d) $\frac{7}{8}$

27. $\frac{p^m}{p^n} \times \frac{n^p}{m^p} \div \frac{m^{p+n}}{p^{n+m}} = m \neq 0,\ p \neq 0$ and $m = n = p$
(a) 1 (b) p^{2p}
(c) $p^{2p}+1$ (d) p^{3p}

28. The size of a plant cell is 0.00001275 m. Express this distance in standard form.
(a) 1275×10^{-6} (b) 1275×10^{-5} m
(c) 1.275×10^{-5} (d) 1.275×10^{-6} m

29. $\left[\left(\frac{1}{3}\right)^{-2} - \left(\frac{1}{4}\right)^{-2}\right]^{-2} \times 7^2 =$
(a) 49 (b) 0
(c) 7 (d) 1

30. $2^{3x+5} \times 3^{2x+5} = (6)^{3x+2}$, then $x=$
(a) 6 (b) 5
(c) $3(\log_2 3+1)$ (d) $3(\log_3 2+1)$

Answer Key

1. (c)	2. (d)	3. (c)	4. (b)	5. (b)	6. (b)	7. (c)	8. (b)	9. (c)	10. (b)
11. (d)	12. (d)	13. (d)	14. (a)	15. (a)	16. (c)	17. (b)	18. (c)	19. (a)	20. (d)
21. (b)	22. (c)	23. (d)	24. (c)	25. (b)	26. (c)	27. (a)	28. (c)	29. (d)	30. (d)

Hints and Solutions

1. **(c)** We have $[(5^{-1}\times 3^{-1})^{-1}\div 6^{-1}]$

$$=\left[\left(\frac{1}{5}\times\frac{1}{3}\right)^{-1}\div\frac{1}{6}\right]=\left[\left(\frac{1}{15}\right)^{-1}\div\frac{1}{6}\right]$$

$$=\left[\frac{1}{\frac{1}{15}}\times\frac{6}{1}\right]=15\times 6=90$$

2. **(d)** $\left(\frac{1}{2}\right)^{-2}+\left(\frac{1}{3}\right)^{-2}+\left(\frac{1}{4}\right)^{-2}$

$$=\frac{1}{\left(\frac{1}{2}\right)^2}+\frac{1}{\left(\frac{1}{3}\right)^2}+\frac{1}{\left(\frac{1}{4}\right)^2}=4+9+16=29$$

3. **(c)** $\left(\frac{4}{9}\right)^4\times\left(\frac{4}{9}\right)^{-7}=\left(\frac{4}{9}\right)^{2p-1}$

$$\Rightarrow \left(\frac{4}{9}\right)^{4-7}=\left(\frac{4}{9}\right)^{2p-1}$$

$$\Rightarrow 2p-1=-3\Rightarrow 2p=-2$$

$$\Rightarrow p=-1$$

4. **(b)** Here $5^{2x+1}\div 25=125$

$$5^{2x+1}\div 5^2=5^3\Rightarrow 5^{2x+1-2}=5^3$$

$$\Rightarrow 2x-1=3$$

$$\Rightarrow 2x=4\Rightarrow x=2$$

5. **(b)** Let the number be x.

$$\left(\frac{-3}{2}\right)^{-3}\div x=\left(\frac{9}{4}\right)^{-2}$$

$$\Rightarrow\left(\frac{-3}{2}\right)^{-3}\times\frac{1}{x}=\left[\left(\frac{3}{2}\right)^2\right]^{-2}$$

$$\Rightarrow\left(\frac{-3}{2}\right)^{-3}\times\frac{1}{x}=\left(\frac{3}{2}\right)^{-4}$$

$$\Rightarrow x=-\left(\frac{3}{2}\right)^{-3}\div\left(\frac{3}{2}\right)^{-4}$$

$$\Rightarrow x=\frac{-3}{2}$$

6. **(b)** We have $(4^{-1}+8^{-1})\div\left(\frac{2}{3}\right)^{-1}$

$$=\left(\frac{1}{4}+\frac{1}{8}\right)\div\frac{1}{\frac{2}{3}}=\frac{3}{8}\div\frac{3}{2}=\frac{3}{8}\times\frac{2}{3}=\frac{1}{4}$$

7. **(c)**

8. **(b)** Let the number be x.

$$\left(\frac{1}{2}\right)^{-1}\times x=\left(\frac{-5}{4}\right)^{-1}$$

$$\Rightarrow \frac{1}{\frac{1}{2}}\times x=\frac{1}{\frac{-5}{4}}\Rightarrow 2x=\frac{4}{-5}$$

$$\Rightarrow x=\frac{4}{-5\times 2}=-\frac{2}{5}$$

9. **(c)** $(-6)^{-1}\times x=9^{-1}$

$$\Rightarrow \frac{1}{-6}\times x=\frac{1}{9}\Rightarrow x=\frac{-6}{9}=\frac{-2}{3}$$

10. **(b)** We have

$$0.00000000837=\frac{837}{10^{11}}=\frac{837}{100\times 10^9}$$

$$=8.37\times 10^{-9}$$

11. **(d)** Given $\left(\frac{7}{12}\right)^{-4}\times\left(\frac{7}{12}\right)^{3x}=\left(\frac{7}{12}\right)^5$

$$\Rightarrow \left(\frac{7}{12}\right)^{3x-4}=\left(\frac{7}{12}\right)^5$$

$$\Rightarrow 3x-4=5\Rightarrow 3x=9\Rightarrow x=3$$

12. **(d)** Here $(3^{-1}+4^{-1})^{-1}\div 5^{-1}$

$$=\left(\frac{1}{3}+\frac{1}{4}\right)^{-1}\div 5^{-1}$$

$$=\left(\frac{7}{12}\right)^{-1}\div\frac{1}{5}$$

$$=\frac{1}{\frac{7}{12}}\div\frac{1}{5}$$

$$=\frac{12}{7}\times\frac{5}{1}=\frac{60}{7}$$

13. **(d)** Here $(2^{3x-1}+10)\div 7=6$

$\Rightarrow \quad (2^{3x-1}+10)\times\frac{1}{7}=6$

$\Rightarrow \quad 2^{3x-1}+10=42$

$\Rightarrow \quad 2^{3x-1}=32=2^5$

On comparing the powers

$3x-1=5\Rightarrow 3x=6$

$\Rightarrow \quad x=2$

14. **(a)** 0.000467×10^4.

$=\frac{467}{10^6}\times 10^4=\frac{467}{10^2}=\frac{467}{100}=4.67$

15. **(a)** $\left(\frac{5}{4}\right)^{-2}\div\left(\frac{-5}{4}\right)^{-3}=-\left(\frac{5}{4}\right)^{-2-(-3)}$

$=\left(\frac{-5}{4}\right)^{1}=-\left(\frac{4}{5}\right)^{-1}$

$=\left(\frac{-4}{5}\right)^{x}\Rightarrow x=-1$

16. **(c)** $\left[(2)^{\frac{1}{2}}\right]^{4\times -0.5}=\left[(2)^{\frac{1}{2}}\right]^{-2}$

$=[2]^{\frac{1}{2}\times(-2)}=(2)^{-1}=\frac{1}{2}$

17. **(b)** 1 micron $=\frac{1}{1000000}$ m

$=1\times 10^{-6}$m.

18. **(c)** $5^{-3}+5^{-2}+5^{-1}+5^0$

$=5^{-1}(5^{-2}+5^{-1}+5^0)+5^0\quad[\because 5^0=1]$

$=5^{-1}\left(\frac{1}{25}+\frac{1}{5}+1\right)+1$

$=5^{-1}\left(\frac{1+5+25}{25}\right)+1$

$=\frac{31}{125}+1=\frac{156}{125}=1.248$

19. **(a)** Let $5^p=t$,

$\therefore \quad 5^{2p}+5^p=650$

$\Rightarrow \quad t^2+t-605=0\Rightarrow t=25$

$\Rightarrow \quad 5^p=25\Rightarrow 5^p=(5)^2$

$\Rightarrow \quad p=2$

20. **(d)** Given $\frac{5^3}{5^2}=(5)^{3-2}=(5)^1=5$

$5\times\frac{2^5}{3^5}\times\frac{2^x}{3^x}=0.0578$

$\Rightarrow \quad \frac{2^x}{3^x}=\left(\frac{2}{3}\right)^6$

$\Rightarrow \quad x=6$

21. **(b)** $(2)^5=32$

$\therefore (32)^{2x+1}=((2)^5)^{2x+1}=(2)^{10x+5}$

$\therefore (2)^{10x+5}=(2)^{-3x}(2)^{-8}$

$\Rightarrow 10x+5=-3x-8$

$\Rightarrow \quad 13x=-13\Rightarrow x=-1.$

22. **(c)** $(23)^{-3}\times x=(69)^{-1}$

$x=\frac{23\times 23\times 23}{69}=\frac{529}{3}$

23. **(d)** $\left(5^{-1}+6^{-1}\right)=\frac{1}{5}+\frac{1}{6}=\frac{11}{30}$

$\therefore \quad k^{-1}=\frac{11}{30}\times\frac{1}{22}=\frac{1}{60}$

$\Rightarrow \quad \frac{1}{k}=\frac{1}{60}$

$\Rightarrow \quad k=60$

24. **(c)** Distance $=15\times 10^7$ km

$=15\times 10^7\times 10^3$ m

$=15\times 10^{10}$ m

$=1.5\times 10^{11}$ m

25. **(b)** $\left(\frac{25}{16}\right)^4=\left(\left(\frac{5}{4}\right)^2\right)^4=\left(\frac{5}{4}\right)^{2\times 4}=\left(\frac{5}{4}\right)^8.$

$\left(\frac{225}{144}\right)^{-3}=\left(\frac{25}{16}\right)^{-3}=\left(\frac{5}{4}\right)^{-2\times 3}=\left(\frac{5}{4}\right)^{-6}$

$\therefore \left(\frac{25}{16}\right)^4\div\left(\frac{225}{144}\right)^{-3}=\left(\frac{5}{4}\right)^{14}$

26. **(c)** Here $(6+3)\times 9^{-1}\div 3^{-1}+2^{-2}$

$=9\times 9^{-1}\div 3^{-1}+2^{-2}$

$$= 9 \times \frac{1}{3} + 2^{-2} = 3 + \frac{1}{4} = \frac{13}{4}$$

27. **(a)** We have $\frac{p^m}{p^n} \times \frac{n^p}{m^p} \times \frac{p^{n+m}}{m^{p+n}}$

$$= p^{m-n+n+m} \times n^p \times m^{-p-p-n}$$

$$= p^{2m} \times n^p \times m^{-2p-n}$$

$\because m = n = p$

$\therefore p^{3p-2p-p} = p^0 = 1$

28. **(c)** Size of plant cell $= 1275 \times 10^{-8}$ m

$= 1.275 \times 10^{-5}$ m.

29. **(d)** $\left(\frac{1}{3}\right)^{-2} = 9, \left(\frac{1}{4}\right)^{-2} = 16$

$\therefore [9-16]^{-2} \times 7^2 = (7)^{-2} \times (7)^2$

$= (7)^{-2+2}$

$= (7)^0 = 1$

30. (d) Here $2^{3x+5} \times (3)^{2x+5}$

$= (2)^{3x+2} \times (3)^{3x+2}$

$\Rightarrow (2)^{(3x+5-3x-2)} = (3)^{3x+2-2x-5}$

$\Rightarrow (2)^3 = (3)^{x-3}$

$\Rightarrow \log_2 (2)^3 = \log_2 (3)^{x-3}$

$\Rightarrow 3 = (\log_2 3)(x-3)$

$\Rightarrow x = \frac{3}{\log_2 3} + 3$

$= 3 \log_3 2 + 3$

$= 3 (\log_3 2 + 1)$

6. Profit and Loss

Profit and Loss

Profit or gain = Selling price – cost price

$$\text{Profit percent} = \frac{\text{profit}}{\text{cost price + price}} \times 100$$

Loss = Cost Price – Selling Price

$$\text{Loss percent} = \frac{\text{loss}}{\text{cost price + price}} \times 100$$

Example 1: Rajesh sold a scooter for ₹ 23000 and earned a profit of 15%. What is the cost price of scooter?

Solution: S.P. = ₹ 23000

Profit = 15%

$$\text{Cost Price} = \frac{23000 \times 100}{(100+15)} = \frac{100 \times 23000}{115}$$

$$= 100 \times 200 = ₹\ 20000$$

Example 2: Mohan buys a mobile for ₹ 3680 and sell it at a gain of $7\frac{1}{2}$%. What is its selling price?

Solution: Here C.P. = ₹ 3680, Gain $= \frac{15}{2}$%.

$$\text{S.P.} = \frac{215}{200} \times 3680 = \text{Rs. } 3956.$$

Example 3: On selling a shoe for ₹ 987 a shopkeeper loses 6%. What is the cost price of the shoe?

Solution: S.P. = ₹ 987.

Loss = 6%

$$\text{C.P. of the shoe} = \frac{100}{94} \times 987 = ₹1050$$

Example 4: Raju bought apples at 10 for ₹ 25 and sold them at ₹ 25 per down. What is the gain or loss percent?

Solution: C.P. of one apple = ₹ $\frac{25}{10}$

and S.P. of one apple = ₹ $\frac{25}{12}$

$$\therefore \quad \text{Loss} = \frac{25}{10} - \frac{25}{12} = \frac{150-125}{60} = \frac{25}{60}$$

$$\text{Loss percent} = \frac{\text{Loss}}{\text{C.P.}} \times 100$$

$$= \frac{\frac{25}{60}}{\frac{25}{10}} \times 100$$

$$= \frac{25}{60} \times \frac{10}{25} \times 100 = \frac{100}{6} = \frac{50}{3} = 16\frac{2}{3}\%$$

Discount

In order to increase the sale, sometimes the shopkeepers offer a certain percentage of rebate on the market price. This rebate is called as discount.

Marked Price : In departmental store, every article is tagged with a card and its price is written on it. It is called marked price of that article.

Example 5: The marked price of a shirt is ₹ 1250 and a shopkeeper allows a discount of 78% on it. What is the selling price of the shirt?

Solution: M.P. = ₹ 1250

Discount = 7%

Discount = 7% of 1250

$$= \frac{7 \times 1250}{100} = 87.50$$

S.P. = 1250 – 87.50 = ₹ 1162.50

Example 6: Find the single discount equivalent to two successive discounts of 25% and 10%.

Solution: Let the M.P. be ₹ 100.

First discount = ₹ 25

∴ Price after first discount = 100 – 25 = 75

Second discount = 10% of 75

$$= \frac{10 \times 75}{100} = ₹ 7.50$$

Price after second discount = ₹ (75 – 7.50) = ₹ 67.50

Net selling price = ₹ 67.50

Single discount equivalent to given successive discounts = 100 – 67.50 = 32.5%

Compound Interest

When interest is compounded annually

Then $A = P\left(1 + \frac{R}{100}\right)^n$

where, A = Amount

P = Principal value

R = Rate percent

N = time in years

C.I. = A – P

Example 7: Find the amount and compound interest of ₹ 8000 for 3 years compounded annually at 10% per annum.

Solution: Here $P = ₹\ 8000$, $R = 10\%$, $n = 3$ years.

Now $A = P\left(1+\frac{R}{100}\right)^n$

$\Rightarrow \quad A = 8000\left(1+\frac{10}{100}\right)^3 = 8000\left(\frac{11}{10}\right)^3$

$\Rightarrow \quad A = 8000\times\frac{11}{10}\times\frac{11}{10}\times\frac{11}{10} = 8\times1331 = 10648$

$\therefore$ C.I. = 10648 – 8000 = ₹ 2648

Example 8: At what percent per annum will ₹ 4000 amount to ₹ 4410 in 2 years when compounded annually.

Solution: Here $P = ₹\ 4000$

$A = ₹\ 4410$

$n = 2$ years

$R = ?$

Now $A = P\left(1+\frac{R}{100}\right)^n$

$\Rightarrow \quad 4410 = 4000\left(1+\frac{R}{100}\right)^2$

$\Rightarrow \quad \frac{4410}{4000} = \left(1+\frac{R}{100}\right)^2 \Rightarrow \left(\frac{21}{20}\right)^2 = \left(1+\frac{R}{100}\right)^2$

$\Rightarrow \quad 1+\frac{R}{100} = \frac{21}{20} \Rightarrow \frac{R}{100} = \frac{21}{20} - 1$

$\Rightarrow \quad \frac{R}{100} = \frac{1}{20}$

$\Rightarrow \quad R = \frac{100}{20} = 5\%$

Example 9: In how many years ₹ 1800 amount to ₹ 2178 at 10% per annum when compounded annually?

Solution: Here $P = ₹\ 1800$; $A = ₹\ 2178$; $R = 10\%$; $n = ?$

$\therefore \quad A = P\left(1+\frac{R}{100}\right)^n \Rightarrow 2178 = 1800\left(1+\frac{10}{100}\right)^n$

$\Rightarrow \quad \frac{2178}{1800} = \left(1+\frac{10}{100}\right)^n \Rightarrow \frac{1089}{900} = \left(\frac{11}{10}\right)^n$

$\Rightarrow \quad \left(\frac{11}{10}\right)^2 = \left(\frac{11}{10}\right)^n$

$\Rightarrow \quad n = 2$ yeras.

Multiple Choice Questions

1. By selling an umbrella at a profit of ₹ 60 a shopkeeper made a profit of 20%. What is the cost price of umbrella?
   (a) ₹ 300 (b) ₹ 320 (c) ₹ 400 (d) ₹ 420
2. 72% of 250 students are good in science. How many students are not good in science?
   (a) 180 (b) 70 (c) 120 (d) 130
3. An item marked at ₹ 840 sold for ₹ 714. What is the discount percent?
   (a) 15% (b) 25%
   (c) 30% (d) None of these
4. What is the selling price if a profit of 5% is made on a fan bought for ₹ 560 and expenses of ₹ 40 made on its repair?
   (a) ₹ 600 (b) ₹ 630
   (c) ₹ 650 (d) ₹ 680
5. A shopkeeper buys 80 articles for ₹ 4800 and sells them for a profit of 16%. What is the selling price of one article?
   (a) ₹ 66.90 (b) ₹ 69.60
   (c) ₹ 63.60 (d) ₹ 68.90
6. If 8% VAT is included in the prices, then what is the original price of a bucket bought for ₹180?
   (a) ₹ 166.66 (b) ₹ 162.66
   (c) ₹ 163.66 (d) ₹ 164.66
7. A milkman sold two of his cows for ₹ 20000 each. On one he made a gain of 5% and on the other a loss of 10%. What is his overall gain or loss?
   (a) 1269.84 Loss (b) 1269.84 Profit
   (c) 1169.84 Loss (d) 1169.84 Profit
8. Rahman bought a mobile for ₹ 3300 including a tax of 10%. What is the price of mobile before VAT was added?
   (a) ₹ 2500 (b) ₹ 3000
   (c) ₹ 2800 (d) ₹ 400
9. An article is sold at ₹ 5225 after allowing discount of 5%. What is its marked price?
   (a) ₹ 5500 (b) ₹ 5400
   (c) ₹ 5600 (d) ₹ 5450
10. What is the compound interest on ₹ 62500 for $1\frac{1}{2}$ years at 8% per annum compounded half yearly?
    (a) ₹ 7804 (b) ₹ 7004
    (c) ₹ 7204 (d) ₹ 7624
11. A scooter was bought at ₹ 42,000. Its value depreciated at the rate of 8% per annum what is its value after one year?
    (a) ₹ 40640 (b) ₹ 38,640 9
    (c) ₹ 39,640 (d) None of these
12. By selling 20 pens a shopkeeper gains equal to the selling price of 4 pens. What is his gain percent?
    (a) 15% (b) 20% (c) 25% (d) 30%
13. If the S.P. of 10 articles is equal to the C.P. of 11 articles. What is the gain percent?f
    (a) 5% (b) 10% (c) 15% (d) 20%
14. Mohan purchased a tape recorder and spent ₹ 66 on its repair. He sold the tape recorder for ₹ 1130 and made a profit of 24%. At what price did he buy the tape recorder?
    (a) ₹ 5684 (b) ₹ 5284
    (c) ₹ 5784 (d) ₹ 5648
15. A publisher offers a discount of 10% on his books and still makes a profit of 20%. What is the actual cost of a book if it is marked at ₹ 320?
    (a) ₹ 220 (b) ₹ 240 (c) ₹ 210 (d) ₹ 260
16. What is a single discount equivalent to two successive discounts of 20% and 10%?
    (a) 28% (b) 38% (c) 22% (d) 32%
17. In what time will ₹ 800 amount to Rs,. 88 2.At 5% per annum compounded annually?
    (a) 2 years (b) 2.5 years
    (c) 3 years (d) 4 years
18. What sum will become ₹ 9724.05 in 2 years if the rate of interest is 10% compounded half yearly?
    (a) ₹ 6000 (b) ₹ 6800
    (c) ₹ 7200 (d) ₹ 8000

19. What is the rate percent per annum if ₹ 2000 amount to ₹ 2662 in $1\frac{1}{2}$ years, it interest being compounded half yearly?
(a) 20% (b) 10% (c) 25% (d) 16%

20. A dealer offers a discount of 20%, 10% and 5%. What is the single equivalent rate of discount?
(a) 32.6% (b) 31.6% (c) 28.6% (d) 33.6%

21. The cost of a mobile phone is ₹ 3000. A gain of 10% should be made after a discount of 20%. What is the marked price of the mobile phone?
(a) ₹ 4000 (b) ₹ 4125
(c) ₹ 4025 (d) ₹ 4100

22. Rajesh has to pay 6% sales tax in addition to the price of a certain article. What is the price if he pays ₹ 53 to buy the article?
(a) ₹ 45 (b) ₹ 50
(c) Rs 48 (d) None of these

23. Bunti buys a leather coat costing ₹ 900 at ₹ 999. After paying the sales tax. What is rate of sales tax charged on the coat?
(a) 10% (b) 9%
(c) 11% (d) None of these

24. A shopkeeper increases the price of an item by 10% and then allows a discount of 15%. How much has the customer to pay if the item was initially priod at ₹ 1200 ?
(a) ₹ 1120 (b) ₹ 1140
(c) ₹ 1122 (d) 1124

25. What amount that Jay will receive if he deposits ₹ 8000 for 3 years at 10% per annum compounded annually?
(a) ₹ 10228 (b) ₹ 10548
(c) ₹ 10548 (d) ₹ 10648

26. A businessman marks his good at 40% above the cost price and allows a discount of 25%. What is his gain percent?
(a) 5% (b) 10%
(c) 15% (d) 20%

27. The cost price of 12 books is equal to selling price of 15 books. What is the loss percent?
(a) 10% (b) 20%
(c) 15% (d) 25%

28. Calculate the compound interest on ₹ 10000 at 10% per annum for 3 years, if interest compounded annually?
(a) ₹ 3130 (b) ₹ 1331
(c) ₹ 3310 (d) ₹ 13310

29. The value of a machine at the rate of 20% per annum. It was purchased 2 years ago if its present value is ₹ 4000, for how much was it purchased?
(a) ₹ 62500 (b) ₹ 62800
(c) ₹ 65200 (d). 56500

30. If the simple interest on a sum of money at 5% per annum for 3 years is ₹ 1200. Then what is the compound interest on the same sum for the same period at the same rate?
(a) ₹ 1261 (b) ₹ 1225
(c) ₹ 1241 (d) ₹ 1251

Answer Key

1. (a)	2. (b)	3. (a)	4. (b)	5. (b)	6. (a)	7. (a)	8. (b)	9. (a)	10. (a)
11. (b)	12. (c)	13. (b)	14. (a)	15. (b)	16. (a)	17. (a)	18. (d)	19. (b)	20. (b)
21. (b)	22. (b)	23. (c)	24. (c)	25. (c)	26. (a)	27. (b)	28. (c)	29. (a)	30. (a)

Hints and Solutions

1. **(a)** Let the cost price be ₹ x

$\therefore$ 20% of $x = 60$

$\Rightarrow \frac{20x}{100} = 60 \Rightarrow x = \frac{60 \times 100}{20} = 300$

2. **(b)** The no. of students good in science

$= 72\%$ of 250

$= \frac{72 \times 250}{100} = 180$

No. of students not good in science

$= 250 - 180 = 70$

3. **(a)** Discount % $= \frac{840 - 714}{840} \times 100$

$= \frac{126 \times 100}{840} = 15\%$

4. **(b)** C.P. $= 560 + 40 = 600$

S.P. $= 600 + 5\%$ of 600

$= 600 + \frac{5 \times 600}{100} = 600 + 30 = 630$

5. **(b)** Selling price of one article

$= \frac{4800 + 16\% \text{ of } 4800}{80}$

$= \frac{4800 + 768}{80} = \frac{5568}{80} = ₹ 69.60$

6. **(a)** Let the original price be ₹ x.

$\therefore$ $x + 8\%$ of $x = 180$

$\Rightarrow x + \frac{8x}{100} = 180$

$\Rightarrow x = \frac{180 \times 100}{108} = ₹ 166.66$

7. **(a)** C.P. of 1st cow

$= \frac{20,000 \times 100}{105} = 19047.06$

C.P. of 2nd cow $= \frac{20000 \times 100}{90} = 22222.22$

Total C.P. $= 19047.62 + 2222.22 = ₹ 41269.84$

Total S.P. $= ₹ (20000 + 20000) = ₹ 40000$

Overall loss $= 41269.84 - 40000 = 1269.84$

8. **(b)** Let the price of mobile before VAT be ₹ x.

$\therefore$ $x + 10\%$ of $x = 3300$

$\Rightarrow x + \frac{10x}{100} = 3300$

$\Rightarrow 11x = 3300 \times 10$

$\Rightarrow x = \frac{3300 \times 10}{11} = 3000$

9. **(a)** Let the marked price be ₹ x.

$\therefore$ $x - 5\%$ of $x = 5225$

$\Rightarrow x - \frac{5x}{100} = 5225$

$\Rightarrow 95x = 5225 \times 100$

$\Rightarrow x = \frac{5225 \times 100}{95} = ₹ 5500$

10. **(a)** We know $A = P\left(1 + \frac{R}{100}\right)^n$

$\therefore$ $A = 62500\left(1 + \frac{4}{100}\right)^3$

$= 62500 \times \frac{104}{100} \times \frac{104}{100} \times \frac{104}{100}$

$= 70304$

then C.I. $= 70304 - 62500 = 7804$

1 . Value of scooter after one year

$= 42000\left(1 - \frac{8}{100}\right)^1$

$= 42000\left(\frac{100 - 8}{100}\right) = \frac{42000 \times 92}{100}$

$=$ Rs. 38640

12. **(c)** Let selling price of 20 pens = ₹ 20

$\therefore$ Now Gain = ₹ 4

Cost Price $= 20 - 4 = 16$

Hence Gain percent $= \frac{4}{16} \times 100 = 25\%$

13. **(b)** Let the S.P. of 10 articles = ₹ 10

$\therefore$ S.P. of 1 article $= ₹ \frac{10}{11} = ₹ 1$

and C.P of 11 articles = ₹ 10

C.P of 1 ₹ $n = ₹\ \frac{10}{11}$

$\therefore$ Gain $= 1 - \frac{10}{11} = \frac{1}{11}$

Hence Gain percent $= \frac{\frac{1}{11}}{\frac{10}{11}} \times 100$

$= \frac{1}{10} \times 100 = 10\%$

14. **(a)** Let C.P. be ₹ x.
then $(x + 66) + 24\%$ of $(x + 66) = 7130$

$\Rightarrow \quad (x + 66) + \frac{24\,(x + 66)}{100} = 7130$

$\Rightarrow 100x + 6600 + 24x + 1584 = 713000$

$\Rightarrow \quad 124x = 713000 - 8184$

$\Rightarrow \quad 124x = 704816$

$\Rightarrow \quad x = \frac{704816}{124} = 5684$

15. **(b)** Here Marked Price = ₹ 320.
and Discount = 10%
Selling Price = 320 – 10% of 320
$= 320 - 32 = 288$
Let C.P. be ₹ x.

$\therefore \quad x + 20\%$ of $x = 288$

$\Rightarrow \quad x + \frac{20x}{100} = 288$

$\Rightarrow \quad x = \frac{288 \times 100}{120} = ₹\,240$

16. **(a)** Let the marked price = ₹ 100
and Discount = 20%
then $100 - 20 = 80$

Discount = 10% of $80 = \frac{10 \times 80}{100} = 8$

$80 - 8 = 72$

Successive discount = $100 - 72 = 28\%$

17. **(a)** Here $A = P\left(1 + \frac{r}{100}\right)^n$

$\Rightarrow \quad 882 = 800\left(1 + \frac{5}{100}\right)^n$

$\Rightarrow \quad \frac{882}{800} = \left(\frac{105}{100}\right)^n$

$\Rightarrow \quad \frac{441}{400} = \left(\frac{21}{20}\right)^n$

$\Rightarrow \quad \left(\frac{21}{20}\right)^2 = \left(\frac{21}{20}\right)^n$

$\Rightarrow \quad n = 2$

18. **(d)** We know $A = p\left(1 + \frac{r}{100}\right)^n$.

Here $\quad r = \frac{10}{2} = 5\%$

and $\quad n = 2 \times 2 = 4$

$\therefore \quad 9724.05 = P\left(1 + \frac{5}{100}\right)^4$

$\Rightarrow \quad 9724.05 = P\left(\frac{100 + 5}{100}\right)^4$

$\Rightarrow \quad 9724.05 = P\left(\frac{21}{20}\right)^4$

$\Rightarrow \quad P = \frac{9724.05 \times 20 \times 20 \times 20 \times 20}{21 \times 21 \times 21 \times 21}$

$\Rightarrow \quad P = \frac{9724.05 \times 400 \times 400}{441 \times 441}$

$= 8000$

19. **(b)** Here $A = P\left(1 + \frac{r}{100}\right)^n$

$\Rightarrow \quad 2662 = 2000\left(1 + \frac{r}{100}\right)^3$

$\Rightarrow \quad \frac{2662}{2000} = \left(1 + \frac{r}{100}\right)^3$

$\Rightarrow \quad 1.331 = \left(1 + \frac{r}{100}\right)^3$

$\Rightarrow \quad (1.1)^3 = \left(1 + \frac{r}{100}\right)^3$

$\Rightarrow \quad 1 + \frac{r}{100} = 1.1 \Rightarrow \frac{r}{100} = 0.1$

$\Rightarrow \quad r = 0.1 \times 100 = 10\%$

20. **(b)** Let Marked Price = ₹ 100

Discount = 20%

$100 - 20 = 80.$

Discount = 10% of $80 = \frac{10 \times 80}{100} = 8$

$80 - 8 = 72$

Discount = 5% of $72 = \frac{5 \times 72}{100} = 3.6$

$\therefore \quad 72 - 3.6 = 68.4$

Single equivalent discount = $100 - 68.4$

$= 31.6\%$

21. **(b)** Selling Price = $3000 \times \frac{11}{1000} = 3300$

Let Marked Price be ₹ x

$x - 20\%$ of $x = x - \frac{20x}{100} = \frac{80x}{100}$

$\Rightarrow \quad \frac{80x}{100} = 3300$

$\Rightarrow \quad x = \frac{100 \times 3300}{80} = 4125$

22. Let the price be ₹ x.

then $x + 6\%$ of $x = 53$

$\Rightarrow \quad x + \frac{6x}{100} = 53$

$\Rightarrow \quad 106x = 53 \times 100$

$\Rightarrow \quad x = \frac{53 \times 100}{106} = 50$

23. **(c)** Let sales tax = x %

$\Rightarrow 900 + x\%$ of $900 = 999$

$\Rightarrow \quad 900 + \frac{900 \times x}{100} = 999$

$\Rightarrow \quad 9x = 99 \Rightarrow x = 11$

24. Price = ₹ 1200

Increased Price = 1200 + 10% of 1200

$= 1200 + 120 = 1320$

Discount = 15% of 1320

$= \frac{15 \times 1320}{100}$

$= 198$

The net payable amount = $1320 - 198$

$= ₹1122$

25. **(c)** Here $A = P\left(1 + \frac{r}{100}\right)^n$

then $A = 8000\left(1 + \frac{10}{100}\right)^3$

$= 8000\left(\frac{110}{100}\right)^3$

$= 8000 \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100}$

$= 8 \times 1331$

$= 10648$

26. **(a)** Let the cost price be ₹ 100

Marked price = ₹ 140

Discount = 25% of $140 = \frac{25 \times 140}{100} + 35$

Selling price = $140 - 35 = 105$

Gain Percent = $105 - 100 = 5\%$

27. **(b)** Let the cost price of 12 books = ₹ x.

Cost price of 1 book $= \frac{x}{12}$

Selling price of 15 books = ₹ x.

S.P. of 1 book $= \frac{x}{15}$

$\therefore \quad \frac{x}{12} - \frac{x}{15} = \frac{5x - 4x}{60} = \frac{x}{60}$

Loss percent $= x/60 \times x/12 \times 100$

$= \frac{x}{60} \times \frac{12}{x} \times 100$

$= 20\%$

28. **(c)** Here $A = P\left(1+\frac{r}{100}\right)^n$

$\Rightarrow$ $A = 10000\left(1+\frac{10}{100}\right)^3$

$= 10000 \times \frac{110}{100} \times \frac{110}{100} \times \frac{110}{100}$

$= 10 \times 1331$

$= 13310$

$\therefore$ C.I. = A − P = 13310 − 10000

= ₹3310

29. **(a)** Let the purchase price = ₹ x

then $40.000 = x\left(1+\frac{20}{100}\right)^2$

$\Rightarrow$ $40000 = x\left(\frac{80}{100}\right)^2$

$\Rightarrow$ $x = \frac{40000 \times 100 \times 100}{80 \times 80}$

$\Rightarrow$ $x = 6250$

30. **(a)** Let sum = ₹ P.

then $\text{S.I.} = \frac{P \times r \times t}{100}$

$\Rightarrow$ $1200 = \frac{P \times 5 \times 3}{100}$

$\Rightarrow$ $P = \frac{1200 \times 100}{5 \times 3} = 8000$

$\Rightarrow$ $A = 8000\left(1+\frac{5}{100}\right)^3$

$= 8000 \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100}$

= ₹ 9261

$\therefore$ C.I. = 9261 − 8000 = 1261

7. Algebraic Expressions and Their Identities

Algebraic Expression

An expression in which numbers and literal numbers are combined by the signs of fundamental operations is called an algebraic expression.

Types of Expressions

Monomial

An expression which contains only one term is called a monomial.

e.g., $-2x$, $5x$, $6xy$,. 8, etc.

Binomial

An expression which contains two terms is called a binomial.

e.g., $2x+3$, $5x+3y$, $5pq-8p^3$, $5x^2+3xy$, etc.

Trinomial

An expression which contains three terms is called a trinomial.

e.g., $2ab+a^2+b^2$, $5x-3y+8$, $2xy+3pq+7$, etc.

Operations on Algebraic Expressions

1. Multiplication of Monomials

Monomials are multiplied, using the commutative and associative properties of number. After, we multiply the respective coefficients to get the product.

Example 1: Find the product of $2xy$ and $5x^3y^2$.

Solution: We have $2xy \times 5x^3y^2 = 2 \times x \times y \times 5 \times x^3 \times y^2$

$= (2 \times 5) \times (x \times x^3) \times (y \times y^2)$ [commutative property]

$= 10 \times x^4 \times y^3 = 10x^4y^3$

2. Multiplication of a Binomial/Trinomial by a Monomial

If A, B and C are three expressions, then

(i) $A \cdot (B+C) = A \cdot B + A \cdot C$ (Distributive Property).

(ii) $A \cdot (B-C) = A \cdot B - A \cdot C$

3. Multiplication of a Binomial/Trinomial by a Binomial

If A,B,C and D are four monomials, then

$(A+B) \cdot (C+D) = A \cdot (C+D) + B \cdot (C+D)$ [Distribution property]

$= A \cdot C + A \cdot D + B \cdot C + B \cdot D$

Example 2: Find the product of :

$(5x^2+3xy+2)$ and $(2x+3y+6)$

Solution: $(5x^2 + 3xy + 2) \cdot (2x + 3y + 6) = 5x^2.(2x + 3y + 6) + 3xy.(2x + 3y + 16) + 2 \cdot (2x + 3y + 6)$

$= (5x^2 (2x) + (5x^2) \cdot (3y) + (5x^2) 6) + (3xy) 2x + 6 (3xy)$

$+ (3xy) (3y) + 3(2x) + 2(3y) + 2 \times 6$

$= 10x^3 + 15x^2y + 30x^2 + 6x^2y + 18xy + 9xy^2 + 4x + 6y + 12$

$= 10x^3 + 21x^2y + 9xy^2 + 30x^2 + 18xy + 4x + 6y + 12$

Standard Identities

1. $(a + b)^2 = (a + b) \cdot (a + b) = a(a + b) + b (a + b) = a^2 + 2ab + b^2$
2. $(a - b)^2 = (a - b) \cdot (a - b) = a(a - b) - b (a - b) = a^2 - 2ab + b^2$
3. $(a + b)^2 - (a - b)^2 = 2(a^2 + b^2)$
4. $(a + b)^2 - (a - b)^2 = 4ab$
5. $x^2 - y^2 = (x + y) (x - y)$
6. $(x + y) (x + z) = x^2 + (y + z)x + yz$
7. $(x - a) (x + b) = x^2 + (b - a)x - ab$
8. $(x + a) (x - b) = x^2 + (a - b)x - ab$
9. $(x + a) (x - b) = x^2 - (a + b) x + ab$

Example 3: Simplify

(a) 999×1001 (b) 98×98

Solution: (a) $999 \times 1001 = (1000 - 1) \times (1000 + 1)$

$= (1000)^2 - (1)^2$ $[(a + b) (a - b) = a^2 - b^2]$

$= 1{,}000{,}000 - 1$

$= 999{,}999$

(b) $98 \times 98 = (100 - 2) \times (100 - 2)$

$= (100)^2 - (2)^2 = (110)^2 + (2)^2 - 2 \times 100 \times 2$

$= 10000 + 4 - 400$

$= 9604$

Example 4: If $x - \frac{1}{x} = \sqrt{5}$, then, find the value of $\left(x^4 + \frac{1}{x^4}\right)$.

Solution: Given $x - \frac{1}{x} = \sqrt{5}$,

Squaring both sides,

$$\left(x - \frac{1}{x}\right)^2 = (\sqrt{5})^2$$

$$\Rightarrow \quad x^2 + \frac{1}{x^2} - 2 \times x \times \frac{1}{x} = 5$$

$$\Rightarrow \qquad x^2 + \frac{1}{x^2} = 7$$

Again squaring both sides, $\left(x^2 + \frac{1}{x^2}\right)^2 = (7)^2$

$$\Rightarrow \qquad x^4 + \frac{1}{x^4} + 2 = 49 \Rightarrow x^4 + \frac{1}{x^4} = 47$$

Example 5: If $x + y = 7$ and, $xy = 3$, then find the value of $\sqrt{x^4 + y^4 + 2x^2\ y^2}$.

Solution: $(x + y) = 7$

$$\Rightarrow \qquad (x+y)^2 = (7)^2 \quad \Rightarrow \quad x^2 + y^2 + 2xy = 49$$

$$\Rightarrow \qquad x^2 + y^2 = 49 - 6 = 43 \quad \Rightarrow \quad \sqrt{(x^2 + y^2)^2} = \sqrt{x^4 + y^4 + 2x^2y^2} = 43$$

Division of Monomials

Dividing a monomial x by a monomial y means find a monomial such that, $x = yz$

Here, x is called the dividend, y is called the divisor and z is called the quotient. Similarly, an algebraic expression is divided by a monomial.

Polynomial

An algebraic expression which contains only non-negative integral powers of the variables in then is called a polynomial.

Example: $5x^2 - 3x + 2$, $2x^2 + 5x + 1$, $5x + 3$, $5x^4 + 3x^2 + 3x + 4$, etc.

$x^{-1/2} + \sqrt{x} + 3$, $4\sqrt{x} + x + 3$, etc. are not polynomials.

Degree of a Polynomial

The highest power of the variable involved in the polynomial is called the degree of the polynomial.

Division of Polynomial by a Monomial/Binomial/Trinomial

Example 6: Divide $x^3 - 2x - 21$ by $x - 3$.

Solution:

$$\begin{array}{r|l} & x^2 - 3x + 7 \\ \hline x - 3 & x^3 - 2x - 21 \\ & x^3 - 3x^2 \\ & \quad - \quad + \\ \hline & \quad 3x^2 - 2x \\ & \quad 3x^2 - 9x \\ & \quad - \quad + \\ \hline & \quad\quad 7x - 21 \\ & \quad\quad 7x - 21 \\ & \quad\quad - \quad + \\ \hline & \quad\quad\quad 0 \end{array}$$

Example 7: Find the quotient and remainder in

$$-10y^3 + 12y^4 - 22y \div (1\,2y^2).$$

Solution:
$$12y^2 \overline{)\ 12y^4 - 10y^3 - 22y\ } \quad (-6y^2 + 5y)$$
$$12y^4$$
$$-10y^3$$
$$-10y^3$$
$$-22y$$

$\therefore$ Quotient $= 5y - 6y^2$, remainder $= -22y$.

In case of division of a polynomial by another polynomial, the relation

Dividend = Divisor × Quotient + Remainder.

Factorisation of Algebraic Expressions

Every algebraic expression, in the product will be a required factor. Finding factors of a given expression is called factorisation.

Factorisation is done by several methods and one should carefully memorise the standard identities of algebraic expressions for factorising a given polynomial.

For factorising a given polynomial of homogenous degree, i.e., degree of every term is equal, can be solved using following method,

Let, $p(x) = a^{xn} + bx^{n-1}y + cy^n$, is a polynomial of degree 'n' let, two numbers, l and m, such that.

$l + m = by$ and $lm = a \times cy^n$, and, break the middle term (by) in the form ($l + m$) and proceed.

Example 8: Factorise : $p^4 + 16q^2 - 9p^2 - 81q^4$.

Solution: $p^4 + 16q^2 - 9p^2 - 81q^4$

$= p^4 - 81q^4 - 9p^2 + 16q^2$

$= \left[(p^2)^2 - (9q^2)^2\right] - \left[(3p)^2 - (4q)^2\right]$

$= (p^2 + 9q^2)(p^2 - 9q^2) - (3p + 4q)(3p - 4q)$

$= (p^2 + 9q^2)(p + 3q)(p - 3q) - (3p + 4q)(3p - 4q)$.

Example 9: Factorise : $x^4 + x^2 + 1$.

Solution: $x^4 + x^2 + 1 = (x^2)^2 + 1 + x^2$

$= (x^4 + 2x^2 + 1) - x^2 = (x^2 + 1)^2 - x^2$

$= (x^2 + 1 - x)(x^2 + 1 + x)$.

Example 10: Factorise : $x^2 + 6\sqrt{3}x - 48$

Solution: $x^2 + 6\sqrt{3}x - 48$

$= x^2 + (8\sqrt{3}\,x - 2\sqrt{3}\,x) - 48$

{$\because$ $8\sqrt{3}\,x$ and $-2\sqrt{3}\,x$ gives $-6\sqrt{3}\,x$ sum and $-48x^2$ as a product.}

$= x^2 + 8\sqrt{3}\,x - 2\sqrt{3}x - 48 = x(x + 8\sqrt{3}) - 2\sqrt{3}(x + 8\sqrt{3})$

$= (x - 2\sqrt{3})(x + 8\sqrt{3})$.

Example 11: Factorise : $36x^2 + 12xyz - 15y^2z^2$.

Solution: $l + m = 12\,xyz,\ lm = 36x^2 \times -15y^2z^2 = -540\,x^2y^2z^2$

$\Rightarrow\ l = 30\,xyz,\ \ m = -18\,xyz$

$\therefore\ 36x^2 + 12\,xyz - 15\,y^2\,z^2 = 36\,x^2 + 30\,xyz - 18\,xyz - 15y^2\,z^2$

$= 6x\,(6x + 5yz) - 3yz\,(6x + 5yz)$

$= (6x - 3yz)\,(6x + 5yz)$.

Multiple Choice Questions

1. What are the factors of the expression $ab - a - b + 1$?
   (a) $(a-1)\,(b-1)$ (b) $(1-a)\,(b-1)$
   (c) $(a-1)\ (1-b)$ (d) $(1-a)\ (1-b)$
2. If $(2x - 3)$ is a factor of $6x^2 - 7x - 3$, then what is the other factor?
   (a) $(1-3x)$ (b) $(3x+1)$
   (c) $(x-3)$ (d) $(3-x)$
3. What are the factors of $(g+h)^2 - 4gh$?
   (a) $(g-h)\,(g+h)$ (b) $(g-h)\,(g-h)$
   (c) $(g+h)\,(g+h)$ (d) None of these
4. If one of the factor of $25(x+y)^2 - 36\,(x-2y)^2$ is $(17y - x)$, then what is the other factor?
   (a) $(7x - 11y)$ (b) $(11x - 7y)$
   (c) $(11x + 7y)$ (d) $(7x + 11y)$
5. Find the value of $(a+1)\,(a-1)\,(a^2+1)$.
   (a) $a^4 + 1$ (b) $a^4 - 2a^2 - 1$
   (c) $a^4 - 1$ (d) $a^4 - a^2 - 1$
6. If $x + y = 12$ and $xy = 14$ then what is the value of $x^2 + y^2$?
   (a) 116 (b) 114
   (c) 112 (d) 118
7. If $x + \frac{1}{x} = 11$ then what is the value of $x^2 + \frac{1}{x^2}$?
   (a) 123 (b) 119
   (c) 117 (d) 121
8. If $x + y = 10$ and $xy = 9$, what is the value of $x^2 - y^2$?
   (a) 40 (b) 60
   (c) 80 (d) 90
9. If $x + \frac{1}{x} = 7$ then find the value of $x^4 + \frac{1}{x^4}$.
   (a) 2209 (b) 2207
   (c) 2211 (d) 2205
10. The perimeter of a triangle is $6m^2 - 4m + 9$ and two of the sides are $m^2 - 2m + 1$ and $2m^2 + 3m + 5$. What is the third side?
    (a) $3m^2 - 5m + 3$
    (b) $3m^2 + 5m - 3$
    (c) $5m^2 - 3m + 3$
    (d) $5m^2 - 3m + 3$
11. What is the remainder when $7 + 15\,x - 13x^2 + 5x^3$ is divided by $4 - 3x + x^2$?
    (a) $x - 1$ (b) $x + 1$
    (c) $1 - x$ (d) None of these
12. What is the quotient if $x^4 - 2x^3 + 2x^2 + x + 4$ is divided by $x^2 + x + 1$?
    (a) $x^2 - 3x + 4$ (b) $x^2 - 3x + 2$
    (c) $x^2 + 3x - 4$ (d) none of these
13. What is the quotient if $5x^3 - 4x^2 + 3x + 18$ is divided by $3 - 2x + x^2$?
    (a) $5x - 6$ (b) $5x + 6$
    (c) $6x - 5$ (d) $6x + 5$
14. If $x - \frac{1}{x} = 6$ then what is the value of $x^2 + \frac{1}{x^2}$?
    (a) 38 (b) 36
    (c) 34 (d) None of these
15. $8\,a^2\,b^3 \div (-2ab)$?
    (a) $4\,a^2b$ (b) $-4ab^2$
    (c) $-4a^2b$ (d) $4\,ab^2$

16. What is the value of $\frac{198\times198-102\times102}{96}$?

(a) 200 (b) 300
(c) 400 (d) None of these

17. What is the numerical coefficient in the product of $2abc$, $-16a^2bc$ and $3ab^2c^2$?

(a) 64 (b) 96 (c) –96 (d) –64

18. If $x+\frac{1}{x}=2$, what is the value of $x^4+\frac{1}{x^4}$?

(a) 4 (b) 2
(c) 1 (d) None of these

19. What is the value of $\frac{8.37\times8.37-1.63\times1.63}{0.674}$?

(a) 10 (b) 100
(c) 1000 (d) None of these

20. What is the remainder when $6x^2-11x+15$ is divided by $2x-5$?

(a) 15 (b) 25 (c) 35 (d) – 25

21. What is the quotient if $15p^4+16p^3+\frac{10p}{3}-9p^2-6$ is divided by $3p-2$?

(a) $5p^3+\frac{26}{9}p^2+\frac{25}{0}p+\frac{80}{27}$

(b) $5p^3+\frac{16}{3}p^2+\frac{15}{9}p+\frac{80}{27}$

(c) $5p^3+\frac{26}{9}p^2+\frac{25}{3}p+\frac{80}{27}$

(d) $5p^2+\frac{26}{3}p^2+\frac{25}{3}p+\frac{80}{29}$

22. What is the H.C.F. of $11\,abc^3$, $13\,a^2b^2c$ and $17\,ab^3c^2$?

(a) abc (b) ab^2c (c) a^2bc (d) $3abc$

23. If one of the factor of $x^2-y^2+2yz-x^2$ is $(x+y-z)$ then what is the other factor?

(a) $(x+y-z)$ (b) $(x-y+z)$
(b) $(x+y+z)$ (d) $(x-y-z)$

24. If one of the factor of x^4+x^2+1 is (x^2+x+1) then what is the other factor?

(a) x^2-x+1 (b) x^2+x-1
(c) x^2+x+1 (d) None of these

25. What are the factors of $11a^2+54a+63$?

(a) $(11a+21)(a+3)$ (b) $(11a+21)(a-3)$
(c) $(11a+9)(a+7)$ (d) $(11a+7)(a+9)$

26. What is the degree of the polynomial?

$$1-\frac{5}{3}x+9x^2-6x^2-x^4\,?$$

(a) 1 (b) 2 (c) 3 (d) 4

27. Find the remainder when x^4+4x^2+10 is divided by x^2-2x+4.

(a) –6 (b) 6 (c) 4 (d) – 4

28. Which of the following is not a polynomial ?

(a) x^2-x+1 (b) $x^2+\sqrt{x}-2$
(c) $x^3-x^3=1$ (d) x^4-x+3

29. What is the product of the

$$\frac{1}{4}x^2y^2z^2\times3x\times\frac{3}{2}y^2z\,?$$

(a) $\frac{3}{4}x^3y^2z^2$ (b) $\frac{3}{4}x^3y^3z^3$
(c) $\frac{9}{8}x^3y^4z^3$ (d) $\frac{9}{8}x^3y^4z^2$

30. If $\left(x-\frac{1}{x}\right)^2=36$ then what is the value of $x^4+\frac{1}{x^4}$?

(a) 1442 (b) 1440 (c) 1444 (d) 1438

Answer Key

1. (a)	2. (b)	3. (b)	4. (b)	5. (c)	6. (a)	7. (b)	8. (c)	9. (b)	10. (a)
11. (a)	12. (a)	13. (b)	14. (a)	15. (b)	16. (b)	17. (c)	18. (b)	19. (b)	20. (b)
21. (d)	22. (a)	23. (b)	24. (a)	25. (a)	26. (d)	27. (a)	28. (b)	29. (c)	30. (a)

Hints and Solutions

1. **(a)** $ab - a - b + 1$
$= a(b-1) - 1(b-1) = (b-1)(a-1)$

2. **(b)** $6x^2 - 7x - 3$
$= 6x^2 - 9x + 2x - 3$
$= 3x(2x-3) + 1(2x-3) = (2x-3)(3x+1)$

3. **(b)** $(g+h)^2 - 4gh$
$= g^2 + h^2 + 2gh - 4gh$
$= g^2 + h^2 - 2gh$
$= (g-h)^2 = (g-h)(g-h)$

4. **(b)** $25(x+y)^2 - 36(x-2y)^2$
$= [5(x+y)]^2 - [6(x-2y)^2$
$= (5x + 5y + 6x - 12y)(5x + 5y - 6x + 12y]$
$= (11x - 7y)(-x + 17y)$

5. **(c)** $(a+1)(a-1)(a^2+1)$
$= (a^2-1)(a^2+1) = a^4 - 1$

6. **(a)** $(x+y)^2 = x^2 + y^2 + 2xy$
$x^2 + y^2 = (x+y)^2 - 2xy$
$= (12)^2 - 2 \times 14$
$= 144 - 28$
$= 116$

7. **(b)** $\left(x + \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} + 2 \times x \times \frac{1}{x}$
$x^2 + \frac{1}{x^2} = (11)^2 - 2 = 121 - 2 = 119$

8. **(c)** $(x+y)^2 = x^2 + y^2 + 2xy$
$x - y = \sqrt{(x+y)^2 - 4xy}$
$= \sqrt{(100^2 - 4 \times 9}$
$= \sqrt{100 - 36} = \sqrt{64} = 8$
$(x+y)(x-y) = x^2 - y^2$
$\therefore \quad x^2 - y^2 = 10 \times 8 = 80$

9. **(b)** $x + \frac{1}{x} = 7$
$\left(x + \frac{1}{x}\right)^2 = 7^2 \Rightarrow x^2 + \frac{1}{x^2} = 49 - 2 = 47$
$\left(x^2 + \frac{1}{x^2}\right)^2 = x^4 + \frac{1}{x^4} + 2$
$\Rightarrow \quad x^4 + \frac{1}{x^4} = (47)^2 - 2$
$= 2209 - 2 = 2207$

10. **(a)** Third side $= 6m^2 - 4m + 9$
$- (m^2 - 2m + 1 + 2m^2 + 3m + 5)$
$= 6m^2 - 4m + 9 - (3m^2 + m + 6)$
$= 6m^2 - 4m + 9 - 3m^2 - m - 6$
$= 3m^2 - 5m + 3$

11. **(a)**
$$\begin{array}{r|l} & 5x + 2 \\ \hline x^2 - 3x + 4 & 5x^3 - 13x^2 + 15x + 7 \\ & \underline{5x^3 - 15x^2 + 20x} \\ & \quad 2x^2 - 5x + 7 \\ & \quad \underline{2x^2 - 6x + 8} \\ & \quad\quad x - 1 \end{array}$$
Clearly $(x-1)$ is remainder.

12. **(a)**
$$\begin{array}{r|l} & x^2 - 3x + 4 \\ \hline x^2 + x + 1 & x^4 - 2x^3 + 2x^2 + x + 4 \\ & \underline{x^4 + x^3 + x^2} \\ & \quad -3x^3 + x^2 + x \\ & \quad \underline{-3x^3 - 3x^2 - 3x} \\ & \quad\quad 4x^2 + 4x + 4 \\ & \quad\quad \underline{4x^2 + 4x + 4} \\ & \quad\quad\quad \times \quad \times \quad \times \end{array}$$
$\therefore$ Quotient $= x^2 - 3x + 4$

13. **(b)**
$$\begin{array}{r|l} & 5x + 6 \\ \hline x^2 - 2x + 3 & 5x^3 - 4x^2 + 3x + 18 \\ & \underline{5x^3 - 10x^2 + 15x} \\ & \quad 6x^2 - 12x + 18 \\ & \quad \underline{6x^2 - 12x + 18} \\ & \quad\quad \times \quad \times \quad \times \end{array}$$

14. **(a)** $x-\frac{1}{x}=6$

$\Rightarrow \quad \left(x-\frac{1}{x}\right)^2=6^2$

$\Rightarrow \quad x^2+\frac{1}{x^2}=36+2=38$

15. **(b)** $\frac{8a^2b^3}{-2ab}=-4ab^2$

16. **(b)** $\frac{198\times198-102\times102}{96}=\frac{(198)^2-(102)^2}{96}$

$=\frac{(198+102)(198-102)}{96}=\frac{300\times96}{96}=300$

17. **(c)** $(2abc)(-16a^2bc)(3ab^2c^2)$

$=-96a^4b^4c^3$

18. **(b)** $\because\ x+\frac{1}{x}=2$

$\Rightarrow \quad x^2+\frac{1}{x^2}=4-2=2$

and $\quad x^4+\frac{1}{x^4}=\left(x^2+\frac{1}{x^2}\right)^2-2$

$=2^2-2$

$=4-2=2$

19. **(b)** We have $\frac{8.37\times8.37-1.63\times1.63}{0.674}$

$=\frac{(8.37)^2-(1.63)^2}{0.674}$

$=\frac{(8.37+1.63)(8.37-1.63)}{0.674}$

$=\frac{10\times6.74}{0.674}=\frac{10\times674\times1000}{674\times100}=100$

20. **(b)**

$$
\begin{array}{r|l}
 & 3x+2 \\
\hline
2x-5 & 6x^2-11x+15 \\
 & \underline{-\ 6x^2+15x} \\
 & \quad 4x+15 \\
 & \quad \underline{-\ \ 4x-10} \\
 & \quad\quad 25
\end{array}
$$

21. **(d)**

$$
\begin{array}{r|l}
 & 5p^3+p^2\cdot\frac{26}{3}+\frac{25}{3}p+\frac{20}{3} \\
\hline
3p-2 & 15p^4+16p^3-9p^2+10/3p-6 \\
 & \underline{-\ 15p^4-10p^3} \\
 & \quad 26p^3-9p^2 \\
 & \quad \underline{-\ 26p^3-\frac{10}{3}p^2} \\
 & \quad\quad \frac{25}{3}p^2+\frac{10}{3}p \\
 & \quad\quad \underline{-\ \frac{25}{3}p^2-\frac{50}{3}p} \\
 & \quad\quad\quad 20p-6 \\
 & \quad\quad\quad \underline{-\ 20p-\frac{40}{3}} \\
 & \quad\quad\quad\quad \frac{22}{3}
\end{array}
$$

22. **(a)** H.C.F. of $11abc^3, 13a^2b^2c, 17ab^3c^2 = abc$

23. **(b)** $x^2-y^2+2yz-z^2$

$=x^2-(y^2-2yz+z^2)$

$=x^2-(y-z)^2$

$=(x+y-z)(x-y+z)$

24. **(a)**

$$
\begin{array}{r|l}
 & x^2-x+1 \\
\hline
x^2-x+1 & x^4+x^2+1 \\
 & \underline{-\ x^4-x^3+x^2} \\
 & \quad -x^3+1 \\
 & \quad \underline{+\ x^3-x^2+x} \\
 & \quad\quad x^2+x+1 \\
 & \quad\quad \underline{-\ x^2-x-1} \\
 & \quad\quad \times\ \ \times\ \ \times
\end{array}
$$

25. **(a)** $11a^2+54a+63$

$=11a^2+33a+21a+63$

$=11a(a+3)+21(a+3)$

$=(a+3)(11a+21)$

26. **(d)** $1-\frac{5}{3}x+9x^2-6x^3-x^4$

Degree of the polynomial = Highest power of $x = 4$

27. **(a)**
$$\begin{array}{r} x^2+2x+4 \\ x^2-2x+4\overline{)\,x^4+4x^2+10} \\ \underline{-x^4\mp 2x^3+4x^2} \\ -2x^3+10 \\ \underline{-2x^3\pm 4x^2\mp 8x} \\ 4x^2-8x+10 \\ \underline{4x^2\mp 8x+10} \\ -6 \end{array}$$

28. **(b)** Clearly $x^2+\sqrt{x}-2=0$ is not a polynomial.

29. **(c)** $\frac{1}{4}x^2y^2z^2\times 3x\times\frac{3}{2}y^2z$

$$=\frac{9}{8}x^3y^4z^3$$

30. **(a)** $\left(x-\frac{1}{x}\right)^2=36$

$$\Rightarrow \quad x^2+\frac{1}{x^2}=36+2=38$$

$$\therefore \quad \left(x^2+\frac{1}{x^2}\right)^2=38^2$$

$$x^4+\frac{1}{x^4}=38^2-2$$

$$=1444-2$$

$$=1442$$

8. Linear Equations in One Variable

Linear Equation

An equation is a statement of equality of two algebraic expressions involving one or more unknown quantities called variables.

An equation having only linear polynomials is called a linear equation.

Example: $x + 3 = 7$

Example 1: Solve the equation $\frac{4x+7}{9-3x} = \frac{1}{4}$.

Solution: The given equation can be written as

$$4(4x + 7) = 1\ (9 - 3x)$$
$$\Rightarrow \quad 16x + 28 = 9 - 3x$$
$$\Rightarrow \quad 16x + 3x = 9 - 28$$
$$\Rightarrow \quad 19x = -19$$
$$\Rightarrow \quad x = \frac{-19}{19} = -1$$

Example 2: Simplify $\frac{2-7x}{1-5x} = \frac{3+7x}{4+5x}$.

Solution: We have $(2 - 7x)\ (4 + 5x) = (3 + 7x)\ (1 - 5x)$

$$\Rightarrow \quad 8 + 10x - 28x - 35x^2 = 3 - 15x + 7x - 35x^2$$
$$\Rightarrow \quad 8 - 18x = 3 - 8x$$
$$\Rightarrow \quad -18x + 8x = 3 - 8$$
$$\Rightarrow \quad -10x = -5 \Rightarrow x = \frac{-5}{-10} = \frac{1}{2}$$

Example 3: If 10 is added to four times a number, the result is 5 less than five times the number. What is the number?

Solution: Let the number be x.

$$\therefore \quad 10 + 4x = 5x - 5$$
$$\Rightarrow \quad 5x - 4x = 10 + 5$$
$$\Rightarrow \quad x = 15$$

Example 4: Find three consecutive even numbers whose sum is 348.

Solution: Let three numbers be $x, x + 2, x + 4$

$$\therefore \quad x + x + 2 + x + 4 = 348$$
$$\Rightarrow \quad 3x + 6 = 348$$
$$\Rightarrow \quad 3x = 342$$
$$\Rightarrow \quad x = \frac{342}{3} = 114$$

$\therefore$ Numbers are 114, 116, 118.

Example 5: Two angles of a triangle are in the ratio 4 : 5. If the sum of these angles is equal to 3rd angle. What are the angles of triangle ?

Solution: Let the angles are $4x$ and $5x$.

$$\therefore \quad 4x + 5x + 9x = 180^\circ$$

$$\Rightarrow \quad 18x = 180^\circ$$

$$\Rightarrow \quad x = \frac{180^\circ}{18}$$

$$\Rightarrow \quad x = 10^\circ$$

$\therefore$ angles are $40^\circ, 50^\circ, 90^\circ$.

Example 6: Solve $\frac{x+b}{a+b} = \frac{x-b}{a-b}$.

Solution: Given $(x + b)(a - b) = (x - b)(a + b)$

$$\Rightarrow \quad ax - bx + ab - b^2 = ax + bx - ab - b^2$$

$$\Rightarrow \quad 2bx = 2ab$$

$$\Rightarrow \quad x = \frac{2ab}{2b} = a$$

Example 7: Shankar is 24 years older than his daughter. In 4 years, Shankar will be thrice as old as his daughter. What are their present ages?

Solution: Let the daughter's age be x years.

$\therefore$ Shankar's age $= x + 24$

Now, in 4 years,

Daughter's age $= x + 4$

Shankar's age $= x + 24 + 4 = x + 28$

$$\therefore \quad x + 28 = 3(x + 4)$$

$$\Rightarrow \quad x + 28 = 3x + 12$$

$$\Rightarrow \quad 2x = 28 - 12$$

$$\Rightarrow \quad 2x = 16$$

$$\Rightarrow \quad x = 8$$

$\therefore$ Daughter's age = 8 years

and Shankar's age = 8 + 24 = 32 years

Example 8: The perimeter of a rectangle is 52 cm. How long is each side if the width is 2 cm more than one third of the length ?

Solution: Let the length of rectangle be x cm.

$$\therefore \quad \text{Width} = \frac{x}{3} + 2$$

$\therefore$ Perimeter of rectangle = 52

$\Rightarrow$ 2(length + width) = 52

$$\Rightarrow \quad 2(x+\frac{x}{3}+2)=52$$

$$\Rightarrow \quad x+\frac{x}{3}+2=26.$$

$$\Rightarrow \quad 3x+x+6=78$$

$$\Rightarrow \quad 4x=78-6$$

$$\Rightarrow \quad 4x=72$$

$$\Rightarrow \quad x=\frac{72}{4}=18 \text{ cm}$$

Length $= x = 18$ cm.

Width $= \frac{x}{3}+2=\frac{18}{3}+2=8$ cm.

Multiple Choice Questions

1. A boat goes downstream and covers the distance between two ports in 4 hours, while it covers the same distance upstream in 5 hours. If the speed of the stream is 2km/hour. what is the speed of boat in still water ?
   (a) 18 km/hour (b) 16 km/hour
   (c) 20 km/hour (d) 15 km/hour
2. The ages of Mohan and Sohan are in the ratio 9 : 7. Ten years ago their ages were in the ratio 7 : 5. What is the difference between their present ages?
   (a) 5 years (b) 10 years
   (c) 15 years (d) 20 years
3. The sum of two numbers is 360. If 65% of one number is equal to 85% of the other. What is the largest number among them?
   (a) 204 (b) 156
   (c) 256 (d) 214
4. A certain number of workers can finish a piece of work in 70 days. If there are 20 men less, it would take 10 days more for the same work to be finished. How many workers were there in starting?
   (a) 150 (b) 160
   (c) 140 (d) 152
5. The sum of three consecutive multiples of 11 is 363. Which of these multiple is greatest?
   (a) 121 (b) 131 (c) 132 (d) 122
6. Arun's age is three times his son's age. 10 years age he was 5 times his son's age. What is the sum of their present ages?
   (a) 60 years (b) 70 years
   (c) 80 years (d) 90 years
7. Nirmal thinks of a number and subtracts from it. He multiplies the result by 8. The result now obtained is 3 times the same number he thought of. Find the number.
   (a) 4 (b) 5
   (c) 6 (d) 8
8. The difference between the digits of a two-digit number is 3. If the digits are interchanged and the resulting number is added to the original number we get 143. What was the original number?
   (a) 58 (b) 85 9
   (c) 78 (d) 87
9. A grand father is ten times older than his grandson. He is then also 54 years older than him. What is the difference of their present ages?
   (a) 54 yeas (b) 45 years
   (c) 50 years (d) 52 years
10. An altitude of a triangle is five-thirds the length of its corresponding base. If the altitude is increased by 4 cm and the base is decreased by 2 cm, but the area of triangle

remains the same. Find the base and altitude of the triangle respectively.

(a) 100 cm, 24 cm (b) 24 cm, 10 cm
(c) 20 cm, 12 cm (d) 12 cm, 20 cm

11. A field can be ploughed in 18 days. If everyday an additional area of 16 hectares is ploughed, the field can be ploughed in 12 days. What is the area of the field?

(a) 512 hectares (b) 576 hectares
(c) 528 hectares (d) None of these

12. The sum of the digits of a two number is 9. If 9 is subtracted from the number its digits are interchanged. What is the number?

(a) 54 (b) 63 (c) 72 (d) 45

13. What is the value of x in the given equatiom?

$$\frac{5(x+6)-15(2-x)}{3x-1}=10$$

(a) $x=1$ (b) $x=-1$
(c) $x=2$ (d) $x=-2$

14. What is the value of x in the given equation

$$\frac{3x+1}{16}+\frac{2x-3}{7}=\frac{x+3}{8}+\frac{3x-1}{14}$$

(a) 2 (b) 3 (c) 4 (d) 5

15. What is the value of x if

$$\frac{x-n}{m+n}=\frac{x+n}{m-n}?$$

(a) m (b) n
(c) m (d) $-n$

16. A shirt is sold for ₹1498 and the seller gains 7% on it. What is the cost price of the shirt ?

(a) 1600 (b) 1500 (c) 1400 (d) 1450

17. Half of a herd of deer are grazing in the field and three fourth of remaining are playing nearby. The rest nine are drinking water from the river. What is the number of deer in the herd?

(a) 72 (b) 62 (c) 74 (d) 80

18. The ages of Raju and Rajan are in the ratio 5 : 8. If Raju was 5 years older and Rajan 4 years younger, the age of Raju would have been the same as the age of Rajan. What is the age of Raju?

(a) 15 years (b) 16 years
(c) 24 years (d) 13 years

19. If $\frac{1}{2}$ is subtracted from a number and the difference is multiplied by 8, the result is 12. What is the number?

(a) 2 (b) 3 (c) 4 (d) 8

20. Mohaesh travelled $\frac{1}{2}$th of his Journey by bus, $\frac{1}{4}$th by taxi, $\frac{3}{5}$th by train and remaining 8 km by foot. What is the length of his total Journey?

(a) 120 km (b) 240 km
(c) 220 km (d) 320 km

Answer Key

1. (a)	2. (b)	3. (a)	4. (b)	5. (c)	6. (c)	7. (a)	8. (a)	9. (a)	10. (d)
11. (b)	12. (a)	13. (a)	14. (d)	15. (c)	16. (c)	17. (a)	18. (a)	19. (a)	20. (d)

Hints and Solutions

1. **(a)** Let the speed of boat in still water be x km/hour.

$\therefore \quad (x+2)\,4=(x-2)\,5$

$\Rightarrow \quad 4x+8=5x-10$

$\Rightarrow \quad x=18$ km/hr

2. **(b)** Let Mohan's age $=9x$
and Sohan's age $=7x$
10, years ago,
Mohan's age $=9x-10$
Sohan's age $=7x-10$

$$\therefore \quad \frac{9x-10}{7x-10}=\frac{7}{5}$$

$$\Rightarrow \quad 45x-50=49x-70$$

$$\Rightarrow \quad 4x=20 \Rightarrow x=5$$

$\therefore$ Mohan's age $= 9 \times 5 = 45$

and Sohan's age $= 7 \times 5 = 35$

Hence difference $= 45 - 35 = 10$ years

3. **(a)** Let the one number be x.

Other number $= 360 - x$

Now 65% of x = 85% of $(360 - x)$

$$\Rightarrow \quad \frac{65 \times x}{100}=\frac{85(360-x)}{100}$$

$$\Rightarrow \quad 65x+85x=85 \times 360$$

$$\Rightarrow \quad 150x=85 \times 360$$

$$\Rightarrow \quad x=\frac{85 \times 360}{150}=204$$

Other number $= 360 - 204 = 156$.

$\therefore$ Largest number $= 204$.

4. **(b)** Let the no. of workers in starting be x.

$$\therefore \quad 70 \times x=(x-20)\,80$$

$$\Rightarrow \quad 70x=80x-20 \times 80$$

$$\Rightarrow \quad 10x=20 \times 80$$

$$\Rightarrow \quad x=\frac{20 \times 80}{10}=160$$

5. **(c)** Let the numbers be

$$11x,\ 11(x+1),\ 11(x+2)$$

Hence $11x + 11(x + 1) + 11(x + 2) = 363$

$\Rightarrow 11x + 11x + 11 + 11x + 22 = 363$

$$\Rightarrow \quad 33x+33=363$$

$$\Rightarrow \quad x=\frac{330}{33}=10$$

Greatest multiple $= 11(x + 2)$

$= 11\ (10 + 2) = 11 \times 12 = 132$

6. **(c)** Let Son's age $= x$ years

$\therefore$ Arun's age $= 3x$.

Now 10 years ago, son's age $= x - 10$.

Given Arun's age $= 3x - 10$

$$\Rightarrow \quad 3x-10=5\,(x-10)$$

$$\Rightarrow \quad 3x-10=5x-50$$

$$2x=40 \Rightarrow x=20 \text{ years}$$

Arun's age $= 3 \times 20 = 60$ years

Sum of Arun's and Son's age $= 20 + 60$

$= 80$ years

7. **(a)** Let the number be x.

$$8\left(x-\frac{5}{2}\right)=3x$$

$$\Rightarrow \quad 8x-20=3x$$

$$\Rightarrow \quad 5x=20$$

$$\Rightarrow \quad x=4$$

8. **(a)** Let the unit's digit be x.

Ten's digit $= x + 3$.

Original number $= 10(x + 3) + 1(x)$

$$= 10x + 30 + x$$

$$= 11x + 30$$

After interchange, resulting number

$$= 10\,(x) + 1\,(x + 3)$$

$$= 10x + x + 3$$

$$= 11x + 3$$

$$\therefore \quad 11x+3+11x+30=143$$

$$\Rightarrow \quad 22x+33=143$$

$$\Rightarrow \quad 22x=143-33$$

$$\Rightarrow \quad 22x=110$$

$$\Rightarrow \quad x=\frac{110}{22}=5$$

Original number $= 11x + 3 = 11 \times 5 + 3$

$= 55 + 3 = 58$

9. **(a)** Let the age of grand son be x years.

Grand father's age $= 10x$.

$$\Rightarrow \quad 10x=54+x$$

$$\Rightarrow \quad 9x=54$$

$$\Rightarrow \quad x=6$$

Grand father's age $= 10 \times 6 = 60$ years

Difference of their present ages $= 60 - 6 = 54$.

10. **(d)** Let the base be x.

$$\text{Altitude}=\frac{5}{3}x$$

$$\text{Area}=\frac{1}{2} \times x \times \frac{5}{3}x$$

$$\Rightarrow \frac{1}{2}\times x\times\frac{5}{3}x=\frac{1}{2}\times\left(\frac{5x}{3}+4\right)(x-2)$$

$$\Rightarrow \quad \frac{5x^2}{3}=\frac{5x^2}{3}-\frac{10x}{3}+4x-8$$

$$\Rightarrow 12x^3-10x=24\Rightarrow x=\frac{24}{2}=12$$

$\therefore$ Altitude $= 12\times 5/3 = 20$ cm

11. **(b)** Let the area of the field ploughed daily be x hectares.

Area of the field $= 18x$

$$\Rightarrow \quad 18x=(x+16)\,12$$

$$\Rightarrow \quad 18x=12x+16\times 12$$

$$\Rightarrow \quad 6x=16\times 12$$

$$\Rightarrow \quad x=\frac{16\times 12}{6}=32$$

Area of the field $= 18\times 32 = 576$ hectares

12. **(a)** Let the unit's digit be x.

Ten's digit $= 9-x$

Number $= 10\,(9-x)+1(x)$

$$=90-10x+x=90-9x$$

$$90-9x-9=x(10)+1(9-x)$$

$$\Rightarrow \quad 81-9x=10x+9-x$$

$$\Rightarrow \quad 81-9x=9x+9$$

$$\Rightarrow \quad 18x=72\Rightarrow x=4$$

Number $= 90-9\times 4=90-36=54$

13. **(a)** Here $\dfrac{5\,(x+6)-15\,(2-x)}{3x-1}=10$

$$\Rightarrow 5x+30-30+15x=30x-10$$

$$\Rightarrow \quad 20x+10=30x$$

$$\Rightarrow \quad 10x=10\Rightarrow x=1$$

14. **(d)** Here $\dfrac{3x+1}{16}+\dfrac{2x-3}{7}=\dfrac{x+3}{8}+\dfrac{3x-1}{14}$

$$\Rightarrow \frac{21x+7+32x-48}{112}=\frac{14x+42+24x-8}{112}$$

$$\Rightarrow \quad 53x-41=38x+34$$

$$\Rightarrow \quad 15x=34+41$$

$$\Rightarrow \quad x=\frac{75}{15}=5$$

15. **(c)** Given $\dfrac{x-n}{m+n}=\dfrac{x+n}{m-n}$

$$\Rightarrow \quad (x-n)\,(m-n)=(x+n)\,(m+n)$$

$$\Rightarrow mx-mn-nx+n^2=mx+mn+nx+n^2$$

$$\Rightarrow \quad -mn-nx=mn+nx$$

$$\Rightarrow \quad 2nx=-2mn$$

$$\Rightarrow \quad x=\frac{-2mn}{2n}=-m$$

16. **(c)** Let the cost price of the shirt be ₹ x.

$$\therefore \quad x+7\%\text{ of }x=1498$$

$$\Rightarrow \quad x+\frac{7x}{100}=1498$$

$$\Rightarrow \quad 107\,x=1498\times 100$$

$$\Rightarrow \quad x=\frac{1498\times 100}{107}=1400$$

17. **(a)** Let number of deer be x.

$$\therefore \quad \frac{x}{2}+\frac{3}{4}\text{ of }\frac{x}{2}+9=x$$

$$\Rightarrow \quad \frac{x}{2}+\frac{3x}{8}+9=x$$

$$\Rightarrow \quad 4x+3x+72=8x$$

$$\Rightarrow \quad x=72$$

18. **(a)** Let Raju's age $= 5x$.

$\therefore$ Rajan 's age $= 8x$

$$\therefore \quad 5x+5=8x-4$$

$$\Rightarrow \quad 3x=9\Rightarrow x=3$$

Raju's age $= 5\times = 15$ years

19. **(a)** Let the number be x.

$$\therefore \quad 8\left(x-\frac{1}{2}\right)=12\Rightarrow 8x-4=12$$

$$\Rightarrow \quad 8x=16$$

$$\Rightarrow \quad x=2$$

20. **(d)** Let length of total Journey be x km.

$$\frac{x}{8}+\frac{x}{4}+\frac{3x}{5}+8=x$$

$$\Rightarrow \frac{5x+10x+24x+320}{40}=x$$

$$\Rightarrow \quad 39x+320=40x$$

$$\Rightarrow \quad x=320$$

9. Quadrilaterals

For a regular polygon of n sides, we have each exterior angle $= \left(\frac{360}{n}\right)^{\circ}$

Each interior angle = 180°– (each exterior angle)

In a polygon of n sides, we have sum of all exterior angles = 4 × right angle.

Sum of all interior angles = $(2n - 4)$ right angle.

Number of diagonals in a polygon of n sides $= \frac{n(n-3)}{2}$.

Example 1: What is the measure of each exterior angle of a regular polygon of 9 sides ?

Solution: Each exterior angle $= \frac{360^{\circ}}{9} = 40^{\circ}$

Example 2: What is the measure of each interior angle of regular octagon?

Solution: Each exterior angle $= \frac{360}{8} = 45^{\circ}$

Each interior angle = $180^{\circ} - 45^{\circ} = 135^{\circ}$.

Example 3: What is the number of diagonals in a polygon of 10 sides?

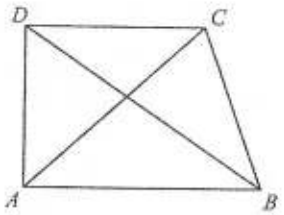
Solution: No. of diagonals $= \frac{10\,(10-3)}{2} = \frac{10 \times 7}{2} = 35$

Example 4: What is the number of sides in a regular polygon whose exterior angle measures 45° ?

Solution: No. of sides in the given polygon $= \frac{360}{45} = 8$

Quadrilateral

If A, B, C, D be four points in a plane such that no three of them are collinear and the line segment AB, BC, CD and AD do not intersect except their end points.



The points A, B, C, D are called its vertices. The line segments AB, BC, CD, DA are sides of quadrilateral.

Adjacent Side

Two sides of a quadrilateral which have a common end point are called adjacent sides.

Example: (AB, BC), (BC, CD) etc.

Opposite Side

Two sides of a quadrilateral are called its opposite sides if they do not have a common end point.

Example: (AB, DC) and (AD, BC) etc.

Sum of the angles of a quadrilateral is 360°.

Example 5: Three angles of a quadrilateral are 54°, 80° and 116°. What is the measure of fourth angle?

Solution: Let x is the fourth angle then

$54° + 80° + 116° + x = 360°$

$\Rightarrow \quad 250 + x = 360 \quad \Rightarrow \quad x = 360 - 250 = 110°.$

Example 6: The angles of a quadrilateral are in the ratio 3: 5: 7:9. What is the measure of each of there angle?

Solution: If the angles are $3x$, $5x$, $7x$ and $9x$ respectively then

$3x + 5x + 7x + 9x = 360°$

$\Rightarrow \quad 24x = 360°$

$\Rightarrow \quad x = \left(\frac{360}{24}\right)° = 15°$

$\therefore$ Angles are $3x = 3 \times 15 = 45°$

$5x = 5 \times 15 = 75$

$7x = 7 \times 15 = 105°$

$9x = 9 \times 15 = 135°$

Trapezium

A quadrilateral having exactly one pair of parallel sides is called a trapezium.

In a parallelogram, the opposite sides are equal.

The opposite angles are equal and the diagonals bisect each other.

The diagonals of a rhombus bisect each other at right angles.

The diagonals of a square are equal and bisect each other at right angles.

Two adjacent angles of a parallelogram are supplementary.

Example 7: The perimeter of a parallelogram is 140 cm. If one of the sides is longer than the other by 10 cm. Find the length of each of its sides.

Solutions : Let the side be x cm.

$\therefore$ Other side $= (x + 10)$ cm.

Hence Perimeter $= x + x + (x + 10) + (x + 10)$

$\Rightarrow \quad 4x + 20 = 140$

$\Rightarrow \quad 4x = 120 \quad \Rightarrow \quad x = \frac{120}{4} = 30$ cm

$\therefore$ Sides are 30 cm, 30 cm, 40 cm, 40 cm.

Example 8: The sum of two opposite angles of a parallelogram is 130°. Find the measure of each of angle.

Solution: Given sum of two opposite angles are 130°.

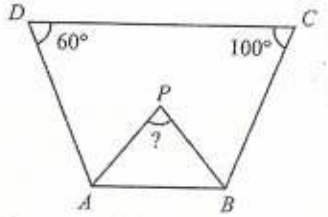
$\therefore \quad x + x = 130°$

$\Rightarrow \quad 2x = 130° \Rightarrow x = \frac{130°}{2} = 65°$

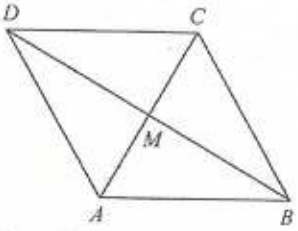
So, the angles are 65°, 115°, 65°, 115°.

Multiple Choice Questions

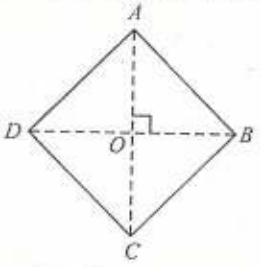
1. The four angles of a quadrilateral are in the ratio 2 : 3 : 5 : 8. Then what is the difference between largest and smallest angle of the quadrilateral?
   (a) 80° (b) 100° (d) 110° (d) 120°
2. In the given figure the bisector of $\angle A$ and $\angle B$ meet in a point P. If $\angle C = 100°$, $\angle D = 60°$, what is the the measure of $\angle APB$?



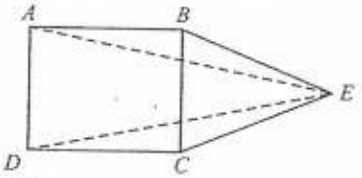
   (a) 60° (b) 80° (c) 90° (d) 100°
3. Three angles of a quadrilateral are equal and the measure of fourth angle is 120°. What is the measure of each of the equal angle?
   (a) 40° (b) 60° (c) 80° (d) 90°
4. The length of diagonals of a rhombus are 16 cm and 12 cm respectively. What is the length of each of its sides?
   (a) 10 cm (b) 12 cm (c) 14 cm (d) 16 cm.
5. The sum of two opposite angles of a parallelogram is 130°. What is the difference between largest and smallest angle of parallelogram?
   (a) 65° (b) 50° (c) 115° (d) 100°
6. The bisectors of any two adjacent angles of a parallelogram intersect at
   (a) 30° (b) 45° (c) 60° (d) 90°
7. If one angle of a parallelogram is 24° less than twice the smallest angle then what is the value of largest angle of the parallelogram?
   (a) 102° (b) 112°
   (c) 116° (d) 120°
8. The ratio of two sides of a parallelogram is 4 : 3. If its perimeter is 56 cm, what is the difference between largest and smallest side?
   (a) 8 cm (b) 4 cm 9
   (c) 12 cm (d) 16 cm
9. In the given Fig. $ABCD$ is a rhombus. If $\angle DAB = 110°$, what is $\angle BDC$?



   (a) 30° (b) 35° (c) 40° (d) 45°.
10. Two adjacent sides of a parallelogram are 5 cm and 7 cm long what is the perimeter of parallelogram?
    (a) 24 cm (b) 28 cm
    (c) 22 cm (d) 26 cm
11. Of any two adjacent sides of a parallelogram one is longer than the other by 3 cm. If the perimeter is 36 cm, then what is the length of smaller side of parallelogram?
    (a) 10.5 cm (b) 7.5 cm
    (c) 6 cm (d) 12 cm
12. $ABCD$ is a rhombus, AC = 16 cm and BD = 12 cm, then what is the measure of BC?

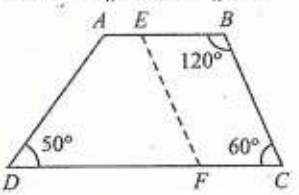


    (a) 10 cm (b) 12cm (c) 9 cm (d) 11 cm
13. In ΔBCE, $BE = EC$, and $ABCD$ is a square, and $\angle BEC = 60°$, then the measure of $\angle BEA$ will be :



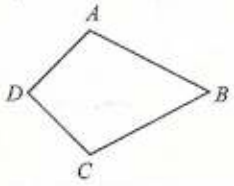
    (a) 45° (b) 35°
    (c) 15° (d) 25°

14. From the adjoining figure, find the measure of $\angle EFD$ if $AB \parallel CD$, $EF \parallel BC$.



(a) 40° (b) 70°
(c) 50° (d) 60°

15. In the adjoining figure $ABCD$, $AB = DC$ and $AB = BC$ and, $\angle ADC = 40°$ and $\angle BCD = 140°$, then, $\angle ABC =$

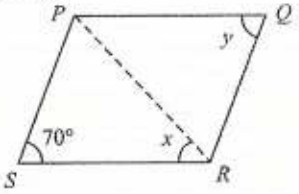


(a) 60° (b) 70°
(c) 40° (d) 50°

16. $ABCD$ is a parallelogram having its sides, $AB = 4x + 1$ $BC = 2y + 3$, $CD = 25$, $DA = y + 28$, then, $x + y =$

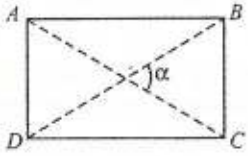
(a) 29 (b) 21
(c) 25 (d) 33

17. $PQRS$ is a parallelogram and $\angle SPR = 50°$, then find y.



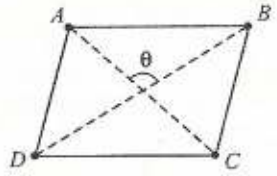
(a) 70° (b) 110°
(c) 50° (d) 130°

18. If $\alpha < 90°$, then, $ABCD$, may be a : (Given : $ABCD$ is a parallelogram) and $\angle B = 90°$



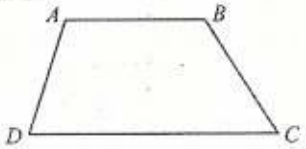
(a) Rectangle (b) Trapezium
(c) Square (d) Rhombus

19. If $\theta = 90°$, and, $\angle A = \angle C = 110°$, then, $ABCD$ is :



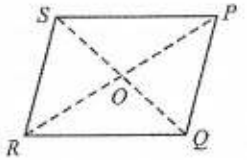
(a) Square (b) Rectangle
(c) Rhombus (d) None of these

20. $ABCD$ is an isosceles trapezium , i.e., $AD = BC$, then



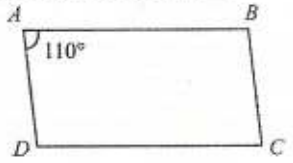
(a) $AD = CD$ (b) $\angle A = \angle B$
(c) $\angle A = \angle D$ (d) $\angle C = \angle A$

21. In the above figure, $OS = OQ$ and $PR = 2OR = 2OR$, and also, $OR = OS$, then, $PQRS$ is not *a*



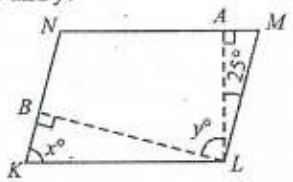
(a) Rhombus (b) Rectangle
(c) Square (d) Parallelogram.

22. In the adjoining figure, $AD \parallel BC$ and AB and DC are not parallel, then $\angle B =$



(a) 110° (b) 70° (c) 80° (d) 40°

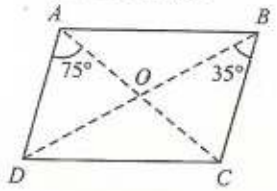
23. Find x and y:



$KLMN$ is a parallelogram.

(a) $x = 55°, y = 55°$ (b) $x = 65°, y = 55°$
(c) $x = 60°, y = 65°$ (d) None of these

24. $ABCD$ is a parallelogram.



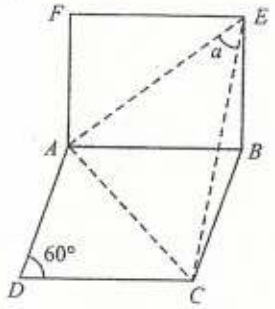
The measure of $\angle ADO$ is :

(a) 55° (b) 45° (c) 35° (d) 75°

25. The quadrilateral formed by joining the mid-points of a given quadrilateral will be (surely) :

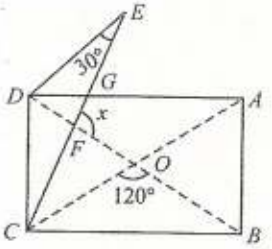
(a) Parallelogram (b) Rectangle
(c) Rhombus (d) Square

26. $ABCD$ is a rhombus and $ABEF$ is a square find 'a'.



(a) 30° (b) 45° (c) 60° (d) 75°

27. $ABCD$ is a rectangle , with, $ED = DC$, $\angle BOC = 120°$, $\angle CED = 30°$.



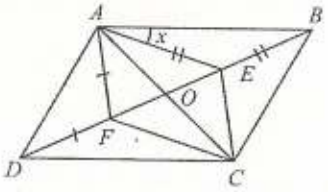
Find 'x' from the adjoining figure.

(a) 75°
(b) 65°
(c) 90°
(d) 120°

28. The adjacent sides of a rectangle are in the ratio 5: 13 and its area is 135 cm^2. The perimeter of the rectangle is :

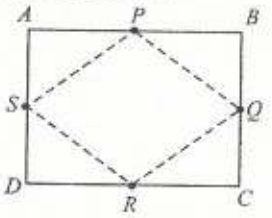
(a) 135 cm
(b) 54 cm
(c) 81 cm
(d) 108 cm

29. $ABCD$ is a rhombus and $\angle AEF = 50°$. Find x.



(a) 15° (b) 20°
(c) 35° (d) 25°

30. $ABCD$ is a square, P,Q,R,S are the mid-points of AB, BC, CD and DA respectively. If the perimeter of $ABCD$ is $16\sqrt{2}$ cm, then perimeter of $PQRS$ is :



(a) $16\sqrt{2}$ cm (b) $8\sqrt{2}$ cm
(c) 8 cm (d) 16 cm

Answer Key

1. (d)	2. (b)	3. (c)	4. (a)	5. (b)	6. (d)	7. (b)	8. (b)	9. (b)	10. (a)
11. (b)	12. (a)	13. (c)	14. (d)	15. (c)	16. (d)	17. (a)	18. (a)	19. (a)	20. (b)
21. (a)	22. (b)	23. (c)	24. (c)	25. (a)	26. (a)	27. (c)	28. (d)	29. (d)	30. (d)

Hints and Solutions

1. **(d)** Let the angles are $2x$, $3x$, $5x$, $8x$.

$\therefore \quad 2x + 3x + 5x + 8x = 360°$

$\Rightarrow \quad 18x = 360° \Rightarrow x = 20°$

$2x = 2 \times 20° = 40°$; $3x = 3 \times 20° = 60°$

$5x = 5 \times 20° = 100°$; $8x = 8 \times 20° = 160°$

Required difference $= 160° - 40° = 120°$.

2. **(b)** In figure $\angle A + \angle B + \angle C + \angle D = 360°$

$\Rightarrow \angle A + \angle B + 100° + 60° = 360°$

$\Rightarrow \quad \angle A + \angle B = 200°$

$\Rightarrow \quad \frac{1}{2}\angle A + \frac{1}{2}\angle B = \frac{1}{2} \times 200°$

$\Rightarrow \quad \frac{1}{2}\angle A + \frac{1}{2}\angle B = 100°$

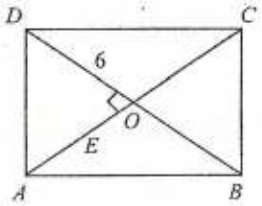
In ΔPAB, $\angle APB = 180° - 100° = 80°$

3. **(c)** Let the angle be x.

$\therefore \quad x + x + x + 120° = 360°$

$\Rightarrow \quad 3x = 240° \Rightarrow x = 80°$

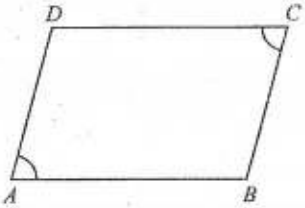
4. **(a)** Here $ABCD$ is a rhombus and in ΔAOD



$AD = \sqrt{8^2 + 6^2}$

$= \sqrt{64 + 36} = \sqrt{100} = 10$

5. **(b)** Here $ABCD$ is a parallelogram and $\angle A + \angle C = 130°$



$\Rightarrow \angle A + \angle A = 130° \quad (\because \angle A = \angle C)$

$\Rightarrow \quad \angle A = 65°$

$\therefore \quad \angle A + \angle D = 180°$

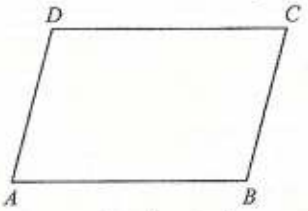
$\Rightarrow \quad \angle D = 180° - 65° = 115°$

$\angle B = \angle D = 115°$

Difference $= 115° - 65° = 50°$

6. **(d)**

7. **(b)** Let $\angle A$ be the smallest angle.



Let measure of $\angle A$ be $x°$.

$\therefore \quad \angle C = x°$

$\therefore \quad \angle D = \angle B = (2x - 24)°$

$\Rightarrow x° + (2x - 24)° = 180°$

$\Rightarrow \quad x = \frac{(180 + 24)°}{3} = \frac{204}{3} = 68°$

$\therefore$ largest angle of parallelogram

$= (2 \times 68° - 24°)$

$= (136° - 24°) = 112°$

8. **(b)** The opposite sides of parallelogram are equal.

$\therefore \quad 4x + 3x + 4x + 3x = 56$

$\Rightarrow \quad 14x = 56 \Rightarrow x = 4$

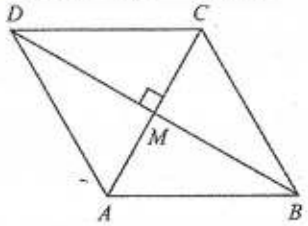
$\therefore \quad 4x = 4 \times 4 = 16$

and $\quad 3x = 4 \times 3 = 12$

$\therefore$ Difference $= 16 - 12 = 4$ cm

9. **(b)** In rhombus $ABCD$,

$\angle DAB = 110° = \angle BCD$



$\angle DMC = 90°$

$\angle DCM = \frac{1}{2} \times 110 = 55°$

$\angle BDC = 180° - (90° + 55°)$

$= 180° - 145° = 35°$

10. **(a)** Perimeter of parallelogram
$= 5 + 7 + 5 + 7 = 24$ cm

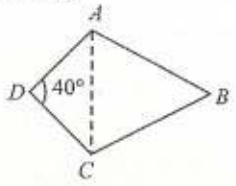
11. **(b)** Let smaller side be x.
Longer side $= x + 3$
$\therefore \quad x + x + 3 + x + x + 3 = 36$
$\Rightarrow \quad 4x + 6 = 36 \Rightarrow 4x = 30$
$\Rightarrow \quad x = \frac{30}{4} = 7.5$

12. **(a)** $\because$ $ABCD$ is a rhombus.
$\therefore \quad AB = BC = CD = DA$
$\because$ Diagonals of a rhombus bisect each other.
$\therefore \quad AO = \frac{AC}{2} = \frac{16}{2} = 8$ cm
$BO = \frac{BD}{2} = \frac{12}{2} = 6$ cm
$\therefore \quad AB = \sqrt{AO^2 + BO^2}$
$= \sqrt{(8)^2 + (6)^2} = \sqrt{100} = 10$ cm
$\therefore \quad BC = 10$ cm.

13. **(c)** Given $BE = EC$
$\therefore \angle EBC = \angle ECB$
In ΔBEC,
$2\angle EBC + \angle BEC = 180°$
$\Rightarrow \quad \angle EBC = \angle ECB = 60°$
$\therefore \Delta EBC$ is an equilateral triangle having
$EB = BC = EC$
$AB = BC = CD = DA = EB = EC$
[$\because ABCD$ is a square].
$\angle ABE = 90° + 60° = 150°$
In ΔABE,
$\angle ABE + 2\angle AEB = 180°$ [$\because \angle AEB = \angle BAE$].
$2\angle AEB = 180° - \angle ABE = 180 - 150 = 30°$
$\Rightarrow \quad \angle AEB = 15°$

14. **(d)** $\angle ABC + \angle BCF = 180°$
[Interior angles or same side of transversal].
$\Rightarrow \angle BCF = 180° - 120° = 60°$
$\angle BCF = \angle EFD$ (corresponding angles)
$\therefore \quad \angle EFD = 60°$

15. **(c)** Joining A to C,



$\because \quad AD = DC$
$\therefore \angle DAC = DCA = \frac{180° - 40°}{2} = \frac{140}{2} = 70°$
$\because \quad \angle BCD = 140°$
$\therefore \quad \angle BCA = 140° - 70° = 70°$
Now, $\angle BCA = \angle BAC = 70°$ ($\because AB = BC$)
$\therefore \quad \angle ABC = 180° - (2 \times 70°)$
$= 180 - 140 = 40°$

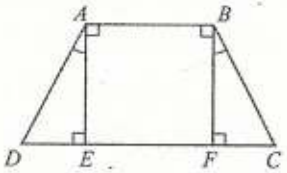
16. **(d)** In a parallelogram.
$AB = CD$, and, $BC = DA$
$\Rightarrow 4x + 1 = 25$ and $2y + 3 = y + 28$
$\Rightarrow \quad x = 8$, and, $y = 25$
$\therefore \quad x + y = 8 + 25 = 33$

17. **(a)** $PQRS$ is a parallelogram.
$\therefore \quad \angle S = \angle Q = y = 70°$

18. **(a)** $\because \angle B = 90°$, and, $ABCD$ is a parallelogram
$\therefore \angle C = 90°$, $\angle A = 90°$ and $\angle D = 90°$
So, $ABCD$ may be a rectangle or square, but, since, $\alpha < 90°$.
$\therefore ABCD$ must be a rectangle.

19. **(a)** $\because \theta = 90°$ (Angle between the diagonals)
$\therefore ABCD$ may be a rhombus or square.
But, since, $\angle A = \angle C = 110°$
$\therefore ABCD$ must be a square.

20. **(b)** $\because$ $ABCD$ is an isosceles trapezium.
$\therefore \quad AD = BC$



Draw $AE \perp DC$ and $BF \perp DC$, then, in ΔAED and $\angle BFC$.
$\angle AED = \angle BFC = 90°$,
$AB = BC$.

$AE = BF$ (perpendicular distance between two parallel lines)

$\therefore \quad \Delta AEB \cong \Delta BFC$ (ets congruency)

$\therefore \quad \angle A = \angle B$

21. **(a)** $\because$ O is the bisector of both the diagonals.

$\therefore$ $PQRS$ is a parallelogram.

$\because$ Diagonals of the parallelogram are equal.

$\therefore$ $PQRS$ may be a square or rectangle.

22. **(b)** $\because$ AB is parallel to BC, and, AB is transversal.

$\therefore \quad \angle A + \angle B = 180°$

$\Rightarrow \angle B = 180° - \angle A = 180° - 110° = 70°$

23. **(c)** In ΔLAM,

$\angle ALM + 90° + \angle M = 180°$

$\Rightarrow \quad \angle M = 65°$

$\therefore x = \angle M = 60°$ ($\because KLMN$ is a parallelogram).

In ΔBLK,

$\angle BLK + 65° + 90° = 180°$

$\Rightarrow \quad \angle M = 180° - 90° = 90°$

$\Rightarrow \quad \angle BLK = 25°$

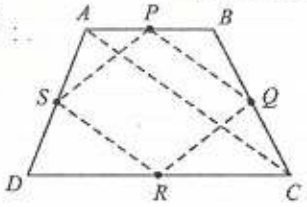
$\because \quad \angle L = 180° - 65° = y + 25° + 25°$

$\Rightarrow \quad y = 65°$

24. **(c)** $\angle OBC = \angle ODA = 35°$

(Alternate Interior $\angle S$).

25. **(a)**



$ABCD$ is a parallelogram and P,Q,R,S are the midpoints of AB, BC, CD, DA respectively.

Consider, AC as a diagonal of $ABCD$.

Now, According to midpoint theorem,

$PQ = \frac{1}{2} AC$ and PQ is parallel to AC,

and $SR = \frac{1}{2} AC$ and PQ is parallel to AC.

$\therefore PQ = RS$ and $PQ \parallel RS \parallel AC$.

$\therefore$ $PQRS$ will be a parallelogram.

26. **(a)** $\because$ AB is a common side in both square and rhombus.

$\therefore AB = BC = CD = DA = FA = FE = EB$

In ΔEBC,

$\angle BEC + \angle C + \angle B = 180°$ [$\angle C = \angle BEC$]

[$\because EB = BC$]

$\therefore \quad \angle BEC = \frac{180° - \angle B}{2} = 15°$

[$\angle B = 90° + 60° = 150°$]

$\because$ AE is the diagonal of square.

$\therefore \quad \angle AEF = 45°$

Now,

$\because \angle E$ is the angle of a square,

$\therefore \quad \angle E = 90°$

$\Rightarrow \quad 45° + 15° + a = 90°$

$\Rightarrow \quad a = 30°$

27. **(c)** From ΔEDC,

$\angle EDC = 180° - 2 \times 30° = 120°$

$\angle EDG = \angle EDC - \angle D = 120° - 90° = 30°$

Also,

$\angle ABO = \angle ADB = \frac{120°}{2} = 60°$

$x = 60° + 30° = 90°$

28. **(d)** $5K \times 13K = 195$

$\Rightarrow \quad K = 3$

$\therefore$ Sides of the rectangle are

15 cm, 39 cm

$\therefore$ Perimeter = 2 (15 + 39)

$= 2 \times 54$

$= 108$ cm.

29. **(d)** $\because$ $AE = EB$.

$\therefore \angle BAE = \angle ABE = x$.

$\because \quad \Delta DO = OB$, and , $AO = OC$

In ΔABE,

$\angle DAE + \angle ABE = \angle AEF$

$\Rightarrow \quad x + x = 50°$

$\Rightarrow \quad 2x = 50°$

$\Rightarrow \quad x = 25°$

30. **(d)** In ΔAPS,

$$AP = AS = \frac{AB}{2} = \left(\frac{16\sqrt{2}}{4}\right) \times \frac{1}{2} = 2\sqrt{2} \text{ cm}$$

and $AP^2 + AS^2 = SP^2$

$\Rightarrow$ $SP = \sqrt{AP^2 + AS^2}$

$$= \sqrt{(2\sqrt{2})^2 + (2\sqrt{2})^2}$$

$$= (2\sqrt{2})\sqrt{2} = 4 \text{ cm}$$

$\therefore$ Perimeter $(PQRS) = 4 \times 4$ cm

$= 16$ cm

10. Mensuration

Volume

Volume of cuboid = Length × Breadth × Height.

$V = l \times b \times h$

Example 1: Find the volume of a cuboid cake whose length is 12 cm, breadth 4 cm and height 3 cm.

Solution: Here $l = 12$ cm

$b = 4$ cm

$h = 3$ cm

$\therefore$ Volume $= l \times b \times h = 12 \times 4 \times 3 = 144$ cm^3

1 ml = 1 cu cm

1 l = 1000 cu cm.

1 kl = 1000 litre = 1 cu m.

Example 2: A tank measuring 15 m long, 10 m wide and 6m deep is full of water. Find the volume of the water in the tank?

Solution: Here $l = 15$ m

$b = 10$ m

$h = 6$ m

Volume $= 15 \times 10 \times 6 = 900$ cu m

$= 900$ kilo litres

Volume of cube $= l \times l \times l = l^3$

Example 3: The volume of a cube is 343 cu m. What is its side?

Solution: Let side of the cube is x then

$x^3 = 343$

$\Rightarrow \quad x^3 = 7^3 \quad \Rightarrow \quad x = 7$ cm

Example 4: How many litres of water can a cubical tank of side 10 m hold?

Solution: Volume of tank $= 10 \times 10 \times 10 = 1000$ m^3

$= 1000 \times 1000 = 1000000$ litres.

Surface area of cuboid $= 2\,(l \times b + b \times h \times l \times h)$

Example 5: What is the surface area of a tin which is 40 cm long, 30 cm broad and 40 cm high?

Solution: Given $l = 40$ cm.

$b = 30$ cm

$h = 40$ cm

$\therefore$ Surface area of tin $= 2\,(40 \times 30 + 30 \times 40 + 40 \times 40)$

$= 2(1200 + 1200 + 1600)$

$= 2 \times 4000 = 8000$ sq. cm.

Lateral surface area of the cuboid $= 2\,(l + b)\,h$.

Example 6: Find the lateral surface area of a cuboid having length 6 cm, breadth 5 cm and height 4 cm.

Solution: Here $l = 6$ cm

$b = 5$ cm

$h = 4$ cm

Lateral surface area of cuboid $= 2(l + b)h$

$= 2(6 + 5) \times 4$

$= 2 \times 11 \times 4$

$= 88 \text{ cm}^2$

Surface area of cube $= 6l^2$.

Example 7: Find the surface area of cube if its edge is 5 cm.

Solution: Here $l = 5$ cm

$\therefore$ Surface area of cube $= 6l^2$

$= 6 \times 5^2$

$= 6 \times 25$

$= 150 \text{ cm}^2$

Volume of cylinder $= \pi r^2 h$.

Example 8: What is the volume of the cylinder if the diameter of the base of cylinder is 14 cm and height 6 cm ?

Solution: Here $r = \frac{14}{2} = 7$ cm

and $h = 6$ cm.

$\therefore$ Volume $= \pi r^2 h = \frac{22}{7} \times 7^2 \times 6$

$= \frac{22}{7} \times 7 \times 7 \times 6$

$= 22 \times 42$

$= 224 \text{ cm}^3$

Lateral surface of cylinder $= 2\pi rh$

Total surface area of cylinder $= 2\pi r^2 + 2\pi rh = 2\pi r(r + h)$

Example 9: What is the lateral surface area of the cylinder having radius 7 cm and height 6 cm.

Solution: Given $r = 7$ cm.

$h = 6$ cm.

$\therefore$ Lateral surface area $= 2\pi rh$

$= 2 \times \frac{22}{7} \times 7 \times 6$

$= 22 \times 12$

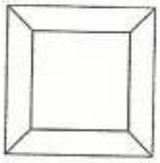
$= 264 \text{ cm}^2$

Multiple Choice Questions

1. A piece of ductile metal is in the form of a cylinder of radius 0.5 cm and length 6 cm. It is drawn out into a wire of diameter 1 mm. What will be the length of the wire?
   (a) 6 m (b) 12 m (c) 9 m (d) 3 m
2. How many cubic metres of earth must be dug out to sink a well of 22.5 m deep and diam 7 m ?
   (a) 866.25 cu m (b) 826.25 cu m
   (c) 16.25 cu m (d) None of these
3. The circumference of the base of a cylinder is 198 cm and its height is 30 cm. What is the curved surface area of the cylinder?
   (a) 5240 cm^2 (b) 5940 cm^2
   (c) 5640 cm^2 (d) 5340 cm^2
4. The volume of a metallic pipe is 1408 cm^3. Its length is 14 cm and its internal radius is 7 cm. What is the thickness of the pipe?
   (a) 3 cm (b) 4 cm (c) 2 cm (d) 2.5 cm
5. What is the total surface area of a cylinder having base radius 10.5 cm and length 18 cm?
   (a) 1188 cm^2 (b) 1818 cm^2
   (c) 1881 cm^2 (d) None of these
6. A cylindrical tank has capacity of 5632 m^3. Its diameter is 16 m. What is its depth?
   (a) 24 m (b) 26 cm (c) 28 cm (d) 32 cm
7. The volume of a cylinder of height 8 cm is 1232 cm^3. What is the difference between curved surface area and the total surface area?
   (a) 352 cm^2 (b) 308 cm^2
   (c) 316 cm^2 (d) 332 cm^2
8. What is the volume of a cube whose total surface area is 486 cm^2 ?
   (a) 729 cm^3 (b) 572 cm^3
   (c) 343 cm^3 (d) None of these
9. A beam of wood is 5 m long and 36 cm. It is made of 1.35 m^3 of wood. What is the width of the beam?
   (a) 15 cm (b) 25 cm
   (c) 75 cm (d) None of these
10. How many planks of size 2m × 25 cm × 8 cm. can be prepared from a wooden block 5 m long 70 cm broad and 32 cm thick ?
    (a) 28 (b) 32 (c) 36 (d) 42
11. The radius and height of a cylinder are in the ratio 3 : 7. Its volume is 1584 cu cm. What is the radius of the cylinder?
    (a) 2 cm (b) 4 cm (c) 6 cm (d) 8 cm
12. How many bricks of size 22 cm × 10 cm × 7 cm are required to construct a wall 33 m long 3.5 m high and 40 cm thick and sand used in the construction occupy $\frac{1}{10}$th part of the wall?
    (a) 24000 (b) 25000
    (c) 26000 (d) 27000
13. A rectangular sheet of paper 44 cm × 18 cm is rolled along its length and a cylinder is forms. What is the volume of that cylinder?
    (a) 2772 cm^3 (b) 2722 cm^3
    (c) 2727 cm^3 (d) 2277 cm^3
14. The area of the base of a cone is 180 cm^2. If the height of the cone is 8 cm. What is its volume?
    (a) 420 cm^3 (b) 480 cm^3
    (c) 460 cm^3 (d) 520 cm^3
15. The radii of two cylinders are in the ratio 2: 3 and their heights are in the ratio 5 : 3. What is the ratio of their volumes?
    (a) 20 : 27 (b) 27 : 20
    (c) 10 : 9 (d) 9 : 10
16. A swimming pool is 260 m long and 140 m wide. If 54600 cubic metres of water is pumped into it, what is the height of the water level in it ?
    (a) 1 m (b) 1·5 m (c) 2 m (d) 2·5 m
17. A rectangular piece paper 22 cm × 6 cm is folded without overlapping to make a cylinder of height 6 cm. What is the volume of the cylinder?
    (a) 221 cm^3 (b) 231 cm^3
    (c) 214 cm^3 (d) 243 cm^3

18. The lateral surface area of a cylinder is 11440 cm^3. If its height is 65 cm then what is its circumference?
(a) 174 cm (b) 176 cm
(c) 184 cm (d) 186 cm

19. In the given figure the outer dimension is 24 cm × 28 cm and the inner dimension 16 cm × 20 cm. What is the difference between two adjacent section of the frame if the width of each section is same?
(a) 20 cm^2
(b) 24 cm^2
(c) 16 cm^2
(d) 28 cm



20. The area of a trapezium is 480 cm^2. The distance between two parallel sides is 15 m and one of the parallel side is 20 m. What is the length of other parallel side?
(a) 42 m (b) 44 m (c) 48 m (d) 52 m

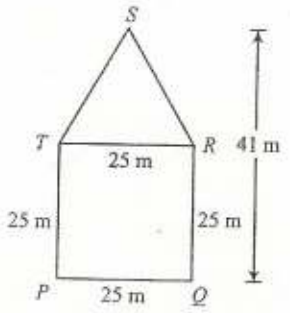
21. A rectangular piece of paper 11 cm × 4 cm is folded without overlapping to make a cylinder of height 4 cm. What is its volume?
(a) 32·5 cm^3 (b) 36·5 cm^3
(c) 38·5 cm^3 (d) None of these

22. T e total surface area of a cube is 486 m^2. Then what is its side?
(a) 7 cm (b) 8 cm (c) 9 cm (d) 12 cm

23. The parallel sides of a trapezium are 25 cm and 11 cm and its non-parallel sides are 15 cm and 13 cm. What is the area of trapezium?
(a) 216 cm^2 (b) 242 cm^2
(c) 226 cm^2 (d) 256 cm^2

24. The area of a trapezium is 384 cm^2. Its parallel sides are in the ratio 5 : 3 and the distance between them is 12 cm. What is the longer of the parallel sides
(a) 36 cm (b) 40 cm (c) 42 cm (d) 44 cm

25. In the given figure $ST = SR$, $PQ = QR = RT = TP = 25$ m and its 5 total height is 41 m. What is its total area?



(a) 825 m^2 (b) 815 m^2
(c) 845 m^2 (d) None of these

26. $ABCD$ is a quadrilateral field in which the diagonal BD is 36 m. $AL \perp BD$ and $CM \perp BD$ such that AL = 19 m and CM = 11 m. What is the area of the field?
(a) 520 m^2 (b) 540 m^2
(c) 560 m^2 (d) 570 m^2

27. If the length of each side of a cube is doubled then how many times does its surface area become?
(a) 4 times (b) 8 times
(c) 16 times (d) None of these

28. The edges of a cuboid are in the ratio 1 : 2 : 3 and its surface area is 88 cm^2. What is the volume of the cuboid?
(a) 48 cm^3 (b) 64 cm^3
(c) 56 cm^3 (d) 64 cm^3

29. The curved surface area of a cylinder is 220 cm^2 and the volume of the cylinder is 770 cm^3 the what is the diameter of cylinder?
(a) 7 cm (b) 14 cm (c) 21 cm (d) 28 cm

30. The circumference of the circular base of a cylinder is 44 cm and its height is 15 cm. What is the volume of the cylinder?
(a) 1155 cm^3 (b) 1540 cm^3
(c) 2310 cm^3 (d) None of these

Answer Key

1. (a)	2. (a)	3. (b)	4. (c)	5. (c)	6. (c)	7. (b)	8. (a)	9. (c)	10. (a)
11. (c)	12. (d)	13. (a)	14. (b)	15. (a)	16. (b)	17. (b)	18. (b)	19. (c)	20. (b)
21. (c)	22. (c)	23. (a)	24. (b)	25. (a)	26. (b)	27. (a)	28. (a)	29. (b)	30. (c)

Hints and Solutions

1. **(a)** Length of wire $= \dfrac{\pi \times 0.5 \times 0.5 \times 6}{\pi \times \frac{0.5}{10} \times \frac{0.5}{10}}$

$$= \frac{6 \times 10 \times 10}{100} = 6 \text{ m}$$

2. **(a)** Given $r = \dfrac{7}{2} = 3.5$ m

$h = 22.5$ m

Volume of the earth dug out $= \pi r^2 h$

$$= \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \times 22.5$$

$$= 11 \times 7 \times 11.25 = 866.25 \text{ m}^3$$

3. **(b)** Given $2\pi r = 198 \Rightarrow r = \dfrac{198}{2\pi} = \dfrac{198 \times 7}{2 \times 22}$

$$= 31.5 \text{ cm}$$

$h = 30$ cm

Curved surface area of cylinder $= 2\pi rh$

$$= 2 \times 3{\cdot}14 \times 31{\cdot}5 \times 30 = 5940 \text{ cm}^2$$

4. **(c)** Let R be the external radius of pipe.

Volume of the pipe $= 1408 \text{ cm}^3$

Length of the pipe $= h = 14$ cm

Internal radius $= r = 7$ cm

$$V = \pi (R^2 - r^2)h.$$

$$\Rightarrow \quad 1408 = \frac{22}{7}(R - 7^2)14$$

$$\Rightarrow \quad R^2 - 49 = \frac{1408}{44} = 32$$

$$\Rightarrow \quad R^2 = 81 \Rightarrow R = 9 \text{ cm}$$

$\therefore$ Thickness of pipe $= 9 - 7 = 2$ cm

5. **(c)** $r = 10.5$ cm, $h = 18$ cm

Total surface area $= 2\pi r\,(h + r)$

$$= 2 \times \frac{22}{7} \times \frac{21}{2}\left(18 + \frac{21}{2}\right)$$

$$= 22 \times 3\left(\frac{57}{2}\right)$$

$$= 11 \times 3 \times 57 = 1881 \text{ cm}^2$$

6. **(c)** Capacity of the tank $= 5632 \text{ m}^3$

Radius $= \dfrac{16}{2} = 8$ m

Let its depth be h m.

$$\pi r^2 h = 5632$$

$$\Rightarrow \quad \frac{22}{7} \times 8 \times 8\, h = 5632$$

$$\Rightarrow \quad h = \frac{5632 \times 7}{22 \times 8 \times 8} = 28 \text{ cm}$$

7. **(b)** Volume of the cylinder $= 1232 \text{ cm}^3$

$$\Rightarrow \quad \pi r^2 h = 1332$$

$$\Rightarrow \quad \frac{22}{7} \times r^2 \times 8 = 1232$$

$$\Rightarrow \quad r^2 = \frac{1232 \times 7}{8 \times 22}$$

$$\Rightarrow \quad r^2 = 7 \times 7 \Rightarrow r = 7 \text{ cm}$$

Curved surface area $= 2\pi rh = 2 \times \dfrac{22}{7} \times 7 \times 8$

$$= 352 \text{ cm}^2$$

Total surface area

$$= 2\pi r\,(h + r) = 2 \times \frac{22}{7} \times 7\,(8 + 7)$$

$$= 44 \times 15 = 660 \text{ cm}^2$$

Difference $= 660 - 352 = 308 \text{ cm}^2$

8. **(a)** Total surface area of cube $= 486 \text{ cm}^2$

$$6a^2 = 486 \Rightarrow a^2 = 81$$

$$\Rightarrow \quad a = 9$$

Volume of cube $= a^3 = 9^3 = 729 \text{ cm}^3$

9. **(c)** Let x be the width of the beam.

Volume of the beam $= 1.35 \text{ m}^3$

$$\Rightarrow \quad l \times b \times h = 1.35$$

$$\Rightarrow \quad x = \frac{1.35 \times 100}{5 \times 36}$$

$$\Rightarrow \quad x = \frac{135}{5 \times 36} = \frac{27}{36} \text{ m}$$

$$\Rightarrow \quad x = \frac{27}{36} \times 100 = 75 \text{ cm}$$

10. **(a)** Number of planks $= \dfrac{5\times100\times70\times32}{2\times100\times25\times8}$

$= 28$

11. **(c)** Let radius be $3x$ and height be $7x$

Volume of the cylinder $= \pi r^2 h = 1584$

$\Rightarrow \quad \dfrac{22}{7}\times3x\times3x\times7x = 1584$

$\Rightarrow \quad x^3 = \dfrac{1584\times7}{22\times3\times3\times7}$

$\Rightarrow \quad x^3 = 8 = 2^3 \Rightarrow x = 2$

$\therefore$ Radius $= 3x = 3\times2 = 6$ cm

12. **(d)** Volume of the wall $= 33\times3.5\times0.4$

$= 33\times100\times3.5\times100\times0.4\times100$

$= 330\times350\times40$

Sand $= \dfrac{1}{10}\times330\times350\times40$

$= 3300\times350\times40$

Required volume

$= 3300\times350\times40 - 330\times350\times40$

$= 3300\times40\,(350-35)$

$= 330\times40\times315$

$\therefore$ No. of bricks $= \dfrac{3300\times40\times315}{22\times10\times7}$

$= \dfrac{300\times4\times45}{2}$

$= 300\times2\times45 = 27000$

13. **(a)** $2\pi r = 44 \Rightarrow r = \dfrac{44}{2\pi} = \dfrac{44\times7}{2\times22} = 7$ cm

$h = 18$ cm

$\therefore$ Volume of the cylinder $= \pi r^2 h$

$= \dfrac{22}{7}\times7^2\times18$

$= 22\times7\times18 = 2772\ \text{cm}^3$

14. **(b)** Volume of cone $= \dfrac{1}{3}(\pi r^2)(h)$

$= \dfrac{1}{3}$ (Area of base) (height)

$= \dfrac{1}{3}\times180\ \text{cm}^2\times8\ \text{cm}$

$= 480\ \text{cm}^3$

15. **(a)** Given, the radii of cylinder $= 2:3$.

Heights of cylinder $= 5:3$

$\therefore$ Ratio of volume of the cylinders

$= \pi\times(2x)^2\times5x : \pi\,(3x)^2\times3x$

$= 4\times5:9\times3$

$= 20:27$

17. **(b)** Here $h = 6$ cm.

$\Rightarrow 2\pi r = 22 \Rightarrow r = \dfrac{22}{2\pi} = \dfrac{22\times7}{2\times22} = \dfrac{7}{2}$ cm

Volume of the cylinder $= \pi r^2 h$

$= \dfrac{22}{7}\times\dfrac{7}{2}\times\dfrac{7}{2}\times6$

$= 11\times7\times3 = 231\ \text{cm}^3$

18. **(b)** Lateral surface area $= 11440$.

$\Rightarrow \quad 2\pi rh = 11440$

$\Rightarrow 2\times\dfrac{22}{7}\times r\times65 = 11440$

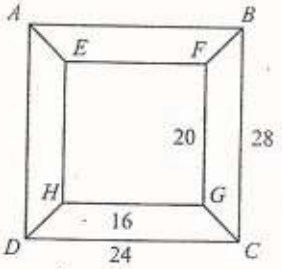
$\Rightarrow \quad r = \dfrac{11440\times7}{44\times65} = 28$ cm

Circumference $= 2\pi r$

$= 2\times\dfrac{22}{7}\times28 = 22\times8 = 176$ cm

19. **(c)** Width of section $AEFB$ = width of $CGHD$

$= \dfrac{1}{2}(28-20) = \dfrac{8}{2} = 4$ cm



Area of $AEFB = \dfrac{1}{2}\times(24+16)\times4 = 80\ \text{cm}^2$

Width of section $AEHD$ =

width of $BFCG = \frac{1}{2}(24-16) = 4$ cm

Area of $AEHD = \frac{1}{2} \times (28+20) \times 4 = 96$ cm^2

Difference $= 96 - 80 = 16$ cm^2

20. **(b)** Area of trapezium $= \frac{1}{2} \times (20+x)\,15$

$$\Rightarrow \quad 480 = \frac{1}{2}(20+x)\,15$$

$$\Rightarrow \quad 20 + x = \frac{2 \times 480}{15}$$

$$\Rightarrow \quad 20 + x = 64 \Rightarrow x = 64 - 20 = 44 \text{ m}$$

21. **(c)** Here $h = 4$ cm

$$2\pi r = 11 \Rightarrow r = \frac{11}{2\pi} = \frac{11 \times 7}{2 \times 22} = \frac{7}{4} \text{ cm}$$

Volume of the cylinder $= \pi r^2 h$

$$= \frac{22}{7} \times \frac{7}{4} \times \frac{7}{4} \times 4$$

$$= \frac{11 \times 7}{2} = \frac{77}{2} = 38.5 \text{ cm}^3$$

22. **(c)** Total surface area of cube = 486 (Given)

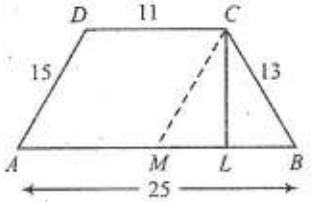
$\therefore \quad 6a^2 = 486$

where a is side.

$$\Rightarrow \quad a^2 = 81 \Rightarrow a = 9 \text{ cm}$$

23. **(a)** Here $MC = AD = 15$ cm

$AM = DC = 11$ cm



In ΔBMC, $MB = 25 - 11 = 14$

$$S = \frac{13+14+15}{2} = \frac{42}{2} = 21$$

Area of $\Delta BMC = \sqrt{s(s-a)(s-b)(s-c)}$

$$= \sqrt{21 \times 8 \times 7 \times 6}$$

$$= \sqrt{7 \times 3 \times 4 \times 2 \times 7 \times 3 \times 2}$$

$$= 7 \times 2 \times 3 \times 2 = 84 \text{ cm}^2$$

Now $\quad \frac{1}{2} \times CL \times MB = 84$

$$\Rightarrow \quad CL = \frac{84 \times 2}{14} = 12 \text{ cm}$$

$\therefore$ Area of trapezium

$$= \frac{1}{2}(11+25) \times 12 = 36 \times 6 = 216 \text{ cm}^3$$

24. **(b)** Area of trapezium = 384

$$\Rightarrow \quad \frac{1}{2}(5x+3x)\,12 = 384.$$

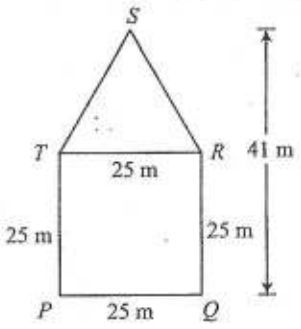
$$\Rightarrow \quad 8x = \frac{384 \times 2}{12}$$

$$\Rightarrow \quad x = \frac{32 \times 2}{8} = 8 \text{ cm}$$

Parallel sides are 40 cm and 24 cm.

25. **(a)** Total area = area of ΔSTR

+ area of square $PQRT$



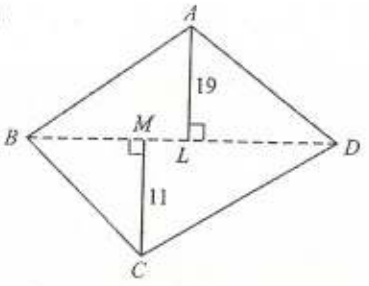
$$= \frac{1}{2} \times 25 \times (41-25) + 25 \times 25$$

$$= \frac{1}{2} \times 25 \times 16 + 625$$

$$= 200 + 625$$

$$= 825 \text{ m}^2$$

26. **(b)**



Area of the field

$= \text{Area of } \Delta ABD + \text{Area of } \Delta BCD$

$= \frac{1}{2} \times 36 \times 19 + \frac{1}{2} \times 36 \times 11$

$= 18 \times 19 + 18 \times 11$

$= 18(19 + 11)$

$= 18 \times 30 = 540 \text{ m}^2$

27. **(a)** Let the length of cube $= a$.

Surface area $= 6a^2$.

$\therefore$ Length of cube $= 2a$.

Surface area $= 6(2a)^2 = 6 \times 4a^2 = 24a^2$

$= 4 \times 6a^2$

28. **(a)** Total surface area of cuboid

$= 2(lb + bh + lh)$

$\Rightarrow 2(x \times 2x + 2x \times 3x + x \times 3x) = 88$

$\Rightarrow 2x^2 + 6x^2 + 3x^2 = 44$

$\Rightarrow 11x^2 = 44 \Rightarrow x^2 = 4 \Rightarrow x = 2$

Here $l = 2$ cm

$b = 2 \times 2 = 4$ cm

$h = 3 \times 2 = 6$ cm

$\therefore$ Volume of cuboid $= 2 \times 4 \times 6 = 48 \text{ cm}^3$

29. **(b)** Curved surface area of cylinder $= 220$

$\Rightarrow \quad 2\pi rh = 220 \quad \ldots(1)$

and volume of cylinder $= 770$

$\pi r^2 h = 270 \quad \ldots(2)$

$\therefore \quad \frac{\pi r^2 h}{2\pi rh} = \frac{770}{220}$

$\Rightarrow \quad \frac{r}{2} = \frac{77}{22}$

$\Rightarrow \quad r = \frac{77 \times 2}{22} = 7$ cm

$\therefore$ Diameter $= 2r = 2 \times 7 = 14$ cm.

30. **(c)** $2\pi r = 44 \Rightarrow 2 \times \frac{22}{7} \times r = 44$

$\Rightarrow \quad r = \frac{7 \times 44}{44} = 7$ cm

and $h = 15$ cm

$\therefore$ Volume of cylinder $= \pi r^2 h$

$= \frac{22}{7} \times 7 \times 7 \times 15$

$= 22 \times 105$

$= 2310 \text{ cm}^3$

11. Visualising Solid Shapes

Key Points

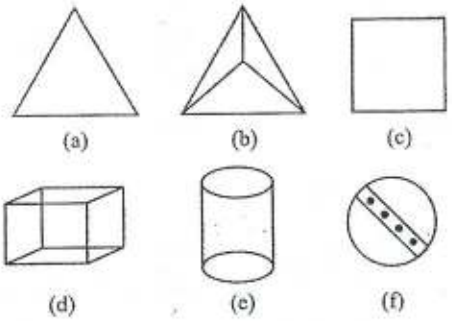
- 2-D shapes is one whose two measurements, *i.e.*, length and breadth are possible.
- 3-D shape or a solid shape has three measurements, *i.e.* length, breadth and height.
- A solid object occupies some space, the measure of this space is known as volume.
- Any 2-D object can be extended to a 3-D object by means of extrusion or rotation.
- Every solid shape has some views. These views are top, side, front, bottom views. Further, side view is classified as right hand side view and left hand side view.
- 3-D shapes were classified into shapes with flat surfaces, curved surfaces, and flat as well as curved surfaces.
- 3-D shapes with flat surfaces only are further classified into prisms and pyramids.
- In prisms, all lateral surfaces are rectangles, parallelograms, whereas, in pyramids, all lateral surfaces are triangles.

Euler's Formula

The number of faces (F), the number of edges (E) and the number of vertices (V) of a 3-D shape with flat surfaces satisfy the following relationship.

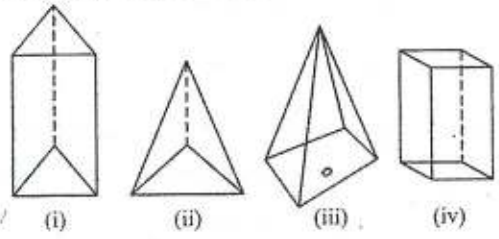
$$V + F - E = 2$$

Example 1: Identify 2-D and 3-D figures :



Solution: 2-D shapes : (a), (c); 3D shapes : (b), (d), (i), (f).

Example 2: Which of the following shapes are pyramids?



Solution: According to definition of pyramids, only (ii) and (iii) have all triangular lateral surfaces.

Polyhedron

A surface bounded by planes is called a polyhedron. The bounded planes are called the faces of polyhedron.

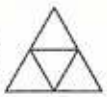
- If all the faces of a polyhedron are congruent, it is called a regular polyhedron. Example: cube, tetrahedron.
- If the faces of a polyhedron are not congruent, it is called a polyhedron having un-equal faces.

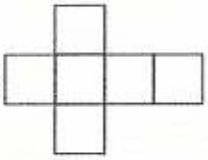
Multiple Choice Questions

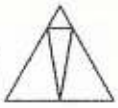
1. A cube has ------ vertices.
   (a) 8 (b) 12 (c) 6 (d) 4
2. A cuboid has ------- edges.
   (a) 4 (b) 12 (c) 8 (d) 6
3. A cube can be obtained by :
   (a) Extruding a square
   (b) Extruding a rectangle
   (c) Rotating a square about centre
   (d) None of these
4. Which of the following is not a 3-D shape?
   (a) Sphere (b) Cylinder
   (c) Cuboid (d) Circle
5. A sphere can be obtained by :
   (a) Extruding a circle
   (b) Rotating a rectangle
   (c) Rotating a square
   (d) Rotating a semicircle about its diameter.
6. A polyhedron is such that its base and top are congruent polygons and other faces (lateral) are parallelograms in shape :
   (a) Pyramid (b) Cylinder
   (c) Prism (d) Tetrahedron
7. A regular polyhedron has :
   (a) Congruent faces
   (b) Non-congruent faces
   (c) Vertices are formed by different number of faces
   (d) None of these
8. A cylinder has :
   (a) 2 surfaces (b) 3 surfaces
   (c) 4 surfaces (d) 5 surfaces
9. A tetrahedron has :
   (a) 3 equilateral triangles
   (b) 4 equilateral triangles
   (c) 5 equilateral triangles
   (d) 4 isosceles triangles
10. A hexahedron has :
    (a) 8 squares (b) 6 squares
    (c) 6 rectangles (d) 6 parallelograms
11. A paraboloid is formed by :
    (a) Extruding a parabola.
    (b) Rotating a parabola about its vertex.
    (c) Rotating a parabola about its axis.
    (d) None of these.
12. The number of edges of a octahedron are :
    (a) 16 (b) 17 (c) 18 (d) 20
13. A dodecahedron has 12 regular
    (a) Equilateral triangles
    (b) Pentagons
    (c) Squares
    (d) Rectangles
14. The number of faces of an icosahedron are :
    (a) 14 (b) 16 (c) 18 (d) 20
15. A solid is formed by rotating right-angled triangle about any of its altitudes. The solid will be :
    (a) Cylinder (Right circular)
    (b) Sphere
    (c) Cone (Right Circular)
    (d) Hemisphere
16. If two equal tetrahedrons are joined through their base triangles, by sticking, then the shape generated will be a :
    (a) Tetrahedron (b) Hexahedron
    (c) Dodecahedron (d) Decahedron
17. While drawing an isometric view of a cube, the sides should be inclined at :
    (a) 30° to the horizontal

(b) 30° to the vertical
(c) (30° + 30°) = 60°, to the vertical
(d) 60° to the horizontal

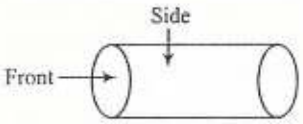
18. The front view of a tetrahedron will be :

(a) 

(b) 

(c) 

(d) None of these

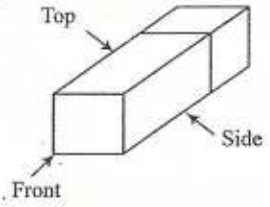
19. 

The front and side views of a right circular cylinder are :
(a) Circular, Triangular
(b) Circular, Rectangular
(c) Curved, straight
(d) None of these.

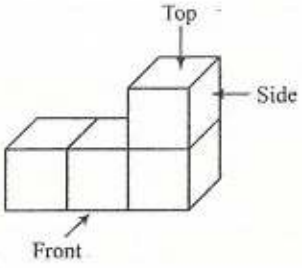
20. A solid shape is generated by rotating a rectangle about any of its sides. The shape will be :
(a) Cuboid
(b) Cone
(c) Sphere
(d) Cylinder (right circular)

21. A solid shape is generated by extruding a rectangle, out of its plane. The shape will be :
(a) Cube (b) Cuboid
(c) Cylinder (d) Cone

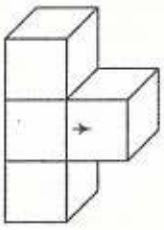
22. The top view will contain :



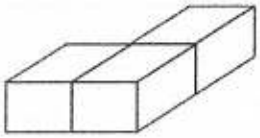
(a) 1 rectangle, 1 square (joined)
(b) 2 squares (joined)
(c) 2 rectangles (joined)
(d) 1 rectangle.

23. 

The above figure is generated from 4 cubes; The number of squares in front view = x, number of squares in top view = y. $(x + y)$ =
(a) 7 (b) 6 (c) 5 (d) 8

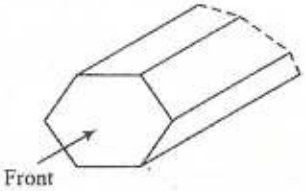
24. 

A cube is extracted from a well-arranged vertical cubes, which are 3 in number. When viewed form top, the number of edges will be :
(a) 8 (b) 6 (c) 7 (d) 10

25. 

The above solid contain 3 cubes. The number of edges will be : (cubes are of different dimensions)
(a) 30 (b) 32 (c) 28 (d) 36

26. Number of vertices in Q – 25 are : (cubes are of same dimension)
(a) 24 (b) 12 (c) 18 (d) 20

27. 

The front view of the shape will have ---- edges.
(a) 5 (b) 6 (c) 7 (d) 4

28. 

The top view of a cone will be :

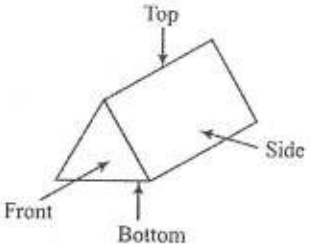
(a) Square (b) Rectangular

(c) Triangle (d) Circular

29. A parallelogram is extruded outwards with the axis inclined at some angle with the vertical. The resulting figure will be :

(a) Cuboid (b) Parallelopiped

(c) Parallelex (d) None of these.

30. 

The number of vertices in front view + number of vertices in top view – number of vertices in bottom view =

(a) 4 (b) 6

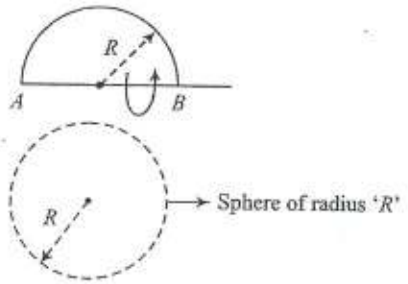
(c) 5 (d) 9

Answer Key

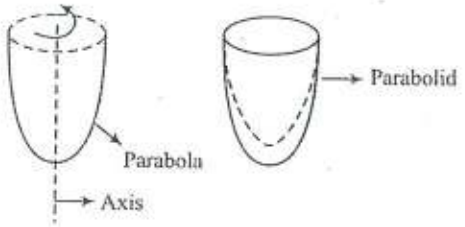
1. (a)	2. (b)	3. (a)	4. (d)	5. (d)	6. (c)	7. (a)	8. (b)	9. (b)	10. (b)
11. (c)	12. (a)	13. (b)	14. (d)	15. (c)	16. (b)	17. (a,c)	18. (a)	19. (b)	20. (d)
21. (b)	22. (a)	23. (b)	24. (c)	25. (c)	26. (b)	27. (b)	28. (b)	29. (b)	30. (c)

Hints and Solutions

1. **(a)** A cube has 8 vertices.
2. **(b)** A cuboid has 12 edges.
3. **(a)** A cube can be obtained by extruding a square.
4. **(d)** A circle is not a 3-D shape.
5. **(d)** A sphere can be obtained by rotating semicircle about its diameter.



6. **(c)** Prism has congruent base and top faces and remaining faces are parallelograms.
7. **(a)** A regular polyhedron has congruent face.
8. **(b)** A cylinder has 2 circular and 2 lateral surface.
9. **(b)** A tetrahedron has 4 equilateral triangles.
10. **(b)** A hexahedron contains 6 squares.
11. **(c)** A paraboloid can be generated by rotating a parabola about its axis.



12. **(a)** Number of faces = F = 8

Number of vertices = V = 10

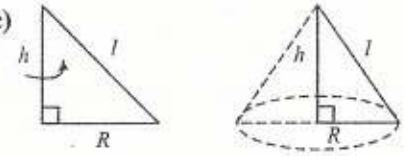
∴ Using Euler's formula,

E = V + F – 2 = 8 + 10 – 2 = 16

13. **(b)** A dodecahedron has 12 regular pentagons.

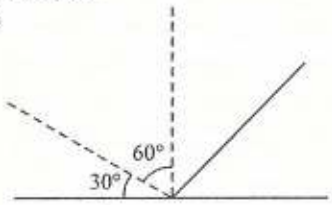
14. **(d)** A isosahedron has 20 faces.

15. **(c)**



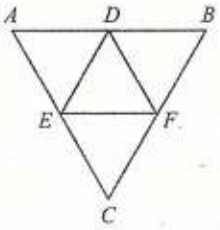
16. **(b)** A hexahedron can be generated by sticking two equal tetrahedrons through their base.

17. **(a,c)**



The edges are inclined at 30° to the horizontal and 60° to the vertical.

18. **(a)**

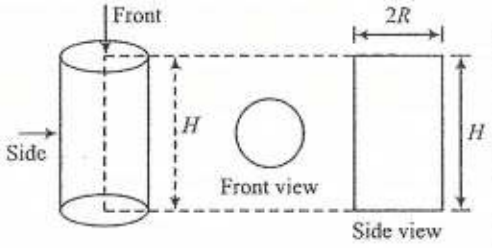


$$AB = BC = AC$$

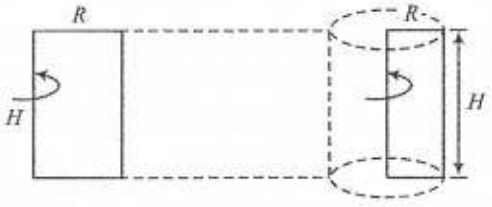
$$DE = EF = DF = \frac{BC}{2}$$

[This is the front view of a tetrahedron]

19. **(b)**

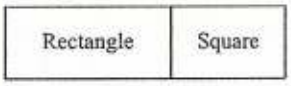


20. **(d)**



21. **(b)** When we extrude a rectangle, a cuboid will be generated.

22. **(a)** The top view will have 1 rectangle joined with a square.

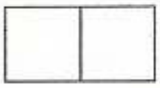


23. **(b)** Number of squares in front view = 3

Number of squares in top view = 3

$\therefore\ x + y = (3 + 3) = 6$

24. **(c)** Top view :



Number of edges = 7

25. **(c)** When 2 cubes are joined, then the number of edges will be

$$= (12 + 12) - (4) = 20$$

When 1st cube is joined to the two cubes in desired manner then no. of edges

$$= (20 + 12) - (4) = 28$$

$\because$ cubes are of same dimensions.

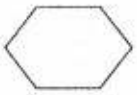
26. **(b)** After joining of 2 cubes, a cuboid will be formed,

$\therefore$ No. of vertices = 8

After final joining, no. of vertices

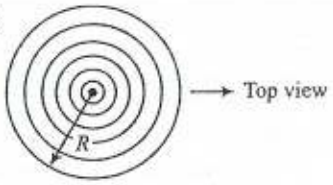
$$= 8 + 4 = 12$$

27. **(b)**



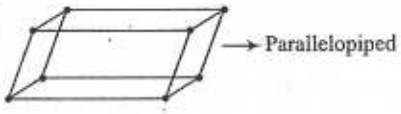
no. of edges = 6

28. **(b)**

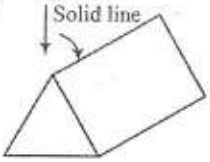


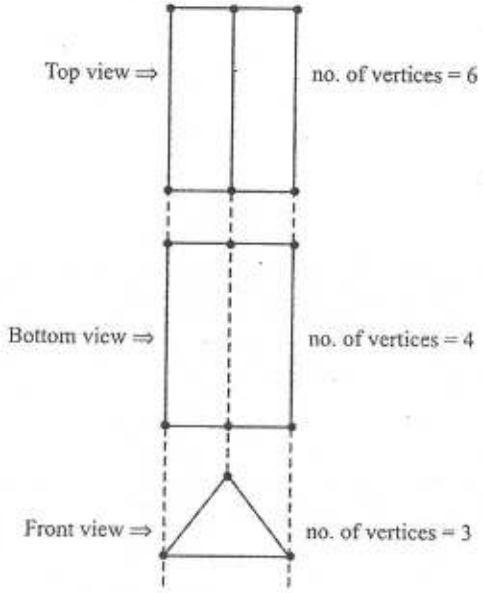
The top view of a cone contains circles with radii varying from zero to R, in radial directions (same centre)

29. **(b)**



30. **(c)** Top view
Solid line





∴ Required no. of vertices = (3 + 6) – (4) = 5.

∵ Top view has solid line, but the solid line will be invisible in bottom view.

∴ Top view has 6 vertices and bottom view has 4 vertices.

12. Data Handling

Multiple Choice Questions

1. From a well shuffled deck of deck of 52 cards, one card is drawn at random. What is the probability that the card drawn is a diamond?

   (a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{13}$

2. A bag contains 4 red balls, 5 green balls and 7 black balls. They are mixed thoroughly and one ball is drawn at random. What is the probability of getting a black ball?

   (a) $\frac{7}{16}$ (b) $\frac{5}{16}$ (c) $\frac{1}{4}$ (d) $\frac{1}{16}$

3. The following data shows the agricultural production in India during a certain year.

Foodgrains	Rice	Wheat	Pulses	Maize
Production in million of tons	57	76	19	38

   What is the central angle for Rice in a pie chart?

   (a) 120° (b) 108° (c) 90° (d) 144°

4. The electricity bill in Rupees of 25 houses of a certain locality for a month are given below. 472, 763, 312, 630, 584, 324, 700, 617, 754, 776, 596, 745, 565, 780, 378, 570, 685, 400, 356, 365, 435, 506, 548, 736.
   Arrange the data in increasing order and find the frequency of the group 7000-800.

   (a) 3 (b) 4 (c) 5 (d) 7

5. The monthly income of a family is ₹ 14, 400 and the central angle for the rent on a pie chart is 100°. What amount shows the rent?

   (a) ₹ 5400 (b) ₹ 1800
   (c) ₹ 4000 (d) ₹ 3600

6. In a pie-chart for expenditure in percent incurred in the construction of a house in a city, the central angle for cement is 72°. What is the percentage of cement expenditures ?

   (a) 15% (b) 20%
   (c) 25% (d) 30%

7. In a lottery there are 10 prizes and 20 blanks. A ticket is chosen at random. What is the probability of not getting a prize?

   (a) $\frac{1}{2}$ (b) $\frac{2}{3}$ (c) $\frac{3}{13}$ (d) $\frac{1}{13}$

8. From a well shuffled deck of 2 cards, one card is drawn at random. What is probability of getting a red card?

   (a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) $\frac{3}{13}$ (d) $\frac{1}{13}$

9. In a box of 100 electric bulbs, 8 bulbs are defective. One bulb is taken out at random from the box. What is the probability that the bulb drawn is not defective?

   (a) $\frac{2}{25}$ (b) $\frac{1}{4}$ (c) $\frac{23}{25}$ (d) $\frac{1}{25}$

10. One card is drawn at random from a well shuffled deck of 52 cards. What is the probability that the card drawn is a queen?

    (a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{1}{13}$ (d) $\frac{2}{13}$

11. A die is thrown. What is the probability of getting 6?

    (a) 1 (b) $\frac{1}{2}$
    (c) $\frac{1}{4}$ (d) $\frac{1}{6}$

12. From a well shuffled deck of 52 cards. One card is drawn at random. What is the probability of getting a card of black 6?

(a) $\frac{1}{26}$ (b) $\frac{1}{52}$ (c) $\frac{1}{13}$ (d) $\frac{3}{26}$

13. The ages of 50 members of the Junior cricket club in a town are as given below. 15, 17, 14, 13, 14, 13, 14, 17, 17, 16, 17, 16, 15, 16, 15, 14, 13, 14, 15, 13, 18, 13, 15, 14, 15, 13, 14, 13, 13, 17, 15, 14, 14, 17, 16, 17, 15, 14, 17, 16, 16, 16, 14, 16, 13, 18, 16, 15, 14, 14.

What percentage of members is in the 15-16 age group?

(a) 28% (b) 30% (c) 32% (d) 36%

14. The pie-chart represents the amount spent on different sports by a sport club in a year. If the total money spent by the club is ₹ 10,800. Find the amount spent on cricket.

(a) 3000 (b) 4500 (c) 5000 (d) 6000

15. Mohan spends 40% of his monthly income on food items, 20% on house rent and 30% on miscellaneous items. He saves 10% of his income every month. What is the central angle for house rent on pie-chart?

(a) 144° (b) 36° (c) 72° (d) 108°

16. One of letters from the word PHYSICS is chosen at random. What is the probability that this letter is S?

(a) $\frac{1}{7}$ (b) $\frac{2}{7}$

(c) $\frac{3}{7}$ (d) None of these

17. One of letters form the word "MOVEMENT" is chosen at random. What is the probability that this letter is M?

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) $\frac{2}{7}$ (d) $\frac{1}{8}$

18. An 8-faced fair dice with numbers 1 to 8 is rolled. What is the probability of getting an even number?

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) $\frac{1}{6}$

19. A survey of 400 family of a town was conducted to find out how many children are there in a family?

No. of Children.	0	1	2	3	4	5
No. of family	56	82	123	95	18	26

What is the probability That a family has 3 children.

(a) $\frac{19}{80}$ (b) $\frac{19}{400}$

(c) $\frac{3}{95}$ (d) None of these

Answer Key

1. (c)	2. (a)	3. (b)	4. (d)	5. (c)	6. (b)	7. (b)	8. (a)	9. (c)	10. (c)
11. (d)	12. (a)	13. (d)	14. (b)	15. (c)	16. (b)	17. (b)	18. (a)	19. (a)	

Hints and Solutions

1. **(c)** Total number of all possible outcomes = 52

No. of diamonds = 13

P(getting a diamond) = $\frac{13}{52} = \frac{1}{4}$

2. **(a)** Total number of balls = 4 + 5 + 7 = 16

Number of black balls = 7

P(getting a black ball) = $\frac{7}{16}$

3. **(b)** Total production $= 57 + 76 + 19 + 38$
$= 190$

Central angle for rice $= \frac{57}{190} \times 360$
$= \frac{3}{10} \times 360 = 108°$

4. **(d)**

Amount of bill (₹)	300-400	400-500	500-600	600-700	700-800
Frequency	5	3	6	4	7

Frequency of the group $= 700 - 800 = 7$

5. **(c)** Central angle
$= \frac{\text{Value of componeent}}{\text{Total value}} \times 360°$

$\Rightarrow \quad 100° = \frac{x}{14400} \times 360$

$\Rightarrow \quad x = \frac{100 \times 14400}{360} = ₹4000$

6. **(b)** Percentage of cement $= \frac{72°}{360°} \times 100$
$= 20\%$

7. **(b)** Tota no. of tickets $= 10 + 20 = 30$
No. of blank tickets $= 20$

P(not getting a prize) $= \frac{20}{30} = \frac{2}{3}$

8. **(a)** Total no. of possible outcomes $= 52$
Number of red cards $= 26$.

P(getting a red card) $= \frac{26}{52} = \frac{1}{2}$

9. **(c)** Total no. of electric bulbs $= 100$
No. of defective bulbs $= 8$
No. of bulbs which are defective $= 100 - 8$
$= 92$

P(getting bulb is not defective) $= \frac{92}{100} = \frac{23}{25}$

10. **(c)** Total no. of possible outcomes $= 52$
No. of queen $= 4$.

P(getting a queen) $= \frac{4}{52} = \frac{1}{13}$

11. **(d)** Total no. of possible outcomes $= 6$

P(getting 6) $= \frac{1}{6}$

12. **(a)** Total no. of possible outcomes $= 52$

No. of black 6 card $= \frac{2}{52} = \frac{1}{26}$

13. **(d)**

Age	13-14	15-16	17-18
No. of members	22	18	10

Percentage of members of 15-16 age group
$= \frac{18}{50} \times 100 = 36\%$

14. **(b)** Amount spent on cricket $= \frac{150°}{360°} \times 10800$
$= ₹4500$

15. **(c)** Central angle for house rent $= \frac{20}{100} \times 360$
$= 72°$

16. **(b)** Total no. of letters $= 7$
no. of letter $S = 2$

Probability that this letter is $S = \frac{2}{7}$

17. **(b)** Total no. of letters $= 8$
No. of letter M $= 2$

P(getting a letter M) $= \frac{2}{8} = \frac{1}{4}$

18. **(a)** Total no. of possible outcomes $= 8$
Total no. of even numbers $= 4$

P(getting an even number) $= \frac{4}{8} = \frac{1}{2}$

19. **(a)** Total no. of family $= 400$
No. of family having 3 children $= 95$

P (family having 3 children) $= \frac{95}{400} = \frac{19}{80}$

13. Direct and Inverse Variations

Direct Variation

Two quantities a and b are said to be in direct variation, if whenever the value of a increasing or decreasing then the value of b increases or decreases in a manner that their ratio $\frac{a}{b}$ remains constant.

$$\frac{a}{b} = \text{constant}$$

Hence $$\frac{a_1}{b_1} = \frac{a_2}{b_2} = \frac{a_3}{b_3} = \ldots\ldots\ldots = \text{Constant}$$

Example 1: If P and Q are directly proportional then find the value of P_1 and Q_1.

P	8	P_1	14
Q	96	36	Q_1

Solution: Here $\frac{8}{96} = \frac{P_1}{36} \Rightarrow P_1 = \frac{8 \times 36}{96} = 3$

Then $\frac{8}{96} = \frac{14}{Q_1} \Rightarrow Q_1 = \frac{14 \times 96}{8} = 168$

Example 2: A train is moving at a uniform speed of 90 km/hr. In how much time will it cover a distance of 270 km?

Solution: If x is required time then

Distance (km)	90	270
Time (hour)	1	x

It is case of direct variation.

$\therefore$ $$\frac{90}{1} = \frac{270}{x} \Rightarrow x = \frac{270}{90} = 3 \text{ hours.}$$

Example 3: A bus covers 680 km in 51 litres of diesel. How much distance would it cover in 30 litres of diesel ?

Solution: If x is required distance then

Distance (km)	680	x
Diesel (litre)	51	30

It is the case of direct variation.

$\therefore$ $\frac{680}{51} = \frac{x}{30}$

$\Rightarrow$ $51 \times x = 680 \times 30$

$\Rightarrow$ $x = \frac{680 \times 30}{51}$

$\Rightarrow$ $x = 400$ km

Example 4: Sohan walks at the uniform rate of 12 km/hr. What distance would be cover in 2 hours 15 minutes?

Solution: If x is required distance then

Distance (km)	12	x
Time (Minute)	60	135

It is the case of direct variation.

$$\therefore \quad \frac{12}{60} = \frac{x}{135}$$

$$\Rightarrow \quad 60 \times x = 12 \times 135$$

$$\Rightarrow \quad x = \frac{12 \times 135}{60} = 27 \text{ km.}$$

Inverse Variation

Two variables a and b are said to be in inverse proportion if $ab = k$

where k is a constant

So, $a_1 b_1 = a_2 b_2 = a_3 b_3 = \ldots\ldots = k$

Example 5: If L and M are inversely proportional then find the value of L_1 and M_1?

L	16	L_1	48
M	946	12	M_1

Solution: Here $16 \times 6 = L_1 \times 12$

$$\Rightarrow \quad L_1 = \frac{16 \times 6}{12} = 8$$

and $$16 \times 6 = 48 \times M_1$$

$$\Rightarrow \quad M_1 = \frac{16 \times 6}{48} = 2$$

Example 6: If 12 men can do a work in 9 days then how many men can do it in 4 days?

Solution: If x is required no. of men then

No. of men	12	x
No. of days	9	4

It is the case of inverse variation.

$$\therefore \quad 12 \times 9 = x \times 4$$

$$\Rightarrow \quad x = \frac{12 \times 9}{4} = 27 \text{ men}$$

Example 7: A train is running at 72 km/hr. If it crosses a pole in 25 seconds. What is its length?

Solution: Here 72 km/hour $= 72 \times \frac{5}{18} = 20$ m/sec

Now if x is the length of train then

Distance (m)	20	x
Time (seconds)	1	25

It is the case of direct variation.

$$\therefore \quad \frac{20}{1} = \frac{x}{25}$$

$$\Rightarrow \quad x = 20 \times 25 = 300 \text{ m.}$$

Example 8: 6 taps of equal capacity can fill a tank in 45 minutes. How many taps can fill in 15 minutes?

Solution: If x is required no. of taps, then

No. of taps	6	x
Time (minutes)	45	15

It is the case of inverse variation.

$$6 \times 45 = x \times 15$$

$$\Rightarrow \quad x = \frac{6 \times 45}{15} = 18 \text{ taps}$$

Multiple Choice Questions

1. A train is running at 36 km/hour. If it crosses a pole in 25 seconds, then what is its length?
   (a) 250 m (b) 225 m (c) 275 m (d) 300 m
2. A garrison of 1500 men had provision for 38 days. However a reinforcement of 400 men arrived. For how many days will the provision last?
   (a) 28 days (b) 30 days
   (c) 32 days (d) 34 days
3. Manish can pack 260 bundles in 5 days. How many bundles can be pack in 7 days?
   (a) 264 (b) 364 (c) 384 (d) 324
4. A worker is paid ₹ 280 for 8 days work. If the total income of the month is ₹ 945. For how many days does he work?
   (a) 25 days (b) 26 days
   (c) 27 days (d) 28 days
5. A bus is travelling at an average speed of 56 km/hour. How much distance it will travel in 15 minutes?
   (a) 14 km (b) 12 km (c) 13 km (d) 16 km
6. In 15 days, the earth picks up 1.2×10^8 kg of dust from the atmosphere. In how many days will it pick up 4.8×10^8 kg of dust?
   (a) 40 days (b) 50 days
   (c) 30 days (d) 60 days
7. If L and M vary inversely. When L is 10, M is 6. Which of the following is not a possible pair of corresponding values of L and M?
   (a) 12 and 5 (b) 15 and 4
   (c) 45 and 1.3 (d) 25 and 2.4
8. If 28 persons can do a piece of work in 65 days. How many persons will do it in 35 days?
   (a) 48 (b) 46 (c) 52 (d) 56
9. A 270 m long train is running at 81 km/hr. How much time will it take to cross a 225 m long platform?
   (a)18 sec (b) 21 sec (c) 22 sec (d) 24 sec
10. By working 8 hours a day Ankur can copy a book in 18 days. How many hours a day should he work so as to finish the work in 12 days?
    (a) 10 hours (b) 12 hours
    (c) 14 hours (d) 16 hours
11. If 6 men can do a job in 8 days. In how many days can 8 men do it?
    (a) 4 days (b) 5 days (c) 6 days (d) 8 days
12. A factory requires 42 machines to produce a given number of articles in 56 days. How many machines would be required to produce the same number of articles in 48 days?
    (a) 40 (b) 46 (c) 48 (d) 49

13. A photograph of a bacteria enlarged 70000 times attains a length of 7 cm. What is the actual length of the bacteria?
(a) 10^3cm (9) 10^{-3}cm
(c) 10^{-2}cm (d) 10^{-4}cm

14. If 5 men or 7 women can earn ₹ 1372 per day. How much would 10 men and 5 women earn per day?
(a) ₹ 3724 (b) ₹ 3624
(c) ₹ 3524 (d) ₹ 3124

15. 11 persons can dig $6\frac{3}{4}$ m long trench in one day. How many men should be employed for digging 27 m trench of the same type in one day?
(a) 42 men (b) 43 men
(c) 44 men (d) 46 men

16. The scale of a map is $1:3 \times 10^7$. Two cities are 5cm apart on the map. What is the actual distance between them in kilometer ?
(a) 1000 km (b) 1200 km
(c) 1500 km (d) None of these

17. A loaded truck covers 18 km in 35 minutes. At the same speed how for can it travel in 7 hours?
(a) 196 km (b) 216 km
(c) 212 km (d) 192 km

18. 6 cows can graze a field in 28 days. How long would 21 cows take to graze the same field?
(a) 6 days (b) 8 days
(c) 7 days (d) 12 days

19. A car is travelling at a uniform speed of 84 km/hr. How much distance will it cover in 15 minutes?
(a) 16 km (b) 18 km
(c) 19 km (d) 21 km

20. Ranjna types 510 words in half an hour. How many words would she type in 10 minutes?
(a) 153 (b) 150
(c) 170 (d) 85

21. 14 workers can build a wall in 42 days. In how many days 21 workers can build?
(a) 21 days (b) 28 days
(c) 14 days (d) 7 days

22. A can do a piece of work in 25 days and B can finish it in 20 days. They work together for 5 days and then A leaves. In how many days will B finish the remaining work?
(a) 8 days (b) 10 days
(c) 11 days (d) None of these

23. Amar, Rajesh and Mohan can do a piece of work in 10 days, 12 days and 15 days respectively. How long will it take to finish it if they work together ?
(a) 5 days (b) 4 days
(c) 6 days (d) 3 days

24. A pipe can fill a cistern in 9 hours. Due to a leak in its bottom, the cistern fills up in 10 hours, If the cistern is full, in how much time will it be emptied by the leak?
(a) 60 hours (b) 70 hours
(c) 80 hours (d) 90 hours

Answer Key

1. (a)	2. (b)	3. (b)	4. (c)	5. (a)	6. (d)	7. (c)	8. (c)	9. (c)	10. (b)
11. (c)	12. (d)	13. (d)	14. (a)	15. (c)	16. (c)	17. (b)	18. (b)	19. (d)	20. (c)
21. (b)	22. (c)	23. (b)	24. (d)						

Hints and Solutions

1. **(a)** Speed of train = 36 km/hour

$$= 36 \times \frac{5}{18} = 10 \text{ m/sec}$$

$\therefore$ Length of train = $10 \times 25 = 250$ m.

2. **(b)** If x is required no. of days then

Number of men	Number of days
1500	38
1900	x

$$\frac{1500}{1900} = \frac{x}{38}$$

$$\Rightarrow \quad x = \frac{1500 \times 38}{1900} = 30 \text{ days}$$

3. **(b)** If x is bundles can be pack in 7 days then

No. of bundles	No. of days
260	5
x	7

$$\frac{260}{x} = \frac{5}{7} \Rightarrow x = \frac{260 \times 7}{5} = 364$$

4. Let x be required no. of days then

Wages	No. of days
280	8
945	x

$$\frac{8}{x} = \frac{280}{945} \Rightarrow x = \frac{8 \times 945}{280}$$

$$\Rightarrow \quad x = 27 \text{ days}$$

5. **(a)** If x is required distance then

Distance	Time (min)
56	60
x	15

$$\frac{56}{x} = \frac{60}{15} \Rightarrow x = \frac{15 \times 56}{60} = 14 \text{ km}$$

6. **(d)** If x is required no. of days then

No. of days	Mass of dust
15	1.2×10^8
x	4.8×10^8

$$\frac{15}{x} = \frac{1.2 \times 10^8}{4.8 \times 10^8}$$

$$\Rightarrow \quad x = \frac{4.8 \times 10^8 \times 15}{1.2 \times 10^8}$$

$$\Rightarrow \quad x = 60 \text{ days.}$$

7. **(c)** Given

L	M
10	6

$\therefore$

$$\frac{10}{12} = \frac{5}{6}$$

$$\frac{10}{15} = \frac{4}{6}$$

$$\frac{10}{45} \neq \frac{1.3}{6}$$

$$\frac{10}{25} = \frac{2.4}{6}$$

8. **(c)** If x is required persons then

No. of persons	No. of days
28	65
x	35

It is the case of inverse variation.

$$\therefore \quad \frac{28}{x} = \frac{35}{65} \Rightarrow x = \frac{28 \times 65}{35} = 52$$

9. **(c)** Here Speed of train = 81 km/hour

$$= 81 \times \frac{5}{18} = \frac{45}{2} \text{ m/s}$$

Distance covered = 270 + 225 = 495m.

$$\text{Time taken by train} = \frac{495}{\frac{45}{2}} = \frac{495 \times 2}{45} = 22 \text{ sec}$$

10. **(b)** If x is required time then

No. of days	No. of hours
18	8
12	x

$$\therefore \quad \frac{18}{12} = \frac{x}{8} \Rightarrow x = \frac{18 \times 8}{12} = 12 \text{ hours}$$

11. **(c)** If x is required days then

No. of Men	No. of days
6	8
8	x

$$\frac{6}{8}=\frac{x}{8}\Rightarrow x=\frac{8\times 6}{8}=6 \text{ days}$$

12. **(d)** If x required machines then

No. of machines	No. of days
42	56
x	48

$$\frac{42}{x}=\frac{48}{56}\Rightarrow x=\frac{42\times 56}{48}=49 \text{ machiens}$$

13. **(d)** Here actual length of bacteria $=\frac{7}{70000}$

$$=\frac{1}{10000}=10^{-4}\text{ cm}$$

14. **(a)** Given 5 men = 7 women

$$\therefore \quad 1 \text{ men}=\frac{7}{5} \text{ women}$$

Now $\quad 10 \text{ men}=\frac{7}{5}\times 10=14 \text{ women}$

If x is required money then

No. of women	Earning (₹)
7	1372
19	x

$$\frac{7}{19}=\frac{1372}{x}\Rightarrow x=\frac{137\times 19}{7}$$

$$\Rightarrow \quad x=₹\ 3724$$

15. **(c)** If x is required men then

Length	No. of persons
$\frac{27}{4}$ m	11
27 m	x

$$\frac{\frac{27}{4}}{27}=\frac{11}{x}$$

$$\Rightarrow \quad x=\frac{27\times 11\times 4}{27}=44 \text{ men}$$

16. **(c)** If x is actual distance then

Distance on map (cm)	1	5
Actual distance (cm)	3×10^7	x

$$x=\frac{5\times 3\times 10^7}{100\times 1000}\text{ km}=1500\text{ km}$$

17. **(b)** If x is required distance then

Time (Sec)	Distance
$\frac{35}{60}$	18
7	x

$$\frac{\frac{35}{60}}{7}=\frac{18}{x}\Rightarrow x=\frac{18\times 7\times 60}{35}$$

$$\Rightarrow \quad x=216\text{ km}$$

18. **(b)** If x is required no. of days then

No. of cows	No. of days
6	28
21	x

It is the case of inverse variation.

$$\Rightarrow \quad \frac{6}{21}=\frac{x}{28}\Rightarrow x=\frac{28\times 6}{21}=8 \text{ days}$$

19. **(d)**

Time (min)	Distance (km)
60	84
15	x

$$\therefore \quad \frac{60}{15}=\frac{84}{x}\Rightarrow x=\frac{84\times 15}{60}=21\text{ km}$$

20. **(c)** If x is required words then

Time (min)	No. of words
30	510
10	x

$$\frac{30}{10}=\frac{510}{x}$$

$$\Rightarrow \quad x=\frac{510\times 10}{30}=170 \text{ words}$$

21. **(b)** If x is required days then

No. of workers	No. of days
14	42
21	x

It is case of inverse variation.

$$\therefore \quad \frac{14}{21}=\frac{x}{42} \Rightarrow x=\frac{14\times 42}{21}=28 \text{ days}$$

22. **(c)** In 1 day A + B can do $\left(\frac{1}{25}+\frac{1}{20}\right)$ part of work.

$$=\frac{4+5}{100}=\frac{9}{100}$$

In 5 days A + B can do $\frac{9\times 5}{100}$ part of work.

$$=\frac{9}{20} \text{ part of work}$$

$$\text{Remaining part} = 1-\frac{9}{20}=\frac{11}{20}$$

B can finish the remaining work in $\frac{11}{20}\times 20$

$$= 11 \text{ days}$$

23. **(b)** In one day Amar + Rajesh + Mohan can do

$$\frac{1}{10}+\frac{1}{12}+\frac{1}{15}=\frac{6+5+4}{60}$$

$$=\frac{15}{60}=\frac{1}{4}$$

So, they can finish the work in 4 days if they work together.

24. **(d)** Here $\frac{1}{9}-\frac{1}{10}=\frac{10-9}{90}=\frac{1}{90}$

So, cistern will implied by the leak in 90 hours.

High Order Thinking Skills

Mathematics

1. The area of the base of a cone is 180 cm^2. If the height of the cone is 8 cm what is its volume?
   (a) 480 cm^3 (b) 1440 cm^3
   (c) 6188 cm^3 (d) 22.5 cm^3
2. The difference between the S.I. and C.I. on ₹ 2500 for 2 years at 20% when the compound interest is payable annually is
   (a) ₹ 50 (b) ₹ 70 (c) ₹ 100 (d) ₹ 200
3. Umesh tossed a coin three times. What is the probability that Umesh gets more heads than tails?
   (a) 0.5 (b) 0.125
   (c) 0.375 (d) None of these
4. If 28 men can do a piece of work in 65 days. How many men will do it in 35 days?
   (a) 48 men (b) 52 men
   (c) 56 men (d) 62 men
5. In 10 days earth picks up 2.6×10^8 kg of dust from the atmosphere. How much dusk will it pick up in 45 days?
   (a) 1.17×10^9 (b) 1.17×10^7
   (c) 1.17×10^5 (d) 1.17×10^4
6. One of the factor of $x^2 + 6\sqrt{3}\,x - 48$ is $(x - 2\sqrt{3})$. What is the other factor ?
   (a) $x + 8\sqrt{3}$ (b) $x - 8\sqrt{3}$
   (c) $x + 6\sqrt{3}$ (d) $x - 6\sqrt{3}$
7. Two octagonal perfect dice with number 1 – 8 are thrown together. What is the probability that both the numbers are even ?
   (a) $\frac{1}{4}$ (b) $\frac{1}{32}$ (c) $\frac{7}{64}$ (d) $\frac{1}{2}$
8. In what time will ₹ 64,000 amount to ₹ 68921 at 5% per annum if interest payable half yearly?
   (a) 1.5 years (b) 2.5 years
   (c) 2 years (d) 3.5 years
9. A mobile set is sold for ₹ 1498 and the seller gains 7% on it. What is its cost price?
   (a) 1200 (b) 1400
   (c) 1440 (d) 1460
10. The sum of digits of a two-digit number is 9. If 9 is subtracted from the number, its digits are interchanged.
    What is the half of that number?
    (a) 26 (b) 27 (c) 28 (d) 29
11. What is the value of x if
    $$\frac{(9x+3)(7-2x)}{(x+4)(5-x)} = 2$$
    (a) 17 (b) – 17 (c) 19 (d) – 19
12. The curved surface area of the cylinder is 5940 cm^2. If its height is 30 cm, what is the diameter of the base?
    (a) 36 cm (b) 198 cm
    (c) 31.5 cm (d) 63 m
13. A cuboid vessel is 20 cm long and 12 cm wide. How high must it be to bold 3 liters of water?
    (a) 12.5 cm (b) 12 cm
    (c) 14 cm (d) 4.5 cm
14. What is the value of $\frac{x^0 - y^0}{x^0 + y^0}$?
    (a) 0 (b) 1 (c) 2 (d) – 1
15. The square root of 0.0004 is
    (a) 0.2 (b) 0.02
    (c) 0.002 (d) None of these
16. What is the value of $\sqrt{\frac{1.21 \times 0.9}{1.1 \times 0.11}}$?
    (a) 2 (b) 3 (c) 9 (d) 11

17. $9x^2 + 25 - 30x$ is the square of
(a) $3x - 5$ (b) $-3x - 5$
(c) $3x + 5$ (d) $-3x^2 + 5$

17. One of the factor of $x^2 + 17x + 60$ is
(a) $x + 12$ (b) $x - 5$
(c) $5x - 1$ (d) $x - 12$

19. The perimeter of a rectangle is 54 cm. If its width is 2 cm more than one-fourth of its length. What is its length?
(a) 12 cm (b) 16 cm
(c) 20 cm (d) 24 cm

20. One of the letters from the word SOCIOLOGY is chosen at random. What is the probability that this letter is O?
(a) $\frac{1}{3}$ (b) $\frac{1}{6}$
(c) $\frac{1}{9}$ (d) None of these

21. What is the value of $\frac{\sqrt{0.2401} - \sqrt{0.1681}}{\sqrt{0.2401} + \sqrt{0.1681}}$?
(a) $\frac{2}{45}$ (b) $\frac{4}{45}$ (c) $\frac{8}{45}$ (d) $\frac{16}{45}$

22. The product of two numbers is 1575 and their quotient is $\frac{9}{7}$. What is the difference of the numbers?
(a) 5 (b) 10 (c) 15 (d) 20

23. The diagonal of a square is $4\sqrt{2}$ m. What is its perimeter?
(a) 12 m (b) 16 m
(c) 24 m (d) None of these

24. What is the simplified value of
$$\frac{1}{3} + \left[\frac{4}{9} + \left(\frac{-8}{13}\right)\right] \times \frac{169}{2}?$$
(a) $\frac{-26}{9}$ (b) -2
(c) $\frac{-23}{9}$ (d) $\frac{-26}{3}$

25. A well with internal diameter 8m is dug 7m deep. The earth taken out of it is spread at around to a width of 2 m to form an embankment. The height of embankment will be :
(a) 1.4 m (b) 2.8 m (c) 4.2 m (d) 5.6 m

Answer Key

1. (a)	2. (c)	3. (a)	4. (b)	5. (a)	6. (a)	7. (c)	8. (b)	9. (b)	10. (b)
11. (d)	12. (d)	13. (a)	14. (a)	15. (b)	16. (b)	17. (a)	18. (a)	19. (c)	20. (a)
21. (b)	22. (b)	23. (b)	24. (c)	25. (d)					

Hints and Solutions

1. **(a)** Area of base $= 180\ \text{cm}^2$
$$\pi r^2 = 180$$
$$\text{Volume of cone} = \frac{1}{3}\pi r^2 h$$
$$= \frac{1}{3} \times 180 \times 8 = 480\ \text{cm}^3$$

2. **(c)** S.I. $= \frac{2500 \times 2 \times 20}{100} = 1000$
$$A = 2500\left(1 + \frac{20}{100}\right)^2$$
$$= 2500\left(\frac{6}{5}\right)^2 = 2500 \times \frac{36}{25} = 3600$$
C.I. $= 3600 - 2500 = ₹\ 1100$
Difference $=$ C.I. $-$ SI
$= 1100 - 1000 = ₹\ 100$

3. **(a)** Probability of getting 2 or 3 heads
$$= \frac{3}{8} + \frac{1}{8} = \frac{1}{2} = 0.5$$

4. **(b)** $\frac{65 \times 28}{35} = 52$ men

5. **(a)** $\frac{2.6\times10^8\times45}{10}=117\times10^7=1.17\times10^9$

6. **(a)** $x^2+6\sqrt{3}\,x-48$

$=x^2+8\sqrt{3}x-2\sqrt{3}x-48$

$=x(x+8\sqrt{3})-2\sqrt{3}\,(x+8\sqrt{3})$

$=(x+8\sqrt{3})\,(x-2\sqrt{3})$

7. **(a)** Total no. of outcomes $=8\times8=64$

Both numbers are even,

{(2,2) (2, 6) (2, 8) (2, 4) (4,2) (4, 4), (4, 6) (4, 8), (6, 2), (6, 4) (6, 6), (6, 8) (8, 2) (8, 4) (8, 6), (8, 8)}.

Required probability $=\frac{16}{64}=\frac{1}{4}$

8. $P=₹\,64000$

$A=₹\,68921.$

$r=\frac{5}{2}\%$

$A=P\left(1+\frac{r}{100}\right)^n$

$\Rightarrow \quad 68921=64000\left(1+\frac{5}{200}\right)^n$

$\Rightarrow \quad \frac{68921}{64000}=\left(\frac{41}{40}\right)^n$

$\Rightarrow \quad \left(\frac{41}{40}\right)^n=\left(\frac{41}{40}\right)^n$

$\Rightarrow \quad n=3$

$\therefore$ Time $=\frac{3}{2}=1.5$ years

9. **(b)** Let cost price be ₹ x.

$x+7\%$ of $x=1498$

$\Rightarrow \quad x+\frac{7x}{100}=1498$

$\Rightarrow \quad 107x=1498\times100$

$\Rightarrow \quad x=\frac{1498\times100}{107}=1400$

10. **(b)** Let unit's digit $=x$.

10's digit $=(9-x)$

Number $=10(9-x)+1\times x$

$=90-10x+x=90-9x$

$=90-9x-9$

$=10x+1(9-x)$

$81-9x=10x+9-x=9x+9$

$9x+9x=81-9$

$\Rightarrow \quad 18x=72\Rightarrow x=\frac{72}{18}=4$

Number $=90-9\times4$

$=90-36=54.$

Half $=\frac{54}{2}=27$

11. **(d)** $\frac{(x+3)\,(7-2x)}{(x+4)\,(5-x)}=2$

$\Rightarrow \quad (x+3)\,(7-2x)=2\,(x+4)\,(5-x)$

$\Rightarrow 7x-2x^2+21-6x=2(5x-x^2+20-4x)$

$\Rightarrow \quad x+21=2x+40$

$\Rightarrow \quad x=21-40=-19$

12. **(d)** Curved surface area $=5940$

$\Rightarrow \quad 2\pi rh=5940$

$\Rightarrow \quad 2\times\frac{22}{7}\times r\times30=5940$

$\Rightarrow \quad 2r=\frac{5940\times7}{2\times22\times30}=63$ m

13. **(a)** $lbh=3000$

$\Rightarrow \quad 20\times12\times h=3000$

$\Rightarrow \quad h=\frac{3000}{20\times12}=12.5$ cm

14. **(a)** $\frac{x^0-y^0}{x^0+y^0}=\frac{1-1}{1+1}=\frac{0}{2}=0$

15. **(b)** $\sqrt{0.0004}=0.02$

16. **(b)** $\sqrt{\frac{\frac{121}{100}\times\frac{9}{10}}{\frac{11}{10}\times\frac{11}{10}}}=\sqrt{\frac{121\times9}{11\times11}}=3$

17. **(a)** $9x^2 + 25 - 30x$
$= (3x)^2 + (5)^2 - 2(3x)(5)$
$= (3x - 5)^2$

18. **(a)** $x^2 + 17x + 60$
$= x^2 + 5x + 12x + 60$
$= x(x+5) + 12(x+5)$
$= (x+5)(x+12)$

19. Let the length be x.
Width $= \frac{x}{4} + 2 = \frac{x+8}{4}$
Perimeter of rectangle $= 54$
$\Rightarrow \quad 2\left(x + \frac{x+8}{4}\right) = 54$
$\Rightarrow \quad 2\left(\frac{4x + x + 8}{4}\right) = 54$
$\Rightarrow 5x + 8 = 108 \Rightarrow 5x = 100$
$\Rightarrow \quad x = 20$ cm.

20. **(a)** Total number of letters $= 9$
Number of letter 'O' $= 3$
Required probability $= \frac{3}{9} = \frac{1}{3}$

21. **(b)** $\frac{\sqrt{0.2401} - \sqrt{0.1681}}{\sqrt{0.2401} + \sqrt{0.1681}}$
$\frac{49 - 41}{49 + 41} = \frac{8}{90} = \frac{4}{45}$

22. **(b)** Let the numbers be x and y.
$\therefore xy = 1575$, and, $\frac{x}{y} = \frac{9}{7}$
From, $\frac{x}{y} = \frac{9}{7}, \Rightarrow x = \frac{9y}{7}$
$\therefore \quad \frac{9y}{7} \times y = 1575$
$\Rightarrow y^2 = \frac{1575 \times 7}{9} = 175 \times 7 = 25 \times 7 \times 7$
$\Rightarrow \quad y = 5 \times 7 = 35, x = 45$
$\therefore$ Difference of numbers $= 45 - 35 = 10$

23. **(b)** Area of square $= \frac{1}{2} \times (4\sqrt{2})^2$
$= \frac{1}{2} \times 16 \times 2$
$= 16\ \text{m}^2$
Side $= \sqrt{16} = 4$ m.
Perimeter $= 4 \times 4 = 16$ m.

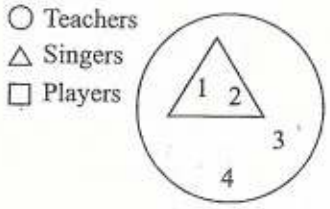
24. **(c)** $\frac{4}{9} - \frac{8}{13} = \frac{52 - 56}{117} = \frac{-4}{117}$
$\frac{-4}{117} \times \frac{169}{2} = \frac{-2 \times 13}{9} = \frac{-26}{9}$
$\frac{-26}{9} + \frac{1}{3} = \frac{-23}{9}$

25. **(d)** Volume of earth dug out
$= \pi\left(\frac{8}{2}\right)^2 \times 7$
$= \frac{22}{7} \times \left(\frac{8}{2}\right)^2 \times 7$
$= \pi \times 16 \times 7$
$= 22 \times 16 = 352\ \text{m}^3$
Area of embankment $= \pi(R^2 - r^2)$
$= \pi(6^2 - 4^2)$
$= \pi(36 - 16) = 20\pi\ \text{m}^3$
Area of embankment $\times$ h = volume of earth dug out.
$\Rightarrow 20\pi \times h = 16 \times 7 \times \pi$
$\Rightarrow \quad h = \frac{16 \times 7}{20} = 5.6$ m

Reasoning

1. If GSJJII stands for COFFEE. How will you write NOODLES?
   (a) RSSHPIW (b) RSSGPHV
   (c) RSSHQJV (d) RSSHPJW

2. Players who are not singers are represent by



   (a) 2 (b) 3 (c) 4 (d) 1

3. Manoj drives 10 km towards east and turns to the right hand and drives 3km then he drives towards west 3km. He then turns to left and drives 2km. Finally he turns to his right and travels 7km. How far is he om his starting point and in which direction would he be?
   (a) 10 km, East (b) 5 km, West
   (c) 8 km, West (d) 5 km, South

4. Find the missing number in fig (*X*)

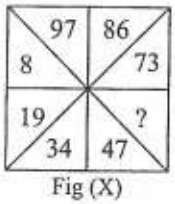


Fig (X)

   (a) 58 (b) 60
   (c) 56 (d) 62

5. Find the odd one out in the following anagrams.
   (a) GNDREA (b) HNOPE
   (c) AOIRD (d) TPSO

6. Find the odd one out in the following anagrams
   (a) HCRIA (b) HEAWT
   (c) SPLUE (d) ZIAME

7. How many such 3's are there in the following number sequence which are immediately preceded by an odd number and immediately followed by an even number?
   5 3 8 9 4 3 7 2 3 8 1 3 8 4 2 3 5 7 3 4 2 3 6
   (a) One (b) Two (c) Three (d) Four

7. How many such 5's are there in the following number sequence which are immediately preceded by an odd number and immediately followed by an even number
   9 3 5 8 6 4 5 3 2 6 1 5 2 7 4 5 3 2
   (a) One (b) Two (c) Three (d) Four

9. The Mishras have three children
   Suman, Sumit and Sangeeta. Suman is married to Sajal Mahajan and they have a son Mohit. Sangeeta marries Sunder Pandey and Preeti and Ankur are their children. Sumit (Suman's brother) is younger to Suman but elder to Sangeeta. What is the surname of Mohit?
   (a) Pandey (b) Sharma
   (c) Mahajan (d) None of these

10. If '×' denotes '>', '÷' denotes '+' 'Δ' denotes '×' '–' denotes '=', > denotes '+', < denotes '–', '=' denotes '<' then which of the following option is correct?
    (a) $9 < 3, 2 > 1 \times 8 \wedge 2$
    (b) $9 > 5 > 4 - 18 + 9 > 16$
    (c) $28 + 4 \wedge 2 = 6 \wedge 4 + 2$
    (d) $13 > 7 < 6 + 2 = 3 \wedge 4$

11. Find out the correct letter pair form the option to denote the same relationship among the group of letters as established between the sets given below.
    RT : WZ :: ..... : .....
    (a) BD : MP (b) AB : PW
    (c) AC : RV (d) FG : SV

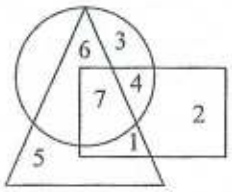
12. In the given series, one term is wrong. Find out the wrong term .
5, 27, 61, 122, 213, 240, 509
(a) 509 (b) 122 (c) 61 (d) 27

13. Ankit ranks seventh from the top and twenty sixth from the bottom in a class. How many students are there in class?
(a) 31 (b) 29 (c) 32 (d) 34

14. In the given series how many pairs of successive numbers have a difference of 2 each?
8 6 1 2 2 8 7 4 2 1 5 3 8 6 2 1 7 1 4 1 3 2 6 4
(a) Four (b) Five (c) Six (d) Seven

15. 6, 13, 25, 61, 101, ?
(a) 201 (b) 202 (c) 203 (d) 205

16. Find out the number that lies inside all the figures

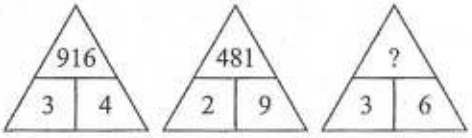


(a) 3 (b) 4 (c) 6 (d) 7

17. If black means pink, pink means blue, blue means white, white means yellow, yellow means red then what is the colour of clear sky ?
(a) Red (b) Pink
(c) Yellow (d) None of these

17. A family consists of six members *I*, *J*, *K*, *L*, *M*, *N*. There are two married couples. *J* is doctor and father of M. N is grand father of *K* and is a teacher. *L* is grand mother of *M* and is a housewife. There is one doctor, one teacher one nurse, one housewife and two students in the family?
Which of the following are two married couples?
(a) *NL, JM* (b) *NL, JI*
(c) *MN, KN* (d) *NL, KI*

20. Find the missing term



(a) 916 (b) 936 (c) 918 (d) 924

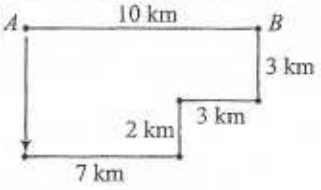
Answer Key

1. (a)	2. (d)	3. (d)	4. (a)	5. (a)	6. (a)	7. (c)	8. (b)	9. (c)	10. (c)
11. (a)	12. (d)	13. (c)	14. (a)	15. (c)	16. (d)	17. (b)	18. (b)	19. (d)	20. (b)

Hints and Solutions

1. **(a)** COFFEE → GSJJII
NOODLES → RSSHPIW

3. **(d)**



$3 + 2 = 5$ km south

5. **(a)** All other are means of communication.

6. **(a)** All others are food grains

7. **(c)** 5 3 8 9 4 3 7 2 3 8 1 3 8 4 2 3 5 7 3 4 2 3 6

8. **(b)** 9 3 5 8 6 4 5 3 2 6 1 5 2 7 4 5 3 2

10. **(c)** $9 > 5 > 4 - 18 + 9 > 16$
$9 + 5 + 4 = 18 \div 9 + 16$
$18 = 2 + 16 \Rightarrow 18 = 18$

13. **(c)** $6 + 1 + 25 = 32$

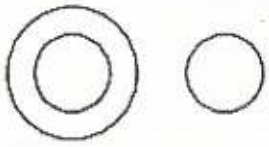
15. **(c)** $6 \times 2 + 1 = 13$, $13 \times 2 - 1 = 25$
$25 \times 2 + 1 = 51$, $51 \times 2 - 1 = 101$
$101 \times 2 + 1 = 203$

20. **(b)** $3^2 = 9$
$6^2 = 36$

Model Paper - 1

Section I: Logical Reasoning

1. Which one of the following sets is best represented by the given diagrams?

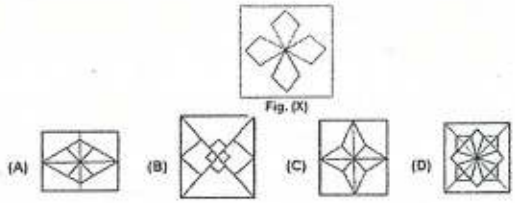


(A) Animals, Insects, Cockroaches
(B) Country, States, Districts
(C) Sun, Planets, Earth
(D) Classroom, Blackboard, School

2. In a certain code TELEPHONE is written as ENOHPELET. How is ALIGATOR written in that code?
(A) ROTAGILA (B) ROTAGAIL
(C) ROTAGILE (D) OTAGILAR

3. In the series 6 4 1 2 2 8 7 4 2 1 5 3 8 6 2 1 7 1 4 1 3 2 8, how many pairs of successive numbers have a difference of 1 each?
(A) Four (B) Five
(C) Six (D) Seven

4. Find amongst the four options the figure which most nearly contains the Fig. (X).



5. Letters of the word given below have been jumbled up. The letters have been numbered and followed by four options. Choose the option which gives the correct order of the letters to form a meaningful word.

I	N	L	A	S	G
1	2	3	4	5	6

(A) 2, 4, 3, 6, 1, 5
(B) 3, 4, 6, 1, 2, 5
(C) 5, 1, 6, 2, 4, 3
(D) 6, 1, 3, 5, 4, 2

Section II: Mathematical Reasoning

6 Father's age is equal to the sum of the ages of his five children. After 15 years, his age will be only half of the sum of the children's ages. How old is the father?
(A) 42 years (B) 43 years
(C) 44 years (D) 45years

7. What is the value of $x^3 + y^3 + z^3 - 3xyz$, when $x = 2$, $y = 1$ and $z = -3$?
(A) 6 (B) 0
(C) 2 (D) - 4

Find the value of:

$$\frac{\sqrt[6]{0.001}\sqrt[6]{x^{1296}}}{\sqrt{10}}$$

(A) $10x$ (B) $\frac{x^3}{10^3}$

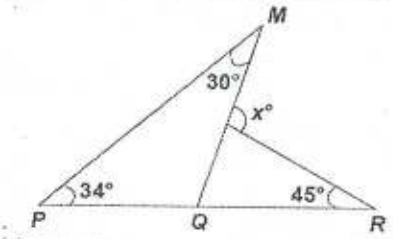
(C) $\frac{x^{36}}{10}$ (D) $\left(\frac{10x}{x^5}\right)^{36}$

8. What is the value of x in the given equation?
$(3x-8)(3x+2)-(4x-11)(2x+1)=(x-3)(x+7)$
(A) 2 (B) 4
(C) 3 (D) 5

9. Last year Mr. Nitin earned Rs. 19600 from the corn he grew on his farm. This year he expects a 7% increase in the income from corn. How much does he expect to earn from corn this year?
(A) Rs. 13720 (B) Rs. 30972
(C) Rs. 10972 (D) Rs. 20972

10. Evaluate:
$\sqrt{10+\sqrt{25+\sqrt{108+\sqrt{154+\sqrt{225}}}}}$
(A) 4 (B) 6
(C) 8 (D) 10

11. What is the measure of x in the given figure?

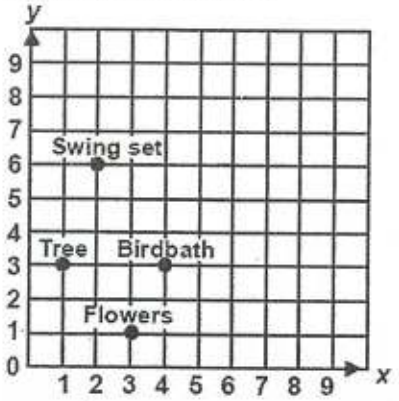


(A) 112° (B) 110°
(C) 109° (D) 107°

12. Write $(3^{-7} \div 3^{-10}) \times 3^{-5}$ in simplest form.
(A) 1/3 (B) 3^2
(C) 3^{-2} (D) 3^4

13. A 2 cm long grasshopper can jump 160 cm. If a 6-metre tall animal had the same height and jump ratio, how far could he jump?
(A) 48 m (B) 480 m
(C) 180 m (D) 8000 m

14. John made the given grid to show some locations in his garden.



15. Which ordered pair best represents the point on the grid labelled "Birdbath"?
(A) (2, 6) (B) (3, 4)
(C) (1, 3) (D) (4, 3)

16. Students at a local college were asked how many hours they slept last night. The given chart shows the data. The probability of the students who slept for 6 hours is ____.

Hours of Sleep	No. of Students
6	14
7	26
8	28
9	15
More than 10	6

(A) 15/89 (B) 6/89
(C) 14/28 (D) 14/89

17. What is the average of the sixth even number, and fifth and eighth odd number after 200?
(A) 210 (B) 211
(C) 212 (D) 213

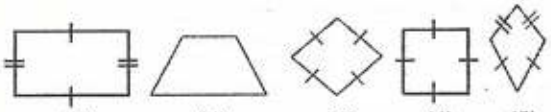
18. Addition of rational numbers does not satisfy which of the following property ?
(A) Commutative (B) Associative
(C) Closure (D) None of these

19. How many cubic metres of earth must be dug out to sink a well 22.5 m deep and of diameter 7 m.
(A) 866.25 m^3 (B) 495 m^3
(C) 77.82 m^3 (D) 748 m^3

20. When a number is divided by 125, the remainder is 82, when the same number is divided by 25, the remainder will be ____.
(A) 8 (B) 9
(C) 6 (D) 7

21. Between which two consecutive whole numbers $\sqrt{2000}$ lies?
(A) 41 and 42 (B) 44 and 45
(C) 43 and 44 (D) 45 and 46

22. Which two quadrilaterals have exactly four lines of symmetry ?



(A) (1) and (5) (B) (3) and (2)
(C) (3) and (4) (D) (2) and (5)

23. In the given figure, if $\angle A = (2x + 10)°$, $\angle B = (x + 20)°$, $\angle C = (y - 50)°$ and $\angle D = (y - 10)°$, the values of x and y are ____.
(A) $x = 30°, y = 20°$
(B) $x = 60°, y = 40°$
(C) $x = 50°, y = 120°$
(D) $x = 70°, y = 90°$

24. The compound interest on a certain sum for 2 years at 10% per annum is Rs.525. The simple interest on the same sum for double the time at half the rate percent per annum is ____.
(A) Rs. 400 (B) Rs. 500
(C) Rs. 600 (D) Rs. 800

25. Factorise : $3 - 12(a - b)^2$
(A) $3(1 + 2a + 2b)(1 - 2a + 2b)$
(B) $3(1 - 2a - 2b)(1 + 2a - 2b)$
(C) $3(1 + 2a - 2b)(1 - 2a + 2b)$
(D) $3(1 - 2a - 2b)(1 - 2a - 2b)$

Section III: Everyday Mathematics

26. A man sold 10 eggs for Rs.5 and gained 20%. How many eggs did he buy for Rs. 5?
(A) 12 (B) 25/12
(C) 25 (D) None of these

27. Mrs. Nysa needs to take a taxi to the doctor's clinic. The taxi ride costs Rs. 15 for the first km and Rs. 8 for each additional km and part thereof. How much does Mrs. Nysa pay for a 3.8 km taxi ride?
(A) Rs. 35 (B) Rs. 28
(C) Rs. 32 (D) Rs. 39

28. Two flower beds in a park are similar rectangles of same width. The longest side of the large flower bed is 48 cm long, and the longest side of the small flower bed is 16 cm. If L is the area of the large flower bed and S is the area of the small flower bed, which equation is true?
(A) S = L – 16 (B) S = L + 16
(C) S = (1/9) L (D) S = (1/3) L

29. The Wright brothers had their first successful flight near Kitty Hawk, North Carolina. Mr. Mohit finds it easy to remember the year in which the flight occurred because the number is the square root of his telephone number 3629025. In which year did the flight occur?
(A) 1925 (B) 1935
(C) 1945 (D) 1905

30. Kareena is on the fifth floor of a building. Her car is in the parking garage which is three levels below the ground floor. She gets in the elevator and travels from the fifth floor above ground level to the third floor below ground level. How many floors did she travel?
(A) 7 (B) 6
(C) 4 (D) 8

Answer Key

1.(C)	2.(A)	3.(B)	4.(D)	5.(C)	6.(D)	7.(B)	8.(C)	9.(B)	10.(D)
11.(A)	12.(C)	13.(C)	14.(B)	15.(D)	16.(D)	17.(C)	18.(D)	19.(A)	20.(D)
21.(B)	22.(C)	23.(C)	24.(B)	25.(C)	26.(A)	27.(D)	28.(D)	29.(D)	30.(D)

Model Paper - 2

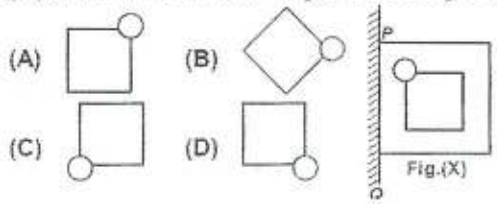
1. How many numbers from 11 to 50 are there, which are exactly divisible by 7 but not by 3?
   (A) Two (B) Four
   (C) Five (D) Six

2. Rahul bought 4 packets of notebook papers for school last year. Each packet contained 50 notebook papers. He used about 20 notebook papers every week. Find the number of notebook papers Rahul was left with after 7 weeks?
   (A) 67 (B) 17
   (C) 70 (D) 60

3. If 'paper' is called 'wood', 'wood' is called 'straw', 'straw' is called 'grass', 'grass' is called 'rubber' and 'rubber' is called 'cloth', what is furniture made up of ?
   (A) Paper (B) Wood
   (C) Straw (D) Grass

4. A community swimming pool is open on different days depending on the air temperature. The given table shows the air temperature on different days. The dates listed in the table show that the pool was closed on July 1, August 1 and October 1. If the pool was open on all the other dates listed, which of the following statements best describes the air temperature when the pool is open?

5. Choose the correct mirror image of Figure (X), when the mirror is placed along PQ.



Section II: Mathematical Reasoning

6. A mistake was made in simplifying the expression given below.

Simplify: $5 + 2(6 + 4)^2 - 2^3$,

Step 1: $5 + 2(10) - 2^3$,

Step 2: $5 + 20 - 8$,

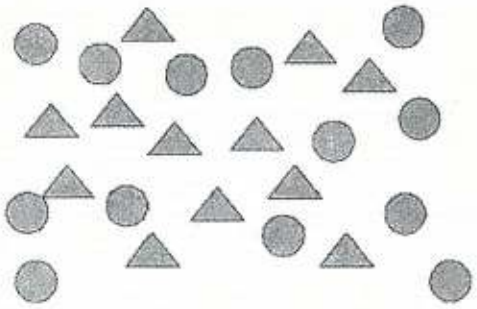
Step 3: $25 - 8$,

Step 4: 17.

In which step did the first mistake appear?

(A) Step 1 (B) Step 2
(C) Step 3 (D) Step 4

7. What percentage of the figures are circles ?



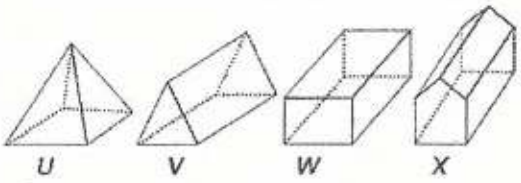
(A) 48% (B) 50%
(C) 52% (D) 54%

8. Find the value of the expression given below?

$$\left(\frac{3a^2 + 2a \times 5 - 4}{4}\right) + 5a - 2, \text{ when a} = 4$$

(A) 24 (B) 39
(C) 27 (D) 36

9. Which of the following figures has 10 vertices?

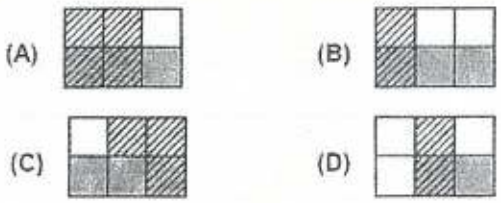


(A) Figure U (B) Figure V
(C) Figure W (D) Figure X

10. Which list of integers is in order from greatest to least ?

(A) - 42, –39, – 4, 40, 41
(B) - 42, 41, 40, – 39, – 4
(C) - 4, – 39, 40, 41, 42
(D) 41, 40, – 4, – 39, – 42

11. Which model best represents the expression $\frac{1}{2} \times \frac{1}{3}$?



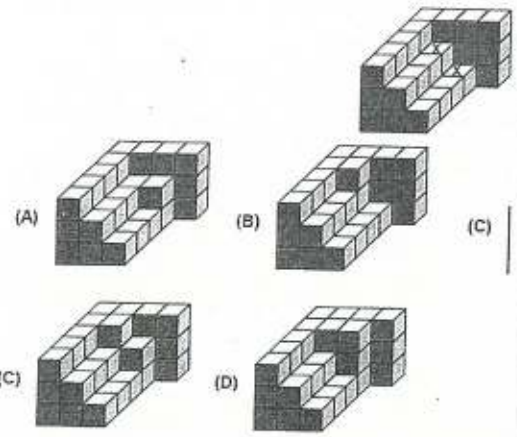
12. Mr. Sameer was trying to find a tablecloth for his rectangular dining table. He knew the area and perimeter of the tabletop.

Area = 40 square metres, Perimeter = 28 metres

Which of the following best represents the width and length of the tabletop?

(A) Length = 10 m, Width = 4 m
(B) Width = 2 m, Length = 20 m
(C) Width = 5 m, Length = 8 m
(D) Width = 4 m, Length = 12 m

13. If 2 unit cubes, one on each are placed on the unit cubes marked 'X', which solid will be obtained?

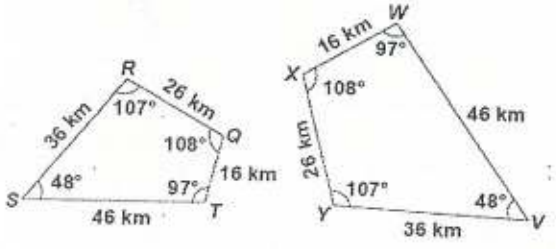


14. Fill in the blank of the statement given below.

70 have _____ factors.

(A) 2 (B) 4
(C) 6 (D) 8

15. Which of the following is true for the two given congruent figures?.

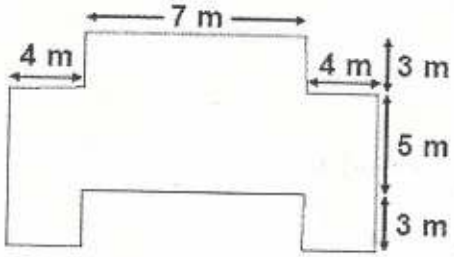


(A) $\overline{TQ} \cong \overline{XY}$
(B) $\overline{ST} \cong \overline{XY}$
(C) $\overline{TQ} \cong \overline{WX}$
(D) $\angle Q \cong \angle Y$

16. The total cost of 5 teddy bears is the same as the total cost of 9 clowns. Find the cost of a teddy bear.

(A) Rs. 27 (B) Rs. 28
(C) Rs. 30 (D) Rs. 32

17. The perimeter of the given figure is ____.



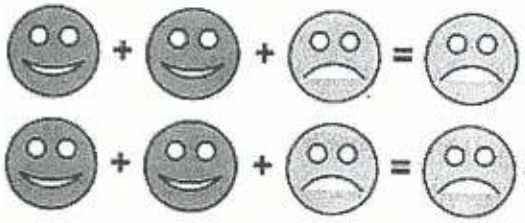
(A) 68 m (B) 48 m
(C) 58 m (D) 50 m

18. Which of the following digits makes the given statement true?

The number 60619 is divisible by 9.

(A) 3 (B) 6
(C) 5 (D) 8

19. Given that,



If each ☹ stands for $\frac{1}{4}$, what does each ☺ stand for ?

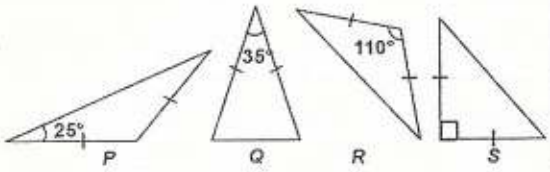
(A) 3/4 (B) 3/2
(C) 3/8 (D) 3/5

20. Asha looked at several different flower arrangements before purchasing one. The arrangements varied in price from Rs.15.62

to Rs. 37.50. Which measure of data can be used to describe the variation between maximum and minimum price?

(A) Mean (B) Mode
(C) Range (D) Median

21. Which of the following figures are acute isosceles triangles ?



(A) P only (B) Q only
(C) R only (D) R and S only

22. Evaluate:

$$\frac{3}{4}+5\frac{1}{2}-1\frac{1}{3}-\frac{1}{2}\times\frac{9}{10}$$

(A) 4.48 (B) - 4.46
(C) - 4.82 (D) 4.46

23. Ashwin used the rule listed below to rewrite the expression $10^2 \times 10^5 = 10^7$.

$10^m \times 10^n = 10^{m+n}$

Based on this rule, which of the following is equivalent to the expression $8^{-8} \times 8^6$?

(A) 8^{-10}, because $8^{-4} \times 8^6 = 8^{-4-6}$
(B) 8^{-12}, because $8^{-4} \times 8^{-8} = 8^{-4-8}$
(C) 8^{-2}, because $8^{-8} \times 8^6 = 8^{-8+6}$
(D) 8^2, because $8^{-4} \times 8^6 = 8^{-4+6}$

24. A building is 24 m long. The bottom of the ladder is 10 m away from the foot of the building. Find the length of the ladder?

(A) 12 m (B) 24 m
(C) 26 m (D) 8 m

25. Amit counted the number of people in line for tickets at the movie theatre. Every time he saw 7 people, he added a tick mark on his counting sheet, as shown below.

Amit saw 6 more people after he added his last tick mark. Which could be used to find u, the total number of people he saw?

(A) $16 \div 6 + 7 = u$
(B) $16 \times 6 \times 7 = u$
(C) $16 \times 7 + 6 = u$
(D) $16 + 7 - 6 = u$

Section III: Everyday Mathematics

26. The average of three numbers is $9m + 8$. Two of the three numbers are $2m + 3$ and $4m + 5$. Express the third number in terms of m in the simplest form.

(A) $9m + 8$ (B) $27m + 24$
(C) $21m + 16$ (D) $21m + 32$

27. Hrishant packs boxes for an appliance company. He can pack a large box in 10 minutes and a small box in 4 minutes. He needs to pack 10 large boxes and 20 small boxes. If he starts his work 3.5 hours before closing time, will Hrishant have time to finish the work before closing time if he works without stopping?

(A) Yes, Hrishant will finish the work in 3 hours.
(B) No, it will take Hrishant 4 hours to finish.
(C) Yes, Hrishant will finish the work in 2.5 hours.
(D) No, it will take Hrishant 6 hours to finish.

28. The total length of all songs on a CD, Anshuman bought is about 74 minutes. Each song is between 4 to 6 minutes long. Which is a reasonable number of songs that could be on the CD?

(A) 10 (B) 40
(C) 74 (D) 16

29. Misha answered 56% of the 150 problems on her history homework correctly. How many problems on her homework did she answer correctly?
(A) 56 (B) 65
(C) 84 (D) 92

30. Which of the following statements represents the greatest percent of change?
(A) A tree grew from 6 feet to 12 feet in 1 year.
(B) An aquarium that was originally priced at Rs. 90 is now priced at Rs.140.
(C) A person whose salary was Rs. 1000 per week is now earning Rs. 1500 per week.
(D) A baby who weighed 5 pounds at birth now weighs 20 pounds.

Answer Key

1.(C)	2.(A)	3.(B)	4.(D)	5.(C)	6.(D)	7.(B)	8.(C)	9.(B)	10.(D)
11.(A)	12.(C)	13.(C)	14.(B)	15.(D)	16.(D)	17.(C)	18.(D)	19.(A)	20.(D)
21.(B)	22.(C)	23.(C)	24.(B)	25.(C)	26.(A)	27.(D)	28.(D)	29.(D)	30.(D)