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*X – Maths*
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CHAPTER 1

REAL NUMBERS

KEY POINTS

1. Euclid’s division lemma:
   For given positive integers ‘a’ and ‘b’ there exist unique whole numbers ‘q’ and ‘r’ satisfying the relation
   \[ a = bq + r, \quad 0 \leq r < b. \]

2. Euclid’s division algorithms:
   HCF of any two positive integers \( a \) and \( b \). With \( a > b \) is obtained as follows:
   
   **Step 1** : Apply Euclid’s division lemma to \( a \) and \( b \) to find \( q \) and \( r \) such that
   \[ a = bq + r, \quad 0 \leq r < b. \]
   
   **Step 2** : If \( r = 0 \), HCF \((a, b)\), \( = b \) if \( r \neq 0 \), apply Euclid’s lemma to \( b \) and \( r \).

3. The Fundamental Theorem of Arithmetic:
   Every composite number can be expressed (factorized) as a product of primes and this factorization is unique, apart from the order in which the prime factors occur.

4. Let \( x = \frac{p}{q}, \quad q \neq 0 \) to be a rational number, such that the prime factorization of ‘\( q \)’ is of the form \( 2^m 5^n \), where \( m, n \) are non-negative integers. Then \( x \) has a decimal expansion which is terminating.

5. Let \( x = \frac{p}{q}, \quad q \neq 0 \) be a rational number, such that the prime factorization of \( q \) is not of the form \( 2^m 5^n \), where \( m, n \) are non-negative integers. Then \( x \) has a decimal expansion which is non-terminating repeating.

6. \( \sqrt{p} \) is irrational, which \( p \) is a prime. A number is called irrational if it cannot be written in the form \( \frac{p}{q} \) where \( p \) and \( q \) are integers and \( q \neq 0 \).
MULTIPLE CHOICE QUESTIONS

1. $7 \times 11 \times 13 + 7$ is a
   (a) prime number  
   (b) composite number  
   (c) odd number  
   (d) none

2. Which of these numbers always ends with the digit 6.
   (a) $4^n$  
   (b) $2^n$  
   (c) $6^n$  
   (d) $8^n$
   where $n$ is a natural number.

3. For $a, b \ (a \neq b)$ positive rational numbers $(\sqrt{a} + \sqrt{b}) (\sqrt{a} - \sqrt{b})$ is a
   (a) Rational number  
   (b) irrational number  
   (c) $\left(\sqrt{a} - \sqrt{b}\right)^2$  
   (d) 0

4. If $p$ is a positive rational number which is not a perfect square then $-3\sqrt{p}$
   is
   (a) integer  
   (b) rational number  
   (c) irrational number  
   (d) none of the above.

5. All decimal numbers are–
   (a) rational numbers  
   (b) irrational numbers  
   (c) real numbers  
   (d) integers

6. In Euclid Division Lemma, when $a = bq + r$, where $a, b$ are positive integers which one is correct.
   (a) $0 < r \leq b$  
   (b) $0 \leq r < b$  
   (c) $0 < r < b$  
   (d) $0 \leq r \leq b$

7. Which of the following numbers is irrational number
   (a) 3.131131113...  
   (b) 4.4636363636...  
   (c) 2.35  
   (d) $b$ and $c$ both
8. The decimal expansion of the rational number \( \frac{51}{2^5 \cdot 5^4} \) will terminate after ___ decimal places.
   (a) 3  
   (b) 4  
   (c) 5  
   (d) never

9. HCF is always
   (a) multiple of L.C.M.  
   (b) Factor of L.C.M.  
   (c) divisible by L.C.M.  
   (d) \( a \) and \( c \) both

10. Which one is not the factor(s) of 255
    (a) 5  
    (b) 25  
    (c) 3  
    (d) 17

11. Which of the following is an irrational number between 0 and 1
    (a) 0.11011011...  
    (b) 0.90990999...  
    (c) 1.010110111...  
    (d) 0.3030303...

12. \( p^n = (a \times 5)^n \). For \( p^n \) to end with the digit zero \( a = \) ___ for natural no. \( n \)
    (a) any natural number  
    (b) even number  
    (c) odd number  
    (d) none.

13. After how many places the decimal expansion of \( \frac{51}{1500} \) will terminate.
    (a) 2 places  
    (b) 3 places  
    (c) 4 places  
    (d) 5 places

**SHORT ANSWER TYPE QUESTIONS**

14. What will be the value of \( 0.\overline{3} + 0.\overline{4} \)?

15. If unit’s digit of \( 7^3 \) is 3 then what will be the unit’s digit of \( 7^{11} \).

17. Solve $\sqrt{18} \times \sqrt{50}$. What type of number is it, rational or irrational.

18. What type of decimal expansion will $\frac{69}{60}$ represent? After how many places will the decimal expansion terminate?

19. Find the H.C.F. of the smallest composite number and the smallest prime number.

20. If $a = 4q + r$ then what are the conditions for $a$ and $q$. What are the values that $r$ can take?

21. What is the smallest number by which $\sqrt{5} - \sqrt{3}$ be multiplied to make it a rational no? Also find the no. so obtained.

22. What is the digit at unit’s place of $9^n$?

23. Find one rational and one irrational no. between $\sqrt{3}$ and $\sqrt{5}$.

24. If the no. $p^n$ ever to end with the digit 0 then what are the possible value(s) of $p$?

25. State Euclid’s Division Lemma and hence find HCF of 16 and 28.

26. State fundamental theorem of Arithmetic and hence find the unique fraternization of 120.

27. Prove that $\frac{1}{2 - \sqrt{5}}$ is irrational number.

28. Prove that $5 - \frac{2}{7\sqrt{5}}$ is irrational number.

29. Prove that $\sqrt{2} + \sqrt{7}$ is not rational number.

30. Find HCF and LCM of 56 and 112 by prime factorisation method.

31. Why $17 + 11 \times 13 \times 17 \times 19$ is a composite number? Explain.

32. Check whether $5 \times 7 \times 11 + 7$ is a composite number.

33. Check whether $7 \times 6 \times 3 \times 5 + 5$ is a composite number.
34. Check whether $14^n$ can end with the digit zero for any natural number, $n$.

35. Show that $9^n$ can never end with the digit zero.

36. If the HCF of 210 and 55 is expressible in the form $210 \times 5 + 55y$ then find $y$.

**LONG ANSWER TYPE QUESTIONS**

37. Find HCF of 56, 96 and 324 by Euclid's algorithm.

38. Show that the square of any positive integer is either of the form $3m$ or $3m + 1$ for some integer $m$.

39. Show that any positive odd integer is of the form $6q + 1$, $6q + 5$ where $q$ is some integer.

40. Prove that the square of any positive integer is of the form $5q$, $5q + 1$, $5q + 4$ for some integer, $q$.

41. Prove that the product of three consecutive positive integers is divisible by 6.

42. Show that one and only one of $n$, $n + 2$, $n + 4$ is divisible by 3.

43. Two milk containers contains 398 l and 436 l of milk the milk is to be transferred to another container with the help of a drum. While transferring to another container 7l and 11l of milk is left in both the containers respectively. What will be the maximum capacity of the drum.

**ANSWERS**

1. $b$  
2. $c$
3. $a$  
4. $c$
5. $c$  
6. $b$
7. $a$  
8. $b$
9. $b$  
10. $b$
11. $b$  
12. $b$
13. $b$  
14. $\frac{7}{9}$
15. 3
16. 675
17. 30, rational
18. Terminate after two places
19. 2
20. a-positive integer, r, q whole number $0 \leq r < 4$

21. $\left( \sqrt{5} + \sqrt{3} \right) \times 2$
22. Even power = 1, Odd power = 9
23. –
24. Multiples of 10
25. 4
26. $2 \times 2 \times 2 \times 3 \times 5$
27. —
28. —
29. –
30. H.C.F. = 28, L.C.M. = 336
31. –
32. Yes
33. Yes
34. No
35. –
36. Find HCF (210, 55) = 5, as $5 = 210 \times 5 + 55y \Rightarrow y = -19$
37. 4
38. Take $a = 3q + r$
39. Take $a = 6q + r$
40. –
41. –
42. Take $n = 3q + r$
43. 17
CHAPTER 2

POLYNOMIALS

KEY POINTS

1. Polynomials of degrees 1, 2 and 3 are called linear, quadratic and cubic polynomials respectively.

2. A quadratic polynomial in $x$ with real coefficient is of the form $ax^2 + bx + c$, where $a$, $b$, $c$ are real numbers with $a \neq 0$.

3. The zeroes of a polynomial $p(x)$ are precisely the $x$-coordinates of the points where the graph of $y = p(x)$ intersects the $x$-axis i.e. $x = a$ is a zero of polynomial $p(x)$ if $p(a) = 0$.

4. A polynomial can have at most the same number zeroes as the degree of the polynomial.

5. For quadratic polynomial $ax^2 + bx + c$ ($a \neq 0$)

   Sum of zeroes $= -\frac{b}{a}$

   Product of zeroes $= \frac{c}{a}$.

6. The division algorithm states that given any polynomial $p(x)$ and polynomial $g(x)$, there are polynomials $q(x)$ and $r(x)$ such that:

   
   $p(x) = g(x).q(x) + r(x)$, $g(x) \neq 0$

   whether $r(x) = 0$ or degree of $r(x) <$ degree of $g(x)$.

MULTIPLE CHOICE QUESTIONS

1. A real no. $\alpha$ is a zero of the polynomial $f(x)$ if

   (a) $f(\alpha) > 0$ (b) $f(\alpha) = 0$

   (c) $f(\alpha) < 0$ (d) none
2. The zeroes of a polynomial \( f(x) \) are the coordinates of the points where the graph of \( y = f(x) \) intersects

(a) \( x \)-axis  
(b) \( y \)-axis  
(c) origin  
(d) \( (x, y) \)

3. If \( \beta \) is 0 zero of \( f(x) \) then ____ is one of the factors of \( f(x) \)

(a) \( (x - \beta) \)  
(b) \( (x - 2\beta) \)  
(c) \( (x + \beta) \)  
(d) \( (2x - \beta) \)

4. If \( (y - a) \) is factor of \( f(y) \) then ___ is a zero of \( f(y) \)

(a) \( y \)  
(b) \( a \)  
(c) \( 2a \)  
(d) \( 2y \)

5. Which of the following is not correct for : A quadratic polynomial may have

(a) no real zeroes  
(b) two equal real zeroes  
(c) two distinct zeroes  
(d) three real zeros.

6. Cubic poly \( x = f(y) \) cuts \( y \)-axis at almost

(a) one point  
(b) two points  
(c) three points  
(d) four points

7. Polynomial \( x^2 + 1 \) has ___ zeroes

(a) only one real  
(b) no real  
(c) only two real  
(d) one real and the other non-real.

8. Zeroes of the polynomial \( 4x^2 - 1 \) are

(a) equal  
(b) unequal with the same sign  
(c) equal in magnitude but opposite in sign  
(d) Unequal with different sign.
9. If $P$ is the sum of the zeroes and $s$ is the product then quadratic polynomial can be obtained as follows.

(a) $x^2 - sx + p$
(b) $x^2 - px + s$
(c) $x^2 + sx - p$
(d) $x^2 + px - s$

10. If 2 is a zero of both the polynomial, $3x^2 + ax - 14$ and $2x - b$ then $a - 2b = ___$

(a) –2
(b) 7
(c) –8
(d) –7

11. If zeroes of the polynomial $ax^2 + bx + c$ are reciprocal of each other then

(a) $a = c$
(b) $a = b$
(c) $b = c$
(d) $a = -c$

12. Three zeroes of $(x + 4)(x^2 - 6x + 8)$ are

(a) 4, -4, 2
(b) 4, 4, -2
(c) -4, -4, 2
(d) -4, -4, -2

13. Graph of $y = ax^2 + 6x + c$ intersects $x$-axis at 2 distinct points if

(a) $b^2 - 4ac > 0$
(b) $b^2 - 4ac < 0$
(c) $b^2 - 4ac = 0$
(d) none

**SHORT ANSWER TYPE QUESTIONS**

14. If $\alpha$ and $\beta$ are the zeroes of the polynomial $2x^2 - 7x + 3$. Find the sum of the reciprocal of its zeroes.

15. If $\frac{1}{3}$ is a zero of the polynomial $3x^3 - 4x^2 - 17x - k$ then find value of $k$.

16. If the polynomial $6x^3 + 16x^2 + px - 5$ is exactly divisible by $3x + 5$, then find the value of $p$.

17. If $(x + a)$ is a factor of the polynomial $2x^2 + 2ax + 5x + 10$ find $a$.

18. Find a quadratic polynomial whose zeroes are $\left(5 - 3\sqrt{2}\right)$ and $\left(5 + 3\sqrt{2}\right)$.
19. If \( \frac{1}{5} \) and \(-2\) are respectively product and sum of the zeroes of a quadratic polynomial. Find the polynomial.

20. Find zeroes of \( \sqrt{3}x^2 - 8x + 4\sqrt{3} \).

21. If \((x + k)\) is a factor of the polynomial \( x^2 - 2x - 15 \) and \( x^3 + a \). Find \( k \) and \( a \).

22. Find zeroes of \( 2x^2 - 5x + 3 \).

23. If sum of the zeroes of \( kx^2 + 3k + 2x \) is equal to their product. Find \( k \).

24. If one zero of \( 4x^2 - 9 - 8kx \) is negative of the other find \( k \).

**LONG ANSWER TYPE QUESTIONS**

25. Find the zeroes of \( 5x^2 - 4 - 8x \). Verify the relationship between the zeroes and coefficients.

26. If one zero of the polynomial \((a^2 + a)x^2 + 13x + 6a \) is reciprocal of the other, find value (s) of \( a \).

27. If \(-5\) is one of the zeroes of \( 2x^2 + px - 15 \). Quadratic polynomial \( p(x^2 + x) + k \) has both the zeros equal to each other. Then find \( k \).

28. Find the value of \( k \) such that \( 3x^2 + 2kx + x - k - 5 \) has the sum of the zeroes as half of their product.

29. If \( f(x) = 2x^4 - 5x^3 + x^2 + 3x - 2 \) is divided by \( g(x) \) the quotient \( q(x) = 2x^2 - 5x + 3 \) and \( r(x) = -2x + 1 \) find \( g(x) \).

30. If \( (x - 2) \) is one of the factors of \( x^3 - 3x^2 - 4x + 12 \) find the other zeroes.

31. If \( \alpha \) and \( \beta \) the zeroes of the polynomial \( x^2 - 5x + k \) such that \( \alpha - \beta = 1 \), find the value of \( k \).

32. Find the zeroes of the polynomial \( 3x^2 - x - 4 \) and verify the relationship between the zeros and the coefficients.

33. Obtain all zeroes of \( x^4 - x^3 - 7x^2 + x + 6 \) if 3 and 1 are zeros.

34. Find all the zeroes of the polynomial \( 4x^4 - 20x^3 + 23x^2 + 5x - 6 \) if two of its zeros are 2 and 3.
35. If \((2 + \sqrt{3})\) and \((2 - \sqrt{3})\) are two zeroes of \(x^4 - 4x^3 - 8x^2 + 36x - 9\) find the other two zeroes.

36. What must be subtracted from \(8x^4 + 14x^3 - 4x^2 + 7x - 8\) so that the resulting polynomial is exactly divisible by \(4x^2 + 3x - 2\).

37. When we add \(p(x)\) to \(4x^4 + 2x^3 - 2x^2 + x - 1\) the resulting polynomial is divisible by \(x^2 + 2x - 3\) find \(p(x)\).

38. Find \(a\) and \(f\) if \((x^4 + x^3 + 8x^2 + ax + f)\) is a multiple of \((x^2 + 1)\).

39. If the polynomial \(6x^4 + 8x^3 + 17x^2 + 21x + 7\) is divided by \(3x^2 + 1 + 4x\) then \(r(x) = (ax + b)\) find \(a\) and \(b\).

40. Obtain all the zeroes of \(2x^4 - 2x^3 - 7x^2 + 3x + 6\) if \(x = \pm \sqrt{3}\) are two factors of this polynomial.

41. Find all the zeroes of \(x^4 - 3x^3 - x^2 + 9x - 6\) if \(-\sqrt{3}\) and \(\sqrt{3}\) are two of its zeros.

42. If \((x^3 - 3x + 1)\) is one of the factors of the polynomial \(x^5 - 4x^3 + x^2 + 3x + 1\), find the other two factors.

**Answers**

1. \(b\) 
2. \(a\)
3. \(a\) 
4. \(b\)
5. \(a\) 
6. \(c\)
7. \(b\) 
8. \(c\)
9. \(b\) 
10. \(d\)
11. \(a\) 
12. \(a\)
13. \(a\) 
14. \(\frac{1}{a} + \frac{1}{\beta} = \frac{7}{3}\)
15. $-6$
16. $p = 7$
17. $a = 2$
18. $x^2 - 10x + 7$
19. $x^2 + 2x + \frac{1}{5}$
20. $2\sqrt{3}, \frac{2}{3}\sqrt{3}$
21. $k = -5, 3$ and $a = -125, +27$
22. $1, \frac{3}{2}$
23. $-\frac{2}{3}$
24. $0$
25. $2, -\frac{2}{5}$
26. $5$
27. $p = 7, k = \frac{7}{4}$
28. $k = 1$
29. $g(x) = x^2 - 1$
30. $-2, 3$
31. $k = 6$
32. $\frac{4}{3}, -1$
33. $-2, -1$
34. $-\frac{1}{2}, +\frac{1}{2}$
35. $\pm 3$
36. $14x - 10$
37. $61x + 65$
38. $r(x) = 0$
   $\Rightarrow (a - 1)x + (f - 7) = 0$
   $\Rightarrow a = 1$ and $f = 7$
39. $r(x) = x + 2 = ax + f \Rightarrow a = 1$ and $f = 2$
40. $2, -1 \pm \frac{3}{\sqrt{2}}$
41. $\pm\sqrt{3}, 1, 2$
42. $(x - 1), (x + 1)$
CHAPTER 3

PAIR OF LINEAR EQUATION IN TWO VARIABLE

KEY POINTS

1. The most general form of a pair of linear equations is:
   \[ a_1x + b_1y + c_1 = 0 \]
   \[ a_2x + b_2y + c_2 = 0 \]
   Where \( a_1, a_2, b_1, b_2, c_1, c_2 \) are real numbers and \( a_1^2 + b_1^2 \neq 0, a_2^2 + b_2^2 \neq 0 \).

2. The graph of a pair of linear equations in two variables is represented by two lines;
   (i) If the lines intersect at a point, the pair of equations is consistent. The point of intersection gives the unique solution of the equation.
   (ii) If the lines coincide, then there are infinitely many solutions. The pair of equations is consistent. Each point on the line will be a solution.
   (iii) If the lines are parallel, the pair of the linear equations has no solution. The pair of linear equations is inconsistent.

3. If a pair of linear equations is given by \( a_1x + b_1y + c_1 = 0 \) and \( a_2x + b_2y + c_2 = 0 \)
   (i) \( \frac{a_1}{a_2} \neq \frac{b_1}{b_2} \Rightarrow \) the pair of linear equations is consistent. (Unique solution).
   (ii) \( \frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2} \Rightarrow \) the pair of linear equations is inconsistent (No solution).
(iii) \( \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \Rightarrow \) the pair of linear equations is dependent and consistent (infinitely many solutions).

**MULTIPLE CHOICE QUESTIONS**

1. Every linear equation in two variables has ___ solution(s).
   (a) no \hspace{1cm} (b) one
   (c) two \hspace{1cm} (d) infinitely many

2. \( \frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2} \) is the condition for
   (a) intersecting lines \hspace{1cm} (b) parallel lines
   (c) coincident lines \hspace{1cm} (d) none

3. For a pair to be consistent and dependent the pair must have
   (a) no solution \hspace{1cm} (b) unique solution
   (c) infinitely many solutions \hspace{1cm} (d) none of these

4. Graph of every linear equation in two variables represent a ___
   (a) point \hspace{1cm} (b) straight line
   (c) curve \hspace{1cm} (d) triangle

5. Each point on the graph of pair of two lines is a common solution of he lines in case of ___
   (a) infinitely many solutions \hspace{1cm} (b) only one solution
   (c) no solution \hspace{1cm} (d) none of these

6. Which of he following is the solution of the pair of linear equations
   \( 3x - 2y = 0, 5y - x = 0 \)
   (a) (5, 1) \hspace{1cm} (b) (2, 3)
   (c) (1, 5) \hspace{1cm} (d) (0, 0)
7. One of the common solution of \( ax + by = c \) and \( y \)-axis is _____

(a) \( \left( 0, \frac{c}{b} \right) \)   
(b) \( \left( 0, \frac{b}{c} \right) \)

(c) \( \left( \frac{c}{b}, 0 \right) \)   
(d) \( \left( 0, -\frac{c}{b} \right) \)

8. If the value of \( x \) in the equation \( 2x - 8y = 12 \) is 2 then the corresponding value of \( y \) will be

(a) -1   
(b) +1

(c) 0   
(d) 2

9. The pair of linear equations is said to be inconsistent if they have

(a) only one solution   
(b) no solution

(c) infinitely many solutions.   
(d) both \( a \) and \( c \)

10. On representing \( x = a \) and \( y = b \) graphically we get ____

(a) parallel lines   
(b) coincident lines

(c) intersecting lines at \( (a, b) \)   
(d) intersecting lines at \( (b, a) \)

11. How many real solutions of \( 2x + 3y = 5 \) are possible

(a) no   
(b) one

(c) two   
(d) infinitely many

12. The value of \( k \) for which the system of equation \( 3x + 2y = -5, \ x - ky = 2 \) has a unique solutions.

(a) \( k = \frac{2}{3} \)   
(b) \( k \neq \frac{2}{3} \)

(c) \( k = -\frac{2}{3} \)   
(d) \( k \neq -\frac{2}{3} \)

13. If the lines represented by the pair of linear equations \( 2x + 5y = 3, \ 2(k + 2) \ y + (k + 1) \ x = 2k \) are coincident then the value of \( k \) is ____
14. The coordinates of the point where \( x \)-axis and the line represented by \( \frac{x}{2} + \frac{y}{3} = 1 \) intersect, are

(a) (0, 3)  (b) (3, 0)  (c) (2, 0)  (d) (0, 2)

15. Graphically \( x - 2 = 0 \) represents a line

(a) parallel to \( x \)-axis at a distance 2 units from \( x \)-axis.
(b) parallel to \( y \)-axis at a distance 2 units from it.
(c) parallel to \( x \)-axis at a distance 2 units from \( y \)-axis.
(d) parallel to \( y \)-axis at a distance 2 units from \( x \)-axis.

16. If \( ax + by = c \) and \( lx + my = n \) has unique solution then the relation between the coefficients will be ____. 

(a) \( am \neq lb \)  (b) \( am = lb \)  (c) \( ab = lm \)  (d) \( ab \neq lm \)

**SHORT ANSWER TYPE QUESTIONS**

17. Form a pair of linear equations for: The sum of the numerator and denominator of fraction is 3 less than twice the denominator. If the numerator and denominator both are decreased by 1, the numerator becomes half the denominator.

18. Amar gives ₹ 9000 to some athletes of a school as scholarship every month. Had there been 20 more athletes each would have got ₹ 160 less. Form a pair of linear equations for this.

19. Find the value of \( k \) so that the equations \( x + 2y = -7 \), \( 2x + ky + 14 = 0 \) will represent coincident lines.

20. Give linear equations which is coincident with \( 2x + 3y - 4 = 0 \)
21. What is the value of a for which (3, a) lies on \(2x - 3y = 5\)?

22. The sum of two natural nos. is 25 of their difference is 7. Find the nos.

23. Dinesh in walking along the line joining (1, 4) and (0, 6), Naresh is walking along the line joining (3, 4,) and (1,0). Represent on graph and find the point where both of them cross each other.

24. Solve the pair of linear equations
   \[ x - y = 2 \quad \text{and} \quad x + y = 2 \]
   Also find \(p\) if \(p = 2x + 3\)

25. For what value of K the following system of equations are parallel.
   \[ 2x + Ky = 10 \]
   \[ 3x + (k + 3)y = 12 \]

26. For m a pair of linear equations for the following situation assuming speed of boat in still water as ‘x’ and speed of stream ‘y’: A boat covers 32 km upstream and 36 km downstream in 7 hours. It also covers 40 km upstream and 48 km downstream in 9 hours.

27. Check graphically whether the pair of linear equations \(3x + 5y = 15, x - y = 5\) is consistent. Also check whether the pair is dependent.

28. For what value of \(p\) the pair of linear equations
   \[ (p + 2)x - (2p + 1)y = 3(2p - 1) \]
   \[ 2x - 3y = 7 \]
   has unique solution.

29. Find the value of K so that the pair of linear equations:
   \[ (3K + 1)x + 3y - 2 = 0 \]
   \[ (K^2 + 1)x + (k-2)y - 5 = 0 \] is inconsistent.

30. Given the linear equation \(x + 3y = 4\), write another linear equation in two variables such that the geometrical representation of the pair so formed is (i) intersected lines (ii) parallel lines (iii) coincident lines.

31. Solve \(x - y = 4, x + y = 10\) and hence find the value of \(p\) when \(y = 3x - p\)
32. Determine the value of \( K \) for which the given system of linear equations has infinitely many solutions:

\[
Kx + 3y = K - 3
\]

\[
12x + Ky = K
\]

33. Find the values of \( \alpha \) and \( \beta \) for which following system of linear equations has infinite no of solutions:

\[
2x + 3y = 7
\]

\[
2\alpha x + (\alpha + \beta)y = 28.
\]

34. Solve for \( x \) and \( y \):

\[
\frac{(x + 1)}{2} + \frac{(y - 1)}{3} = 8; \quad \frac{(x - 1)}{3} + \frac{(y + 1)}{2} = 9
\]

35. Solve for \( x \) and \( y \):

\[
2^x + 3^y = 17
\]

\[
2^x + 2 - 3^{y+1} = 5.
\]

36. Solve for \( x \) and \( y \)

\[
\begin{align*}
139x + 56y &= 641 \\
56x + 139y &= 724
\end{align*}
\]

37. Solve for \( x \) and \( y \)

\[
\frac{5}{x + y} + \frac{1}{x - y} = 2
\]

\[
\frac{15}{x + y} - \frac{5}{x - y} = -2
\]

38. Solve for \( x \) and \( y \)

\[
37x + 43y = 123
\]

\[
43x + 37y = 117
\]
39. Check graphically whether the pair of lines $3x + 2y - 4 = 0$ and $2x - y - 2 = 0$ is consistent. Also find the coordinates of the points where the graphs of the lines of equations meet the y-axis.

**LONG ANSWER TYPE QUESTIONS**

40. Solve for $x$ and $y$

$$\frac{1}{2(2x + 3y)} + \frac{12}{7(3x - 2y)} = \frac{1}{2}$$

$$\frac{7}{2x + 3y} + \frac{4}{3x - 2y} = 2 \quad \text{for} \ 2x + 3y \neq 0 \ \text{and} \ 3x - 2y \neq 0$$

41. Solve for $p$ and $q$

$$\frac{p + q}{pq} = 2, \quad \frac{p - q}{pq} = 6, \quad p \neq 0, \quad q \neq 0.$$

42. Solve for $x$ and $y$

$$\frac{2}{3x + 2y} + \frac{3}{3x - 2y} = \frac{17}{5} \quad 3x + 2y \neq 0 \ \text{and} \ 3x - 2y \neq 0$$

$$\frac{5}{3x + 2y} + \frac{1}{3x - 2y} = 2$$

43. $\frac{6}{x + y} = \frac{7}{x - y} + 3, \quad \frac{1}{2(x + y)} = \frac{1}{3(x - y)}, \quad x + y \neq 0, \quad x - y \neq 0$

44. $\frac{2}{\sqrt{x}} + \frac{3}{\sqrt{y}} = 2, \quad \frac{4}{\sqrt{x}} - \frac{9}{\sqrt{y}} = -1, \quad x \neq 0, \quad y \neq 0.$

45. $ax + by = 1$

$$bx + ay = \frac{(a + b)^2}{a^2 + b^2} - 1.$$

46. If from twice the greater of two numbers, 20 is subtracted, the result is the other number If from twice the smaller number, 5 is subtracted, the result is the greater number Find the numbers.
47. 27 pencils and 31 rubbers together costs ₹ 85 while 31 pencils and 27 rubbers together costs ₹ 89. Find the cost of 2 pencils and 1 rubber.

48. The area of a rectangle remain the same if its length is increased by 7 cm and the breadth is decreased by 3 cm. The area remains unaffected if length is decreased by 7 cm and the breadth is increased by 5 cm. Find length and breadth.

49. A two digit number is obtained by either multiplying the sum of the digits by 8 and adding 1; or by multiplying the difference of the digits by 13 and adding 2. Find the number. How many such nos. are there.

50. A number consists of three digits whose sum is 17. The middle one exceeds the sum of other two by 1. If the digits are reversed, the no. is diminished by 396. Find the number.

51. A boatman rows his boat 35 km upstream and 55 km down stream in 12 hours. He can row 30 km. upstream and 44 km downstream in 10 hours. Find the speed of he stream and that of the boat in still water. Hence find the total time taken by the boat man to row 50 cm upstream and 77 km downstream.

52. In a function if 10 guests are sent from room A to B, the number of guests in room A and B are same. If 20 guests are sent from B to A, the number of guests in A is double the numbr of guests in B. Find number of guests in both the rooms in the beginning.

53. In a function Madhu wished to give ₹ 21 to each person present and found that she fell short of ₹ 4 so she distributed ₹ 20 to each and found that ₹ 1 were left over. How much money did she gave and how many persons were there.

54. A mobile company charges a fixed amount as monthly rental which includes 100 minutes free per month and charges a fixed amount these after for every additional minute. Abhishek paid Rs. 433 for 370 minutes and Ashish paid Rs. 398 for 300 minutes. Find the bill amount under the same plain, if Usha use for 400 minutes.

55. Father's age is three times the sum of ages of his two children. After 5 years his age will be twice the sum of ages of two children. Find the age of the father.

56. Draw the graphs of the following equations:
3x – 4y + 6 = 0 and 3x + y – 9 = 0. Also find the coordinates of the vertices of the triangle formed by these lines and the x-axis.

57. 90% and 97% pure acid solutions are mixed to obtain 21 litres of 95% pure acid solution. Find the quantity of each type of acid to be mixed to form the mixture.

58. The sum of the numerator and denominator of a fraction is 8. If 3 is added to both the numerator and denominator, the fraction becomes 3/4. Find the fraction.

59. The monthly income of Supriya and Dhruv are in the ratio 5 : 4 and their monthly expenditures are in the ratio 7 : 5. If each saves ₹ 3000 per month. Find the monthly income of each.

60. Find four angles of a cyclic quadrilateral ABCD in which ∠A = 2x – 3°, ∠B = (y + 7)°, ∠C = (2y + 17)° and, ∠D = (4x – 9)°.

**ANSWERS**

1. d 2. c
3. c 4. b
5. a 6. d
7. a 8. a
9. b 10. c
11. d 12. d
13. b 14. c
15. b 16. a
17. If \( N = x \) and \( D = y \) then \( x – y = – 3 \), \( 2x – y = 1 \)
18. No. of athletes = \( x \), No. of athletes increased = \( y \)

\[
\begin{align*}
y – x &= 20 \\
x – \frac{1}{y} &= \frac{4}{225}
\end{align*}
\]

19. \( k = 4 \)
20. \( k(2x + 3y – 4) = 0 \), \( k \) is any real \( k \neq 0 \).
21. \( \frac{1}{3} \) 22. 16, 9
23. (2, 2)  
24. (2, 0) \( p = 7 \)
25. \( k = 6 \)
26. Speed of boat = \( x \), speed of stream = \( y \)
\[
\begin{align*}
\frac{32}{x - y} + \frac{36}{x + y} &= 7 \\
\frac{40}{x - y} + \frac{48}{x + y} &= 9
\end{align*}
\]
27. Yes, No  
28. \( p \neq 4 \)
29. \( k = -1, k \neq \frac{19}{2} \)
30. ___
31. (7, 3), 18  
32. \( k = 6 \)
33. (4, 8)  
34. (7, 13)
35. (3, 2) [**Hint.** : put \( 2^x = m, 3^y = n \)]  
36. (3, 4)
37. (3, 2)  
38. (1, 2)
39. Yes, (0, 2), (0, –2)  
40. (2, 1)
41. \( \begin{pmatrix} -1 & 1 \\ 2 & 4 \end{pmatrix} \)  
42. (1, 1)
43. \( \begin{pmatrix} -5 & -1 \\ 4 & 4 \end{pmatrix} \)  
44. (4, 9)
45. \( \frac{a}{a^2 + b^2} + \frac{b}{a^2 + b^2} \)  
46. 15, 10
47. \( \text{Rs.} 5 \)  
48. 28m, 15m
49. 41 or 14 (2 numbers possible)  
50. \( \begin{pmatrix} x + y = 8 \\ y - x = 4 \end{pmatrix} \)  
51. 3 km/hr., 8 km/hr., 17 hr.  
52. 100, 80
53. Rs. 101, 5  
54. \( \begin{pmatrix} \text{Rs.} 298, \text{Rs.} \frac{1}{2} \end{pmatrix} \) \( \text{Rs.} 448 \)
55. 45 years  
56. (–2, 0), (2, 3), (3, 0).
57. 6 litre of 90%, 15 litre of 97%.  
58. \( \frac{3}{5} \).
59. \( \text{Rs.} 10000, \text{Rs.} 8000 \)
60. 60°, 57°, 117°, 123°.
CHAPTER 4

SIMILAR TRIANGLES

KEY POINTS

1. **Similar Triangles**: Two triangles are said to be similar if their corresponding angles are equal and their corresponding sides are proportional.

2. **Criteria for Similarity**:

   in $\triangle ABC$ and $\triangle DEF$

   (i) **AAA Similarity**: $\triangle ABC \sim \triangle DEF$ when $\angle A = \angle D$, $\angle B = \angle E$ and $\angle C = \angle F$

   (ii) **SAS Similarity**:

   $$\triangle ABC \sim \triangle DEF \quad \text{when} \quad \frac{AB}{DE} = \frac{AC}{DF} \quad \text{and} \quad \angle B = \angle E$$

   (iii) **SSS Similarity**: $\triangle ABC \sim \triangle DEF$, $\frac{AB}{DE} = \frac{AC}{DF} = \frac{BC}{EF}$.

3. The proof of the following theorems can be asked in the examination:

   (i) **Basic Proportionality Theorems**: If a line is drawn parallel to one side of a triangle to intersect the other sides in distinct points, the other two sides are divided in the same ratio.

   (ii) The ratio of the area of two similar triangles is equal to the square of the ratio of their corresponding sides.

   (iii) **Pythagoras Theorem**: In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.
(iv) **Converse of Pythagoras Theorem**: In a triangle, if the square of one side is equal to the sum of the squares of the other two sides then the angle opposite to the first side is a right angle.

**MULTIPLE CHOICE QUESTIONS**

1. \( \triangle ABC \sim \triangle DEF. \) If \( DE = 2 \ AB \) and \( BC = 3 \text{cm} \) then \( EF \) is equal to _______.
   - (a) 1.5 cm
   - (b) 3 cm
   - (c) 6 cm
   - (d) 9 cm

2. In \( \triangle DEW, \ AB \parallel EW \) If \( AD = 4 \text{ cm}, \ DE = 12 \text{cm} \) and \( DW = 24 \text{ cm} \) then the value of \( DB = ____ \)
   - (a) 4 cm
   - (b) 8 cm
   - (c) 12 cm
   - (d) 16 cm

3. In the figure the value of \( cd = ____ \)
   - (a) \( ae \)
   - (b) \( af \)
   - (c) \( bf \)
   - (d) \( be \)

4. If in \( \triangle ABC, \ AB = 6 \text{ cm}, \ BC = 12 \text{cm} \) and \( CA = 6\sqrt{3} \text{ cm} \) then the measure of \( \angle A \) is
   - (a) 30°
   - (b) 45°
   - (c) 60°
   - (d) 90°
5. The area of two similar triangles are in the ratio 9 : 16. The corresponding sides must be in the ratio ______
   (a) $9 : 16$  
   (b) $16 : 9$  
   (c) $3 : 4$  
   (d) $4 : 3$

6. In the figure, $\triangle ABC$ is similar to ______

   ![Diagram of a triangle with sides and angles labeled]

   (a) $\triangle BDC$  
   (b) $\triangle DBC$  
   (c) $\triangle CDB$  
   (d) $\triangle CBD$

7. $\triangle AMB \sim \triangle CMD$. Also $2 \text{ar}(\triangle AMB) = \text{ar}(\triangle CMD)$ the length of $MD$ is
   (a) $\sqrt{2} \cdot MB$  
   (b) $\sqrt{2} \cdot MD$  
   (c) $\frac{\sqrt{2}}{MB}$  
   (d) $\frac{\sqrt{2}}{MD}$

8. In fig. length of $AE$ is
   (a) $10$ cm  
   (b) $9$ cm  
   (c) $5\sqrt{5}$ cm  
   (d) $\sqrt{5}$ cm
9. In \( \triangle PQR \) if \( S \) and \( T \) are the points on the sides \( PR \) and \( QR \) respectively such that \( ST \parallel PQ \) then \( \frac{RS}{RT} = \) ___.

(a) \( \frac{SP}{TQ} \)  
(b) \( \frac{PR}{QR} \)  
(c) \( \frac{SP}{RS} \)  
(d) \( \frac{TQ}{RT} \)

10. In \( \triangle ABC \), \( DE \parallel BC \). If \( \frac{AD}{DB} = \frac{3}{5} \) then \( \frac{ar(\triangle ADE)}{ar(\triangle ABC)} = \) ___.

(a) \( \frac{3}{5} \)  
(b) \( \frac{3}{8} \)  
(c) \( \frac{9}{64} \)  
(d) \( \frac{9}{25} \)
11. In \( \triangle ABC \), \( DE \parallel BC \). In the figure the value of \( x \) is ______

\[
\begin{array}{c}
A \\
 x \\
 D \\
 x - 3 \\
 E \\
 x - 1 \\
 B \\
 x - 5 \\
 C
\end{array}
\]

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

12. In \( \triangle ABC \), \( \angle B = 90^\circ \), \( BE \) is the perpendicular bisector of \( AC \) then 
\[
\frac{\text{ar} ( \triangle BEC )}{\text{ar} ( \triangle ABC )} = \]

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

13. The altitude of an equilateral triangle, having the length of its side 12cm is 

(a) 12 cm  
(b) \(6\sqrt{2} \) cm  
(c) 6 cm  
(d) \(6\sqrt{3} \) cm

14. The straight line distance between \( A \) and \( B \) is 

(a) \(3\sqrt{5} \)  
(b) \(5\sqrt{3} \)  
(c) 5  
(d) \(5\sqrt{2} \)
15. If in an isosceles right-angled triangle the length of the hypotenuse is 10 cm then the perimeter of the triangle is

(a) $5\sqrt{2}$ cm  
(b) $2\sqrt{5}$ cm  
(c) $10\left(\sqrt{2} + 1\right)$ cm  
(d) $10\left(\sqrt{2} - 1\right)$ cm

**SHORT ANSWER TYPE QUESTIONS**

16. In figure if $ST \parallel QR$, $PT = 8$ cm and $PR = 10$ cm then what is the value of $\frac{PS}{SQ}$
17. In the adjoining figure find \( AE \) if \( DE \parallel BC \)

![Diagram of two triangles with parallel sides labeled](image)

18. In the figure name the similar triangles.

![Diagram of two triangles with similar angles labeled](image)

19. An isosceles triangle \( ABC \) is similar to triangle \( PQR \). \( AC = AB = 4 \) cm, \( RQ = 10 \) cm and \( BC = 6 \) cm. What is the length of \( PR \)? Which type of triangle is \( \triangle PQR \)?

20. In the figure \( \triangle ABC \sim \triangle PQR \). What is the value of \( x \)?

![Diagram of two similar triangles labeled](image)
21. In \( \triangle PQR \), \( DE \parallel QR \) and \( DE = \frac{1}{4} QR \). Find \( \frac{\text{ar}(\triangle PQR)}{\text{ar}(\triangle PDE)} \).

22. In triangles \( ABC \) and \( PQR \) if \( \angle B = \angle Q \) and \( \frac{AB}{PQ} = \frac{BC}{QR} = \frac{1}{2} \) then what is the value of \( \frac{PR}{QR} \)?

23. The measurement of three sides of a triangle are \( a, \sqrt{10}a, 3a \). What is the measurement of the angle opposite to the longest side?

24. In the adjoining figure \( DE \parallel BC \). What is the value of \( DE \).

\[ \text{LONG ANSWER TYPE QUESTIONS} \]

25. In the figure find \( SR \) if \( \angle QPR = \angle PSR \). \( PR = 6 \) cm and \( QR = 9 \) cm
26. \( \triangle PQR \), \( RS \perp PQ \), \( \angle QRS = \angle P \), \( PS = 5 \) cm, \( SR = 8 \) cm. Find \( PQ \).

27. Two similar triangles \( ABC \) and \( PBC \) are made on opposite sides of the same base \( BC \). Prove that \( AB = BP \).

28. In figure \( ABCD \) is a rectangle. \( \triangle ADE \) and \( \triangle ABF \) are two triangles such that \( \angle E = \angle F \). Prove that \( \frac{AD}{AE} = \frac{AB}{AF} \).

29. In figure \( DE \parallel BC \), \( DE = 3 \) cm, \( BC = 9 \) cm and or \( (\triangle ADE) = 30 \) cm\(^2\). Find \( \text{ar (trap. } BCED) \).
30. Amit is standing at a point on the ground 8m away from a house. A mobile network tower is fixed on the roof of the house. If the top and bottom of the tower are 17m and 10m away from the point. Find the heights of the tower and house.

31. In a right angled triangle $ABC$, right angle at $B$, \( \frac{BC}{AB} = \sqrt{3} \). Find $\frac{AB}{AC}$.

32. In a right angled triangle $PRO$, $PR$ is the hypotenuse and the other two sides are of length 6cm and 8cm. $Q$ is a point outside the triangle such that $PQ = 24\text{cm}$ $RQ = 26\text{cm}$. What is the measure of \( \angle QPR \)?

33. In the figure \( \triangle ABC \) is isosceles with $AB = AC$. $P$ is the mid point of $BC$. If $PM \perp AB$ and $PN \perp AC$. Prove that $MP = NP$.

34. $PQRS$ is a trapezium. $SQ$ is a diagonal. $E$ and $F$ are two points on parallel sides $PQ$ and $RS$ respectively intersecting $SQ$ at $G$. Prove that $SG \times QE = QG \times SF$.

35. In the figure $P$, $Q$, $R$ and $S$ are points on the sides of quadrilateral $ABCD$ such that these points divides the sides $AB$, $CB$, $CD$ and $AD$ in the ratio $2 : 1$. Prove that $PQRS$ is a parallelogram.
36. Prove that if a line is drawn parallel to one side of a triangle, it divides the other two sides in the same ratio.

37. In a rhombus, prove that four times the square of any sides is equal to the sum of squares of its diagonals.

38. Prove that the ratio of the areas of two similar triangles is equal to the ratio of the squares of their corresponding sides.

39. In a triangle, if the square of one side is equal to the sum of the squares on the other two sides, then prove that the angle opposite to the first side is a right triangle.

40. Prove that in a right triangle, the square on the hypotenuse is equal to the sum of the squares on the other two sides.

41. $ABCD$ is a rectangle in which length is double of its breadth. Two equilateral triangles are drawn one each on length and breadth of rectangle. Find the ratio of their areas.

42. Amar and Ashok are two friends standing at a corner of a rectangular garden. They wanted to drink water. Amar goes due north at a speed of 50 m/min and Ashok due west at a speed of 60 m/min. They travel for 5 minutes. Amar reaches the tap and drink water. How far (minimum distance) is Ashok from the tap now.

43. In the figure $BCDE$ is a rectangle. Also $\angle BCA = \angle DCF$. Find the length of the diagonal $BD$ of rectangle.
44. In the figure $BDEF$ is a rectangle. $C$ is the mid point of $BD$. $AF = 7 \text{ cm}$, $DE = 9 \text{ cm}$ and $BD = 24 \text{ cm}$. If $AE = 25 \text{ cm}$ then prove that $\angle ACE = 90^\circ$.

45. In the figure altitude is drawn to the hypotenuse of a right angled triangle the lengths of different line-segments are marked. Determine $x$, $y$, $z$. 
ANSWERS

1. c  
2. b
3. a  
4. d
5. c  
6. d
7. a  
8. c
9. b  
10. c
11. d  
12. d
13. d  
14. a
15. c  
16. (4 : 1)
17. 1.5 cm  
18. $\triangle APQ \sim \triangle ABC$
19. $\frac{20}{3}$ cm  
20. 4.8 cm
21. 16 : 1  
22. $\frac{1}{2}$
23. 90°  
24. 2.5 cm
25. 4 cm  
26. 17.8 cm
27. 4 cm  
28. 17.8 cm
29. 240 cm²  
30. 9m, 6m
31. $\frac{1}{2}$  
32. 90°
33. 5√10 cm  
34. 5√10 cm
35. 5√10 cm  
36. 5√10 cm
37. 5√10 cm  
38. 5√10 cm
39. 5√10 cm  
40. 5√10 cm
41. 4 : 1  
42. $50\sqrt{61}$ m
43. 5√10 cm  
44. 5√10 cm
45. $x = 5$, $y = 2\sqrt{5}$, $z = 3\sqrt{5}$
CHAPTER 5
TRIGNOMETRY

KEY POINTS

1. **Trignometrical Ratios** : In \( \triangle ABC \), \( \angle B = 90^\circ \) for angle ‘\( A \)’

\[
\sin A = \frac{\text{Perpendicular}}{\text{Hypotenuse}}
\]

\[
\cos A = \frac{\text{Base}}{\text{Hypotenuse}}
\]

\[
\tan A = \frac{\text{Perpendicular}}{\text{Base}}
\]

\[
\cot A = \frac{\text{Base}}{\text{Perpendicular}}
\]

\[
\sec . A = \frac{\text{Hypotenuse}}{\text{Base}}
\]

\[
\cosec A = \frac{\text{Hypotenuse}}{\text{Perpendicular}}
\]

2. **Reciprocal Relations** :

\[
\sin \theta = \frac{1}{\cosec \theta}, \quad \cosec \theta = \frac{1}{\sin \theta}
\]

\[
\cos \theta = \frac{1}{\sec \theta}, \quad \sec \theta = \frac{1}{\cos \theta}
\]
\[
\tan \theta = \frac{1}{\cot \theta}, \quad \cot \theta = \frac{1}{\tan \theta}
\]

3. **Quotient Relations** :

\[
\tan \theta = \frac{\sin \theta}{\cos \theta}, \quad \cot \theta = \frac{\cos \theta}{\sin \theta}
\]

4. **Identities** :

\[
\sin^2 \theta + \cos^2 \theta = 1 \Rightarrow \sin^2 \theta = 1 - \cos^2 \theta \text{ and } \cos^2 \theta = 1 - \sin^2 \theta
\]
\[
1 + \tan^2 \theta = \sec^2 \theta \Rightarrow \tan^2 \theta = \sec^2 \theta - 1 \text{ and } \sec^2 \theta - \tan^2 \theta = 1
\]
\[
1 + \cot^2 \theta = \csc^2 \theta \Rightarrow \cot^2 \theta = \csc^2 \theta - 1 \text{ and } \csc^2 \theta - \cot^2 \theta = 1
\]

5. **Trigonometric Ratios of Some Specific Angles** :

<table>
<thead>
<tr>
<th>( \angle A )</th>
<th>0°</th>
<th>30°</th>
<th>45°</th>
<th>60°</th>
<th>90°</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \sin A )</td>
<td>0</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{1}{\sqrt{2}} )</td>
<td>( \frac{\sqrt{3}}{2} )</td>
<td>1</td>
</tr>
<tr>
<td>( \cos A )</td>
<td>1</td>
<td>( \frac{\sqrt{3}}{2} )</td>
<td>( \frac{1}{\sqrt{2}} )</td>
<td>( \frac{1}{2} )</td>
<td>0</td>
</tr>
<tr>
<td>( \tan A )</td>
<td>0</td>
<td>( \frac{1}{\sqrt{3}} )</td>
<td>1</td>
<td>( \sqrt{3} )</td>
<td>Not defined</td>
</tr>
<tr>
<td>( \cosec A )</td>
<td>Not defined</td>
<td>2</td>
<td>( \sqrt{2} )</td>
<td>( \frac{2}{\sqrt{3}} )</td>
<td>1</td>
</tr>
<tr>
<td>( \sec A )</td>
<td>1</td>
<td>( \frac{2}{\sqrt{3}} )</td>
<td>( \sqrt{2} )</td>
<td>2</td>
<td>Not defined</td>
</tr>
<tr>
<td>( \cot A )</td>
<td>Not defined</td>
<td>( \sqrt{3} )</td>
<td>1</td>
<td>( \frac{1}{\sqrt{3}} )</td>
<td>0</td>
</tr>
</tbody>
</table>

\( X – Maths \) 39
6. **Trigonometric Ratios of Complementary Angles**

\[
\begin{align*}
\sin (90° - \theta) &= \cos \theta \\
\cos (90° - \theta) &= \sin \theta \\
\tan (90° - \theta) &= \cot \theta \\
\cot (90° - \theta) &= \tan \theta \\
\sec (90° - \theta) &= \cosec \theta \\
\cosec (90° - \theta) &= \sec \theta
\end{align*}
\]

**MULTIPLE CHOICE QUESTIONS**

*Note*: In the following questions \(0° \leq \theta \leq 90°\)

1. If \(x = a \sin \theta\) and \(y = a \cos \theta\) then the value of \(x^2 + y^2\) is _______
   
   (a) \(a\)  
   (b) \(a^2\)  
   (c) \(1\)  
   (d) \(\frac{1}{a}\)

2. The value of \(\cosec 70° - \sec 20°\) is ______
   
   (a) \(0\)  
   (b) \(1\)  
   (c) \(70°\)  
   (d) \(20°\)

3. If \(3 \sec \theta - 5 = 0\) then \(\cot \theta = _____
   
   (a) \(\frac{5}{3}\)  
   (b) \(\frac{4}{5}\)  
   (c) \(\frac{3}{4}\)  
   (d) \(\frac{3}{5}\)

4. If \(\theta = 45°\) then \(\sec \theta \cot \theta - \cosec \theta \tan \theta\) is
   
   (a) \(0\)  
   (b) \(1\)  
   (c) \(\sqrt{2}\)  
   (d) \(2\sqrt{2}\)
5. If \( \sin (90 - \theta) \cos \theta = 1 \) and \( \theta \) is an acute angle then \( \theta = \) _____
   (a) \( 90^\circ \)  
   (b) \( 60^\circ \)  
   (c) \( 30^\circ \)  
   (d) \( 0^\circ \)

6. The value of \( (1 + \cos \theta)(1 - \cos \theta) \cosec^2\theta = \) _____
   (a) \( 0 \)  
   (b) \( 1 \)  
   (c) \( \cos^2 \theta \)  
   (d) \( \sin^2 \theta \)

7. \( \triangle TRY \) is a right-angled isosceles triangle then \( \cos T + \cos R + \cos Y \) is _____
   (a) \( \sqrt{2} \)  
   (b) \( 2\sqrt{2} \)  
   (c) \( 1 + \sqrt{2} \)  
   (d) \( 1 + \frac{1}{\sqrt{2}} \)

8. If \( K + 7 \sec^2 62^\circ - 7 \cot^2 28^\circ = 7 \sec 0^\circ \) then the value of \( K \) is _____
   (a) \( 1 \)  
   (b) \( 0 \)  
   (c) \( 7 \)  
   (d) \( \frac{1}{7} \)

9. The value of \( \cot \theta - \sin \left( \frac{\pi}{2} - \theta \right) \cos \left( \frac{\pi}{2} - \theta \right) \) is _____
   (a) \( \cot \theta \cos^2 \theta \)  
   (b) \( \cot^2 \theta \)  
   (c) \( \cos^2 \theta \)  
   (d) \( \tan^2 \theta \)

10. If \( \sin \theta - \cos \theta = 0 \), \( 0 \leq \theta \leq 90^\circ \) then the value of \( \theta \) is _____
    (a) \( \cos \theta \)  
    (b) \( 45^\circ \)  
    (c) \( 90^\circ \)  
    (d) \( \sin \theta \)

11. \( \frac{\sin \theta}{\sqrt{1 - \sin^2 \theta}} \) can be written as
12. If $\sin \theta = \frac{1}{2}$ then the value of $\sin \theta + \csc \theta$ is ______
   (a) 0  (b) 1  (c) $\frac{3}{2}$  (d) $\frac{5}{2}$

13. In an isosceles right-angled $\triangle ABC$, $\angle B = 90^\circ$. The value of $2 \sin A \cos A$ is _____
   (a) 1  (b) $\frac{1}{2}$  (c) $\frac{1}{\sqrt{2}}$  (d) $\sqrt{2}$

14. If $\frac{\sin^2 20^\circ + \sin^2 70^\circ}{2 \left( \cos^2 69^\circ + \cos^2 21^\circ \right)} = \frac{\sec 60^\circ}{K}$ then $K$ is _____
   (a) 1  (b) 2  (c) 3  (d) 4

15. $\triangle ABC \sim \triangle PRT$ and $\angle C = \angle R = 90^\circ$. If $\frac{AC}{AB} = \frac{3}{5}$ then $\sin T$ is ______
   (a) $\frac{3}{5}$  (b) $\frac{5}{3}$  (c) $\frac{4}{5}$  (d) $\frac{5}{4}$
SHORT ANSWER TYPE QUESTIONS

16. In \( \triangle PQR \), \( \angle Q = 90^\circ \) and \( \sin R = \frac{3}{5} \), write the value of \( \cos P \).

17. If \( A \) and \( B \) are acute angles and \( \sin A = \cos B \) then write the value of \( A + B \).

18. If \( 4 \cot \theta = 3 \) then write the value of \( \tan \theta + \cot \theta \).

19. Write the value of \( \cot^2 30^\circ + \sec^2 45^\circ \).

20. Write the value of \( \sin (90 - \theta) \cos \theta + \cos (90 - \theta) \sin \theta \).

21. If \( \theta = 30^\circ \) then write the value of \( \sin \theta + \cos^2 \theta \).

22. If \( 1 - \tan^2 \theta = \frac{2}{3} \) then what is the value of \( \theta \).

23. What is the value of \( 2 \csc^2 \theta + 3 \sec^2 \theta - 10 \) if \( \theta = 45^\circ \).

24. If \( \theta \) and \( \phi \) are complementary angles then what is the value of

\[
\csc \theta \sec \phi - \cot \theta \tan \phi
\]

25. If \( \tan (3x - 15^\circ) = 1 \) then what is the value of \( x \).

26. If \( 8 \cot \theta - 15 = 0 \) then what is the value of \( \frac{1 + \sin \theta}{\cos \theta} \).

LONG ANSWER TYPE QUESTIONS

27. Simplify:

\[
\tan^2 60^\circ + 4 \cos^2 45^\circ + 3 (\sec^2 30^\circ + \cos^2 90^\circ)
\]

28. Find the value of

\[
\frac{4 \sin 65^\circ}{5 \cos 25^\circ} - \frac{13 \cos 53^\circ \cdot \csc 37^\circ}{5 \left(7 \sec^2 32^\circ - 7 \cot^2 58^\circ \right)}.
\]

29. Prove that

\[
\csc^4 \theta - \csc^2 \theta = \cot^2 \theta + \cot^4 \theta.
\]
30. If \( \sin \theta + \sin^2 \theta = 1 \) then find the value of \( \cos^2 \theta + \cos^4 \theta \).

31. If \( \sin 2\theta = \cos (\theta - 36^\circ) \), \( 2\theta \) and \( \theta - 26^\circ \) are acute angles then find the value of \( \theta \).

32. If \( \sin (3x + 2y) = 1 \) and \( \cos (3x - 2y) = \frac{\sqrt{3}}{2} \), where \( 0 \leq (3x + 2y) \leq 90^\circ \) then find the value of \( x \) and \( y \).

33. If \( \sin (A + B) = \sin A \cos B + \cos A \sin B \) then find the value of
   (a) \( \sin 75^\circ \)
   (b) \( \cos 15^\circ \)

34. Prove that \( \frac{\cos A}{1 - \tan A} + \frac{\cos A}{1 - \cot A} = \cos A \), \( A \neq 45^\circ \).

35. Prove that \( \sqrt{\sec \theta - 1} + \sqrt{\sec \theta + 1} = 2 \cosec \theta \)

36. Find the value of
   \( \sin^2 5^\circ + \sin^2 10^\circ + \sin^2 15^\circ + \ldots + \sin^2 85^\circ \)

37. Prove that
   \( \frac{\tan \theta + \sec \theta - 1}{\tan \theta - \sec \theta + 1} = \frac{\cos \theta}{1 - \sin \theta} \).

38. If \( 2 \sin (3x - 15) = \sqrt{3} \) then find the value of
   \( \sin^2 (2x + 10) + \tan^2 (x + 5) \).

39. Find the value of \( \sin 60^\circ \) geometrically.

40. Let \( p = \tan \theta + \sec \theta \) then find the value of \( p + \frac{1}{p} \).

41. In right angled \( \triangle OPQ \), right angle at \( P \). \( OP = 7 \) cm and \( \angle Q = \alpha \). If \( \sec (90 - \alpha) - \tan (90 - \alpha) = \frac{1}{7} \) then what is the value of \( OQ - PQ \).
42. If \( \sin \alpha = a \sin \beta \) and \( \tan \alpha = b \tan \beta \) then prove that \( \cos^2 \alpha = \frac{a^2 - 1}{b^2 - 1} \).

43. If \( \theta \) is acute angle and \( 5 \sin^2 \theta + \cos^2 \theta = 4 \) then find the value of \( \theta \).

44. In an acute angled \( \triangle ABC \), if \( \sin (A + B - C) = \frac{1}{2} \) and \( \cos (B + C - A) = \frac{1}{\sqrt{2}} \) then find angles \( A, B \) and \( C \).

45. If \( A, B, C \) are the interior angles of a triangle \( ABC \), show that

\[
\sin \left( \frac{B + C}{2} \right) \cos \frac{A}{2} + \cos \left( \frac{B + C}{2} \right) \sin \frac{A}{2} = 1.
\]

**ANSWERS**

1. \( b \) 
2. \( a \)
3. \( c \) 
4. \( a \)
5. \( d \) 
6. \( b \)
7. \( a \) 
8. \( b \)
9. \( a \) 
10. \( b \)
11. \( d \) 
12. \( d \)
13. \( a \) 
14. \( d \)
15. \( a \) 
16. \( \cos P = \frac{3}{5} \)
17. \( 90^\circ \) 
18. \( \frac{25}{12} \)
19. \( 5 \) 
20. \( 1 \)
21. \( \frac{5}{4} \) 
22. \( 30^\circ \)
23. \(0\) 
24. \(1\) 
25. \(x = 20\).
26. \(\frac{5}{3}\) 
27. \(9\)  
28. \(\frac{3}{7}\) 
29. \(1\)  
30. \(20\), \(y = 15\)  
31. \(42^\circ\) 
32. \(x = 20, y = 15\)  
33. \(\frac{\sqrt{3} + 1}{2\sqrt{2}}, \frac{\sqrt{3} + 1}{2\sqrt{2}}\), take \(A = 45^\circ, B = 30^\circ\)  
34. –  
35. –  
36. \(\frac{17}{2}\)  
37. –  
38. \(\frac{13}{12}\)  
39. –  
40. \(2\ \text{sec}\ \theta\)  
41. \(1\)  
42. –  
43. \(60^\circ\)  
44. \(\angle A = 67.5^\circ, \angle B = 37.5^\circ, \angle C = 75^\circ\)
CHAPTER 6

STATISTICS

KEY POINTS

1. The mean for grouped data can be found by:

   (i) The direct method: \[ \bar{X} = \frac{\sum fixi \, fi}{\sum fi} \].

   (ii) The assumed mean method: \[ \bar{X} = a + \frac{\sum fid\, fi}{\sum fi} \], where \( d_i = x_i - a \).

   (iii) The step deviation method

   \[ \bar{X} = a + \frac{\sum fiui \, fi}{\sum fi} \times h, \text{ where } u_i = \frac{x_i - a}{h}. \]

2. The mode for the grouped data can be found by using the formula:

   \[ \text{mode} = l + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h \]

   \( l = \) lower limit of the model class.

   \( f_1 = \) frequency of the model class.

   \( f_0 = \) frequency of the proceeding class of the model class.

   \( f_2 = \) frequency of the succeeding class of the model class.

   \( h = \) size of the class interval.

Model class - class interval with highest frequency.
3. The median for the grouped data can be found by using the formula:

$$\text{median} = l + \left[ \frac{n/2 - Cf}{f} \right] \times h$$

- $l =$ lower limit of the median class.
- $n =$ number of observations.
- $Cf =$ cumulative frequency of class interval preceding the median class.
- $f =$ frequency of median class.
- $h =$ class size.

4. Empirical Formula: Mode = 3 median - 2 mean.

5. Cumulative frequency curve or an Ogive:

   (i) Ogive is the graphical representation of the cumulative frequency distribution.

   (ii) Less than type Ogive:

       - Construct a cumulative frequency table.
       - Mark the upper class limit on the $x$-axis.

   (iii) More than type Ogive:

       - Construct a frequency table.
       - Mark the lower class limit on the $x$-axis.

   (iv) To obtain the median of frequency distribution from the graph:

       - Locate point of intersection of less than type Ogive and more than type Ogive:

       Draw a perpendicular from this point of $x$-axis.

       - The point at which it cuts the $x$-axis gives us the median.
MULTIPLE CHOICE QUESTIONS

1. Mean of first 10 natural numbers is
   (a) 5   (b) 6
   (c) 5.5  (d) 6.5

2. If mean of 4, 6, 8, 10, x, 14, 16 is 10 then the value of ‘x’ is
   (a) 11   (b) 12
   (c) 13   (d) 9

3. The mean of x, x + 1, x + 2, x + 3, x + 4, x + 5 and x + 6 is
   (a) x   (b) x + 3
   (c) x + 4  (d) 3

4. The median of 2, 3, 2, 5, 6, 9, 10, 12, 16, 18 and 20 is
   (a) 9   (b) 20
   (c) 10   (d) 9.5

5. The median of 2, 3, 6, 0, 1, 4, 8, 2, 5 is
   (a) 1   (b) 3
   (c) 4   (d) 2

6. Mode of 1, 0, 2, 2, 3, 1, 4, 5, 1, 0 is
   (a) 5   (b) 0
   (c) 1   (d) 2

7. If the mode of 2, 3, 5, 4, 2, 6, 3, 5, 5, 2 and x is 2 then the value of ‘x’ is
   (a) 2   (b) 3
   (c) 4   (d) 5
8. The model class of the following distribution is

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>4</td>
<td>7</td>
<td>12</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>

(a) 30–35  (b) 20–25  
(c) 25–30  (d) 15–20

9. A teacher asks the student to find the average marks obtained by the class students in Maths the student will find

(a) mean  (b) median  
(c) mode  (d) sum

10. The empirical relationship between the three measures of central tendency is

(a) 3 mean = mode + 2 median  (b) 3 median = mode + 2 mean

(c) 3 mode = mean + 2 median  (d) median = 3 mode – 2 mean

11. Class mark of the class 19.5 – 29.5 is

(a) 10  (b) 49

(c) 24.5  (d) 25

12. Measure of central tendency is represented by the abscissa of the point where the ‘less than ogive’ and ‘more than ogive’ intersect is

(a) mean  (b) median

(c) mode  (d) None of these

13. The median class of the following distribution is

<table>
<thead>
<tr>
<th>Class Interval :</th>
<th>0–10</th>
<th>10–20</th>
<th>20–30</th>
<th>30–40</th>
<th>40–50</th>
<th>50–60</th>
<th>60–70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>10</td>
<td>12</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

(a) 20–30  (b) 40–50  
(c) 30–40  (d) 50–60

50  X – Maths
14. The mean of 20 numbers is 17, if 3 is added to each number, then the new mean is
   (a) 20  (b) 21
   (c) 22  (d) 24

15. The mean of 5 number is 18. If one number is excluded then their mean is 16, then the excluded number is
   (a) 23  (b) 24
   (c) 25  (d) 26

16. The mean of first 5 prime numbers is
   (a) 5.5  (b) 5.6
   (c) 5.7  (d) 5

17. The sum of deviations of the values 3, 4, 6, 8, 14 from their mean is
   (a) 0  (b) 1
   (c) 2  (d) 3

18. If median = 15 and mean = 16, then mode is
   (a) 10  (b) 11
   (c) 12  (d) 13

19. The mean of 11 observations is 50. If the mean of first six observations is 49 and that of last six observations is 52, then the sixth observation is
   (a) 56  (b) 55
   (c) 54  (d) 53

20. The mean of the following distribution is 2.6, then the value of 'x' is

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>4</td>
<td>5</td>
<td>x</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

   (a) 24  (b) 3
   (c) 8   (d) 13
LONG ANSWER TYPE QUESTIONS

21. The mean of 40 observations was 160. It was detected on rechecking that the value of 165 was wrongly copied as 125 for computing the mean. Find the correct mean.

22. Find ‘x’ if the median of the observations in ascending order 24, 25, 26, $x + 2$, $x + 3$, 30, 31, 34 is 27.5.

23. Find the median of the following data.

<table>
<thead>
<tr>
<th>$x$</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f$</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

24. Find the value of ‘p’, if mean of the following distribution is 7.5

<table>
<thead>
<tr>
<th>Variable</th>
<th>3</th>
<th>5</th>
<th>7</th>
<th>9</th>
<th>11</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>6</td>
<td>8</td>
<td>15</td>
<td>$p$</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

25. Find the mean of the following distribution.

<table>
<thead>
<tr>
<th>$x$</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
<th>28</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>$f$</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

26. Find the mean of the following distribution.

<table>
<thead>
<tr>
<th>Class</th>
<th>0–10</th>
<th>10–20</th>
<th>20–30</th>
<th>30–40</th>
<th>40–50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>8</td>
<td>12</td>
<td>10</td>
<td>11</td>
<td>9</td>
</tr>
</tbody>
</table>

27. From the cumulative frequency table, write the frequency of the class 20–30.

<table>
<thead>
<tr>
<th>Marks</th>
<th>Number of Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10</td>
<td>1</td>
</tr>
<tr>
<td>Less than 20</td>
<td>14</td>
</tr>
</tbody>
</table>

52  X – Maths
28. Following is a cumulative frequency curve for the marks obtained by 40 students as shown in figure. Find the median marks obtained by the student.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 30</td>
<td>36</td>
</tr>
<tr>
<td>Less than 40</td>
<td>59</td>
</tr>
<tr>
<td>Less than 50</td>
<td>60</td>
</tr>
</tbody>
</table>

29. The following ‘more than ogive’. Shows the weight of 40 students of a class. What is the lower limit of the median class.
30. The mean of the following frequency distribution is 62.8 and the sum of all the frequencies is 50. Find the values of \( x \) and \( y \).

<table>
<thead>
<tr>
<th>Class Interval</th>
<th>0–20</th>
<th>20–40</th>
<th>40–60</th>
<th>60–80</th>
<th>80–100</th>
<th>100–120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>5</td>
<td>( x )</td>
<td>10</td>
<td>( y )</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

31. The following frequency distribution gives the daily wage of a worker of a factory. Find mean daily wage of a worker.

<table>
<thead>
<tr>
<th>Daily Wage (in ₹)</th>
<th>Number of Workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 300</td>
<td>0</td>
</tr>
<tr>
<td>More than 250</td>
<td>12</td>
</tr>
<tr>
<td>More than 200</td>
<td>21</td>
</tr>
<tr>
<td>More than 150</td>
<td>44</td>
</tr>
<tr>
<td>More than 100</td>
<td>53</td>
</tr>
<tr>
<td>More than 50</td>
<td>59</td>
</tr>
<tr>
<td>More than 0</td>
<td>60</td>
</tr>
</tbody>
</table>

32. The median of the following frequency distribution is 28.5 and sum of all the frequencies is 60. Find the values of \( x \) and \( y \).

<table>
<thead>
<tr>
<th>Class Interval</th>
<th>0–10</th>
<th>10–20</th>
<th>20–30</th>
<th>30–40</th>
<th>40–50</th>
<th>50–60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>5</td>
<td>( x )</td>
<td>20</td>
<td>15</td>
<td>( y )</td>
<td>5</td>
</tr>
</tbody>
</table>

33. Find the mean, median and mode of the following:

<table>
<thead>
<tr>
<th>Class Interval</th>
<th>0–10</th>
<th>10–20</th>
<th>20–30</th>
<th>30–40</th>
<th>40–50</th>
<th>50–60</th>
<th>60–70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>15</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

34. The following frequency distribution shows the marks obtained by 100 students in a school. Find the mode.

<table>
<thead>
<tr>
<th>Marks</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 10</td>
<td>10</td>
</tr>
<tr>
<td>Less than 20</td>
<td>15</td>
</tr>
</tbody>
</table>

54

X – Maths
35. **Draw ‘less than’ and ‘more than’ ogives for the following distribution**

<table>
<thead>
<tr>
<th>Marks</th>
<th>0–10</th>
<th>10–20</th>
<th>20–30</th>
<th>30–40</th>
<th>40–50</th>
<th>50–60</th>
<th>60–70</th>
<th>70–80</th>
<th>80–90</th>
<th>90–100</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Students</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>15</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>5</td>
</tr>
</tbody>
</table>

Also find median from graph.

36. **A survey regarding the height (in cm) of 50 students of class x of a school was conducted and regarding the following data was obtained.**

<table>
<thead>
<tr>
<th>Height (in cm)</th>
<th>120–130</th>
<th>130–140</th>
<th>140–150</th>
<th>150–160</th>
<th>160–170</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Students</td>
<td>2</td>
<td>8</td>
<td>12</td>
<td>20</td>
<td>8</td>
<td>50</td>
</tr>
</tbody>
</table>

Find the mean, median and mode of the above data.

37. **The mode of the following distribution is 65. Find the values of x and y, if sum of the frequencies is 50.**

<table>
<thead>
<tr>
<th>Class Interval</th>
<th>0–20</th>
<th>20–40</th>
<th>40–60</th>
<th>60–80</th>
<th>80–100</th>
<th>100–120</th>
<th>120–140</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>6</td>
<td>8</td>
<td>x</td>
<td>12</td>
<td>6</td>
<td>y</td>
<td>3</td>
</tr>
</tbody>
</table>

38. **During the medical checkup of 35 students of class ‘X’ their weights recorded as follows :**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Students</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>14</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

find mean median and mode of the above data.
39. The weekly observations on cost of living index is a city for the year 2008-2009 are given below:

<table>
<thead>
<tr>
<th>Cost of Living Index</th>
<th>No. of Weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>140–150</td>
<td>5</td>
</tr>
<tr>
<td>150–160</td>
<td>10</td>
</tr>
<tr>
<td>160–170</td>
<td>20</td>
</tr>
<tr>
<td>170–180</td>
<td>9</td>
</tr>
<tr>
<td>180–190</td>
<td>6</td>
</tr>
<tr>
<td>190–200</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>52</td>
</tr>
</tbody>
</table>

Find the mean weekly cost of living index.

40. Find the mode of the following distribution

<table>
<thead>
<tr>
<th>Class</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>3–6</td>
<td>2</td>
</tr>
<tr>
<td>6–9</td>
<td>5</td>
</tr>
<tr>
<td>9–12</td>
<td>10</td>
</tr>
<tr>
<td>12–15</td>
<td>023</td>
</tr>
<tr>
<td>15–18</td>
<td>21</td>
</tr>
<tr>
<td>18–21</td>
<td>12</td>
</tr>
<tr>
<td>21–24</td>
<td>3</td>
</tr>
</tbody>
</table>

**ANSWERS**

1. 1. c
2. b
3. b
4. a
5. b
6. c
7. a
8. b
9. a
10. b
11. c
12. b
13. c
14. a
15. d
16. b
17. a
18. d
19. a
20. c
21. 161
22. x = 25
23. 14.8
24. p = 3
25. 20
26. 25.2
<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>27.</td>
<td>22</td>
<td>28.</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>147.5</td>
<td>30.</td>
<td>$x = 8, y = 12$</td>
<td></td>
</tr>
<tr>
<td>31.</td>
<td>₹ 182.50</td>
<td>32.</td>
<td>$x = 8, y = 7$</td>
<td></td>
</tr>
<tr>
<td>33.</td>
<td>Mean = 30, Median = 30.67, Mode = 33.33</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34.</td>
<td>41.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35.</td>
<td>47.3 (Approx)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36.</td>
<td>Mean = 149.8 cm, Median = 151.5 cm, Mode = 154 cm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37.</td>
<td>$x = 10, y = 5.$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38.</td>
<td>Mean = 45.8, Median = 46.5, Mode = 47.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39.</td>
<td>166.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40.</td>
<td>14.6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### DESIGN OF SAMPLE QUESTION PAPER

**MATHEMATICS, SA - 1**

<table>
<thead>
<tr>
<th>Type of Question</th>
<th>Marks per Question</th>
<th>Total No. of Questions</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>MCQ</td>
<td>1</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>SA - I</td>
<td>2</td>
<td>8</td>
<td>16</td>
</tr>
<tr>
<td>SA - II</td>
<td>3</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>LA</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>34</strong></td>
<td><strong>80</strong></td>
</tr>
</tbody>
</table>

### BLUE PRINT

**SAMPLE QUESTION PAPER**

<table>
<thead>
<tr>
<th>Topic/Unit</th>
<th>MCQ</th>
<th>SA (I)</th>
<th>SA (II)</th>
<th>LA</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number System</td>
<td>2 (2)</td>
<td>1 (2)</td>
<td>2 (6)</td>
<td>–</td>
<td>5 (10)</td>
</tr>
<tr>
<td>Algebra</td>
<td>2 (2)</td>
<td>2 (4)</td>
<td>2 (6)</td>
<td>2 (8)</td>
<td>8 (20)</td>
</tr>
<tr>
<td>Geometry</td>
<td>1 (1)</td>
<td>2 (4)</td>
<td>2 (6)</td>
<td>1 (4)</td>
<td>6 (15)</td>
</tr>
<tr>
<td>Trigonometry</td>
<td>4 (4)</td>
<td>1 (2)</td>
<td>2 (6)</td>
<td>2 (8)</td>
<td>9 (20)</td>
</tr>
<tr>
<td>Statistics1</td>
<td>2 (4)</td>
<td>2 (6)</td>
<td>1 (4)</td>
<td>6 (15)</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>10 (10)</td>
<td>8 (16)</td>
<td>10 (30)</td>
<td>6 (24)</td>
<td>34 (80)</td>
</tr>
</tbody>
</table>

**Note**: Marks are within brackets.
SAMPLE QUESTION PAPER

MATHEMATICS, SA - 1

Time allowed : 3 to 3½ hours
Maximum Marks : 80

General Instructions

1. All question are compulsory.
2. The question paper consists of 34 questions divided into four sections A, B, C and D. Section A comprises of 10 questions of 1 mark each. Section B comprises of 8 questions of 2 marks each. Section C comprises of 10 questions of 3 marks each and Section D comprises of 6 questions of 4 marks each.
3. Question numbers 1 to 10 in Section A are multiple choice questions where you are to select one correct option out of the given four.
4. There is no overall choice. How ever, internal choice has been provided in 1 question of 2 marks 3 questions of three marks each and 2 questions of 4 marks each. You have to attempt only one of the alternatives in all such questions.
5. Use of calculators is not permitted.

SECTION A

Question number 1 to 10 are of 1 mark each

1. \( \triangle ABC \) is right angled at \( A \). The value of \( \tan B \cdot \tan C \) is _______
   
   (a) \( \tan B \)  
   (b) \( \tan C \)  
   (c) 0  
   (d) 1

2. In Euclid Division Lemma, when \( x = yq + r \), where \( x \) and \( y \) are positive integers which one is correct.
3. If the mean of 2, 4, 6, 8, 10, x, 14, 16 is 9 then the value of x is
   (a) 10  (b) 11  (c) 12  (d) 13

4. Graph of \( y = ax^2 + bx + c \) intersects x-axis at 2 distinct points if
   (a) \( b^2 - 4ac = 0 \)  (b) \( b^2 - 4ac > 0 \)
   (c) \( b^2 - 4ac < 0 \)  (d) \( b^2 - 4ac \geq 0 \)

5. If \( \sin 3\theta = \frac{\sqrt{3}}{2} \), \( 0^\circ < \theta < 90^\circ \) then the value of \( \theta \) is ____
   (a) 0°  (b) 20°  (c) 30°  (d) 60°

6. The modal class of the following distribution is

<table>
<thead>
<tr>
<th>Class Interval</th>
<th>10–20</th>
<th>20–30</th>
<th>30–40</th>
<th>40–50</th>
<th>50–60</th>
</tr>
</thead>
<tbody>
<tr>
<td>60–70</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>70–80</td>
<td>4</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   (a) 70–80  (b) 40–50  (c) 50–60  (d) 30–40

7. If product of the zeroes is 5 and sum of the zeroes is −2 then the quadratic polynomial will be–
   (a) \( x^2 - 5x - 2 \)  (b) \( x^2 + 5x - 2 \)
   (c) \( x^2 + 2x - 5 \)  (d) \( x^2 + 2x + 5 \)

8. The relationship in mean, median and mode is
   (a) Mode = 2 median − 3 mean  (b) Mode = 2 median - mean
(c) Mode = 3 median + 2 mean (d) Mode = 3 median – 2 mean

9. The coordinates of the point where y-axis and the line represented by \( \frac{x}{2} + \frac{y}{3} = 1 \) intersect are:
   (a) (0, 2)   (b) (2, 0)
   (c) (0, 3)   (d) (3, 0)

10. If \( x = \tan 2^\circ \cdot \tan 36^\circ \cdot \tan 54^\circ \cdot \tan 88^\circ \) then the value of \( x \) is ______
    (a) 45°   (b) 1
    (c) 2   (d) 90°

SECTION B

Question number 11 to 18 are of 2 marks each


12. Find the mean of the following distribution:

<table>
<thead>
<tr>
<th>( x )</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
<th>28</th>
<th>32</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f )</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

13. In \( \triangle ABC \), \( D \) is the mid point of the side \( AB \) and \( DE \parallel BC \) meets \( AC \) at \( E \).
   Prove that \( AE = \frac{1}{2} AC \).

   OR

   If \( \triangle ABC \sim \triangle DEF \), \( BC = 5 \text{ cm}, EF = 4 \text{ cm} \) and \( ar(\triangle ABC) = 75 \text{ cm}^2 \). Find
   the area of \( \triangle DEF \).

14. If sum of the zeroes of \( kx^2 + 5x + k \) is equal to the product of the zeroes.
   Find value of \( k \).

15. Draw ‘less than ogive’ for the following distribution:

<table>
<thead>
<tr>
<th>Class Interval</th>
<th>0–10</th>
<th>10–20</th>
<th>20–30</th>
<th>30–40</th>
<th>40–50</th>
<th>50–60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>5</td>
<td>8</td>
<td>12</td>
<td>10</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>

\( X – Maths \)

61
16. Without using trigonometric tables, evaluate

\[ 3 \left( \frac{\sin 54^\circ}{\cos 36^\circ} \right)^2 + 2 \tan 14^\circ \tan 30^\circ \tan 76^\circ. \]

17. For what value of \( p \), the pair of linear equations

\[ y - 2x - 5 = 0 \]
\[ px = 2y \]

has unique solution.

18. If \( \sin \theta = \frac{1}{6} \), \( 0^\circ < \theta < 90^\circ \) then evaluate \( \sec \theta + \tan \theta \).

**SECTION C**

Question number 19 to 28 carry 3 marks each

19. Check graphically whether the pair of linear equations \( x - 2y = 4 \) and \( x - y = 3 \) is consistent. Is this pair dependent also.

20. Prove that \( \frac{1}{5 - 2\sqrt{3}} \) is irrational.

OR

Prove \( \sqrt{5} - \sqrt{2} \) that is irrational.

21. In \( \triangle ABC \), \( \angle C = 90^\circ \) points \( P \) and \( Q \) lies on sides \( CA \) and \( CB \) respectively prove that

\[ AQ^2 + BP^2 = AB^2 + PQ^2 \]

22. In figure, find \( x \) if \( DE \parallel BC \)
In the figure $ABCD$ is a trapezium. Find the value of $x$.

23. Solve for $x$ and $y$:
\[ \frac{2}{x - 1} + \frac{3}{y + 1} = 2 \]
\[ \frac{3}{x - 1} + \frac{2}{y + 1} = \frac{13}{6} \]
$x \neq 1$, $y \neq -1$

24. Find the other two factors of $2x^4 - 3x^3 - 3x^2 + 6x - 2$ if two of its factors are $(x - \sqrt{2})$ and $(x + \sqrt{2})$.

25. Prove that $(1 + \tan A \tan B)^2 + (\tan A - \tan B)^2 = \sec^2 A \sec^2 B$ where $A$ and $B$ are acute angles of a triangle.

OR

Prove this $(1 + \cot \theta - \cosec \theta) (1 + \tan \theta + \sec \theta) = 2$.

26. In the adjoining figure prove that $\sin \theta = \frac{1}{\sqrt{10}}$.
27. Find Geometrically the value of \( \sin 30^\circ \).

28. Equiangular triangles are drawn on sides of right angled triangle in which perpendicular is double of the base. Show that the area of the triangle on the hypotenuse is the sum of the areas of the other two triangles.

SECTION D

Question number 29 to 34 carry 4 marks each

29. Show that the square of any positive integer is of the form \( 5q, 5q + 1, 5q + 4 \) for some positive integer \( q \).

30. In three digit number, the digit at the hundred's place is three times the digit at one's place. The sum of the digits is 15. If the digits are reversed the number is reduced by 396. Find the original number.

OR

A family of 4 members is travelling in railways 3 tier coach another family of 3 members is travelling in 2 tier coach. The combined fare of both the families is Rs. 5100. If first family had 1 member less and the second had 1 member more, the total fare would have been Rs. 300 more. What will be the fare for a complex in railways 2-tier coach for the same journey.

31. \( \Delta ABC \) is an acute angled triangle. If \( \tan (A + B - C) = 1 \) and \( \sec (B + C - A) = 2 \) find \( \angle A, \angle B, \) and \( \angle C \).

32. If the median of the following distribution is 28.5, than find the values of \( x \) and \( y \).

<table>
<thead>
<tr>
<th>Class Interval</th>
<th>0–10</th>
<th>10–20</th>
<th>20–30</th>
<th>30–40</th>
<th>40–50</th>
<th>50–60</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>5</td>
<td>( x )</td>
<td>20</td>
<td>15</td>
<td>( y )</td>
<td>5</td>
<td>60</td>
</tr>
</tbody>
</table>

33. Find the mode of the following distribution.

<table>
<thead>
<tr>
<th>Marks</th>
<th>0–10</th>
<th>10–20</th>
<th>20–30</th>
<th>30–40</th>
<th>40–50</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Students</td>
<td>5</td>
<td>15</td>
<td>20</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>

34. Prove that in a right angled triangle, the square of the hypotenuse is equal to the sum of the squares on the other two sides.
### ANSWERS

1. $d$  
2. $a$  
3. $c$  
4. $b$  
5. $b$  
6. $b$  
7. $d$  
8. $d$  
9. $c$  
10. $b$  
11. $3$  
12. $20$  
13. $48 \text{ cm}^2$  
14. $k = -5$  
15. $3 + \frac{2}{\sqrt{3}}$  
16. $p \neq 4$  
17. $\frac{7}{\sqrt{35}}$  
18. $\frac{7}{\sqrt{35}}$  
19. Yes, no  
20. $x = 11, y = 8\sqrt{x} = 9$  
21. $x = 3, y = 2$  
22. $(2x - 1) (x - 1)$  
23. $x = 3, y = 2$  
24. $x = 8, y = 7$  
25. $22.9$  
26. –  
27. $672 \text{ OR } [\text{Rs. 800, Rs. 900}] \text{ Rs. 1800}$  
28. $\angle A = 60^\circ, \angle B = 52.5^\circ, \angle C = 67.5^\circ$  
29. $x = 8, y = 7$  
30. $22.9$  
31. $22.9$
SAMPLE QUESTION PAPER

MATHEMATICS, SA - 1

Time allowed : 3 to 3½ hours
Maximum Marks : 80

General Instructions
1. All question are compulsory.
2. The question paper consists of 34 questions divided into four sections A, B, C and D. Section A comprises of 10 questions of 1 mark each. Section B comprises of 8 questions of 2 marks each. Section C comprises of 10 questions of 3 marks each and Section D comprises of 6 questions of 4 marks each.
3. Question numbers 1 to 10 in Section A are multiple choice questions where you are to select one correct option out of the given four.
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5. Use of calculators is not permitted.

SECTION A

Question number 1 to 10 are of 1 mark each

1. Euclid's Division Lemma states that for any two positive integers $a$ and $b$, there exists unique integers $q$ and $r$ such that $a = bq + r$ where $r$ must satisfy:

   (a) $0 < r < b$   
   (b) $0 \leq r \leq b$
   (c) $0 < r \leq b$   
   (d) $0 \leq r \leq b$
2. In Fig. 1, the graph of a polynomial \( p(x) \) is shown. The number of zeroes of \( p(x) \) is:

![Fig. 1](image)

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

3. In Fig. 2, if \( DE \parallel BC \), then \( x \) equals:

![Fig. 2](image)

(a) 3 cm  
(b) 2 cm  
(c) 4 cm  
(d) \( \frac{20}{3} \) cm

4. If \( \sin(\theta + 36^\circ) = \cos \theta \) where \( \theta \) and \( \theta + 36^\circ \) are acute angles, then value of \( \theta \) is

(a) 36°  
(b) 54°  
(c) 27°  
(d) 90°

5. If \( 3 \cos \theta = 2 \sin \theta \) then the value of \( \frac{4 \sin \theta - 3 \cos \theta}{2 \sin \theta + 6 \cos \theta} \) is:

---

**X – Maths** 67
6. In fig. 3, $\triangle ABC$ is right angled at $B$ and $\tan A = \frac{4}{3}$. If $AC = 15$ cm the length of $BC$ is:

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

7. The decimal expansion of $\frac{21}{24}$ will terminate after how many places of decimal?

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

8. The pair of linear equations $x - 2y = 5$ and $2x - 4y = 10$ have:

(a) Many Solutions  
(b) No Solution  
(c) One Solution  
(d) Two Solution

9. If $\tan A = \cot B = \frac{15}{7}$ then $A + B$ is equal to:

(a) zero  
(b) $90^\circ$  
(c) $< 90^\circ$  
(d) $> 90^\circ$
10. For a given data with 50 observations 'the less than Ogive' and the 'more than 'Ogive' intersect at (38.5, 34). The median of the data is :

(a) 38.5  
(b) 34  
(c) 50  
(d) 4.5

SECTION B

Question number 11 to 18 are of 2 marks each

11. Is $7 \times 11 \times 13 + 11$ a composite number? Justify your answer.

12. Can $(x + 2)$ be the remainder on division of a polynomial $p(x)$ by $(2x - 5)$. Justify your answer.

13. In Fig. 4, ABCD is a rectangle. Find the value of $x$ and $y$.

![Diagram of a rectangle with sides labeled x and y, and opposite sides labeled 16 and 22.]

Fig. 4

14. If $\sin (A + B) = 1$ and $\cos (A - B) = 1$, $0^\circ \leq A + B \leq 90^\circ$, find $A$ and $B$.

OR

If $\cot \theta = \frac{7}{8}$, evaluate $\frac{(1 + \sin \theta)(1 - \sin \theta)}{(1 + \cos \theta)(1 - \cos \theta)}$.

15. $ABCD$ is a trapezium in which $AB \parallel DC$ and its diagonals intersect each other at $O$. Prove that $\frac{AO}{BO} = \frac{CO}{DO}$.

16. In Fig. 5, $\angle S = 90^\circ$, $PQ = 10$ cm, $QS = 6$ cm and $RQ = 6$ cm. Calculate the length $PR$. 

$X - Maths$ 69
17. The following table shows the distribution of the heights of a group of 50 factory workers.

<table>
<thead>
<tr>
<th>Height (in cm)</th>
<th>150-155</th>
<th>155-160</th>
<th>160-165</th>
<th>165-170</th>
<th>170-175</th>
<th>175-180</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Workers</td>
<td>8</td>
<td>14</td>
<td>20</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Convert the distribution to a less than type cumulative frequency distribution.

18. Find the mode of the following distribution:

<table>
<thead>
<tr>
<th>Height (in cm)</th>
<th>30-40</th>
<th>40-50</th>
<th>50-60</th>
<th>60-70</th>
<th>70-80</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Plants</td>
<td>4</td>
<td>3</td>
<td>8</td>
<td>11</td>
<td>8</td>
</tr>
</tbody>
</table>

SECTION C

Question number 19 to 28 carry 3 marks each

19. Show that the square of any positive integer is of the form $3q$ or $3q + 1$ for some integer $q$:

20. Prove that $\frac{3\sqrt{2}}{5}$ is irrational.

OR

Prove $(5 + \sqrt{3})$ is irrational.

21. A person starts his job with a certain monthly salary and earns a fixed increment every year. If his salary was Rs. 4500 after 4 years of service and Rs. 5400 after ten years of service, find his initial salary and the annual increment.

OR

After five years the age of Sudama will be three times that of his son. Five years ago Sudama was seven times that of his son. What are their present age?

22. If $\alpha$, $\beta$ are the zeroes of the polynomial $3x^2 + 5x - 2$ then form a quadratic polynomials whose zeroes are $2\alpha$ and $2\beta$.

23. Prove that $\frac{\cot A - \cos A}{\cot A + \cos A} = \frac{\csc A - 1}{\csc A + 1}$. 

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24. If $\cos \theta - \sin \theta = \sqrt{2} \sin \theta$ then prove that $\cos \theta + \sin \theta = \sqrt{2} \cos \theta$.

25. In Fig. $AD \perp BC$. Prove that $AB^2 + CD^2 = BD^2 + AC^2$.

26. Prove that the area of an equilateral triangle on the side of a square is half the area of an equilateral triangle formed on its diagonal.

27. Find mean of the following frequency distribution using step deviation method:

<table>
<thead>
<tr>
<th>Classes</th>
<th>25-30</th>
<th>30-35</th>
<th>35-40</th>
<th>40-45</th>
<th>45-50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>7</td>
<td>14</td>
<td>22</td>
<td>16</td>
<td>11</td>
</tr>
</tbody>
</table>

OR

The mean of the following frequency distribution is 47. Find the value of $p$:

<table>
<thead>
<tr>
<th>Classes</th>
<th>0-20</th>
<th>20-40</th>
<th>40-60</th>
<th>60-80</th>
<th>80-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>5</td>
<td>15</td>
<td>20</td>
<td>$p$</td>
<td>5</td>
</tr>
</tbody>
</table>

28. Find the median of the following data:

<table>
<thead>
<tr>
<th>Classes</th>
<th>40-45</th>
<th>45-50</th>
<th>50-55</th>
<th>55-60</th>
<th>60-65</th>
<th>65-70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>2</td>
<td>3</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>5</td>
</tr>
</tbody>
</table>

**SECTION D**

Question number 29 to 34 carry 4 marks each

29. Find all the zeroes of $2x^4 + 7x^3 + 19x^2 - 14x + 30$ given that two of its zeroes are $\sqrt{2}$ and $-\sqrt{2}$.

30. Prove that in a right triangle the square of the hypotenuse is equal to the sum of the squares of the other two sides:
OR

Prove that the ratio of the areas of two similar triangles is equal to the squares of the ratio of their corresponding sides.

31. Prove that $\cos^8 \theta - \sin^8 \theta = (\cos^2 \theta - \sin^2 \theta) (1 - 2\sin^2 \theta \cos^2 \theta)$:

OR

Find the value of:

$$\tan (90^\circ - \theta) \cot \theta - \sec (90^\circ - \theta) \cosec \theta + \frac{3(\cot^2 27^\circ - \sec^2 63^\circ)}{\cot 26^\circ \cot 41^\circ \cot 45^\circ \cot 49^\circ \cot 64^\circ}$$

32. Prove that: $\frac{\cos A}{1 - \tan A} + \frac{\sin A}{1 - \cot A} = \sin A + \cos A$.

33. Solve graphically: $4x - y = 4, \ 4x + y = 12$.

(a) Find the solution from the graph.

(b) Shade the triangle region formed by the lines and the $x$-axis:

34. The following distribution gives the heights of 100 pupils in a school:

<table>
<thead>
<tr>
<th>Height (in cm)</th>
<th>120-130</th>
<th>130-140</th>
<th>140-150</th>
<th>150-160</th>
<th>160-170</th>
<th>170-180</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Pupils</td>
<td>12</td>
<td>16</td>
<td>30</td>
<td>20</td>
<td>14</td>
<td>8</td>
</tr>
</tbody>
</table>

Change the above distribution to more than type distribution and draw its Ogive.

**ANSWERS**

1. B
2. A
3. D
4. C
5. B
6. C
7. C
8. A
9. B
10. A
11. Yes  
12. No  
13. $x = 19, y = 3$  
14. $A = 45^\circ, B = 45^\circ$ or $\frac{49}{64}$.  
16. 17 cm.  
18. 65  
21. ₹ 3900, ₹ 150  
22. $3x^2 + 10x - 8$  
27. $38.3$ or $p = 12$.  
28. $58.8$  
29. $\sqrt{2}, -\sqrt{2}, 5, -3/2$.  
33. $x = 2, y = 4$.  

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*Sample Paper II*  

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CHAPTER 1

QUADRATIC EQUATIONS

KEY POINTS

1. The equation $ax^2 + bx + c = 0$, $a \neq 0$ is the standard form of a quadratic equation, where $a$, $b$ and $c$ are real numbers.

2. A real number $\alpha$ is said to be a root of the quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$. If $a\alpha^2 + b\alpha + c = 0$, the zeros of quadratic polynomial $ax^2 + bx + c$ and the roots of the quadratic equation $ax^2 + bx + c = 0$ are the same.

3. If we can factorise $ax^2 + bx + c = 0$, $a \neq 0$ into product of two linear factors, then the roots of the quadratic equation can be found by equating each factors to zero.

4. The roots of a quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ are given by
   
   $$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \text{ provided that } b^2 - 4ac \geq 0.$$  

5. A quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$, has ___
   
   (a) Two distinct and real roots, if $b^2 - 4ac > 0$.
   (b) Two equal and real roots, if $b^2 - 4ac = 0$.
   (c) Two roots are not real, if $b^2 - 4ac < 0$.

6. A quadratic equation can also be solved by the method of completing the square.
   
   (i) $a^2 + 2ab + b^2 = (a + b)^2$
   (ii) $a^2 - 2ab + b^2 = (a - b)^2$

7. Discriminant of the quadratic equation $ax^2 + bx + c = 0$, $a \neq 0$ is given by $D = b^2 - 4ac$. 

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MULTIPLE CHOICE QUESTIONS

1. The general form of a quadratic equation is \( a \neq 0 \)
   (a) \( ax^2 + bx + c \)  \hspace{1cm} (b) \( ax^2 + bx + c = 0 \)
   (c) \( ax + b \)  \hspace{1cm} (d) \( ax + b = 0 \)

2. Number of solutions of a quadratic equation are :
   (a) 0  \hspace{1cm} (b) 1  \hspace{1cm} (c) 2  \hspace{1cm} (d) 3

3. If one root of \( x^2 - 3x + a = 0 \), is 1, then value of \( a \) is
   (a) 2  \hspace{1cm} (b) -2  \hspace{1cm} (c) 2  \hspace{1cm} (d) -4

4. Discriminant of a quadratic equation \( ax^2 + bx + c = 0 \) is given by
   (a) \( \sqrt{b^2 - 4ac} \)  \hspace{1cm} (b) \( \sqrt{b^2 + 4ac} \)
   (c) \( b^2 - 4ac \)  \hspace{1cm} (d) \( b^2 + 4ac \)

5. Which is a quadratic equation?
   (a) \( x + \frac{1}{x} = 2 \)  \hspace{1cm} (b) \( x^2 + 1 = (x + 3)^2 \)
   (c) \( x(x + 2) \)  \hspace{1cm} (d) \( x + \frac{1}{x} \).

6. If the roots of a quadratic equation are 2 and 3, then the equation is
   (a) \( x^2 + 5x + 6 = 0 \)  \hspace{1cm} (b) \( x^2 + 5x - 6 = 0 \)
   (c) \( x^2 - 5x - 6 = 0 \)  \hspace{1cm} (d) \( x^2 - 5x + 6 = 0 \)

7. Roots of the equations \( x^2 - 3x + 2 = 0 \) are
   (a) 1, -2  \hspace{1cm} (b) -1, 2
   (c) -1, -2  \hspace{1cm} (d) 1, 2
8. If the roots of a quadratic equation are equal, than discriminant is
   (a) 1          (b) 0
   (c) greater than 0  (d) less than zero.

9. If one root of $2x^2 + kx + 1 = 0$ is $-\frac{1}{2}$, then the value of ‘$k$’ is
   (a) 3          (b) $-3$
   (c) 5          (d) $-5$

10. The sum of the roots of the quadratic $5x^2 - 6x + 1 = 0$ is
    (a) $\frac{6}{5}$  (b) $\frac{1}{5}$
    (c) $-\frac{5}{6}$  (d) $-\frac{1}{5}$

11. The produce of the roots of the quadratic equation $2x^2 + 5x - 7 = 0$ is
    (a) $\frac{5}{2}$  (b) $-\frac{7}{2}$
    (c) $-\frac{5}{2}$  (d) $\frac{7}{2}$

12. If the roots of the quadratic $2x^2 + kx + 2 = 0$ are equal then the value of ‘$k$’ is
    (a) 4          (b) $-4$
    (c) $\pm 4$    (d) $\pm 16$

13. If the roots of $4x^2 + 3px + 9 = 0$ are real and distinct then, the value of $p$ is
    (a) $p \geq -4$ or $p \leq 4$   (b) $p < -4$ or $p > 4$
    (c) $p \leq -4$ or $p \leq 4$   (d) $p \leq -4$ or $p \geq 4$
14. If the sum and product of roots of a quadratic equation are $\frac{7}{2}$ and $\frac{5}{2}$ respectively, then the equation is

(a) $2x^2 + 7x + 5 = 0$ (b) $2x^2 - 7x + 5 = 0$
(c) $2x^2 - 7x - 5 = 0$ (d) $2x^2 + 7x - 5 = 0$

15. The roots of the equation $3x^2 - 7x + 4 = 0$ are

(a) rationals (b) irrationals
(c) positive intepers (d) negative intepers

**SHORT ANSWER TYPE QUESTIONS**

16. If one root of the equation $x^2 + 7x + k = 0$ is $-2$, then finds the value of $k$ and other root.

17. For what value of ‘$k$’ the equation $2x^2 + kx + 3 = 0$ has equal roots?

18. For what value of ‘$p$’, the equation $3x^2 + px + 3 = 0$ has real roots?

19. The product of two consecutive odd integers is 63. Represent this in form of a quadratic equation.

20. Find the roots of the equation: $x + \frac{1}{x} = 4 \frac{1}{4}$, $x \neq 0$.

21. Find the roots of the equation: $\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$.

22. Divide 51 in to two parts such that their product is 378.

23. Find ‘$k$’ so that $(k - 12) x^2 + 2 (k - 12) x + 2 = 0$ has equal roots. $(k \neq 12)$.

24. Find the roots of the following, by the method of completing the square.

(a) $2x^2 - 5x + 3 = 0$
(b) $3x^2 + 5x + 1 = 0$

25. Find the roots of the equation

$$\frac{1}{x + 2} - \frac{1}{x} = 3, x \neq -2, x \neq 0.$$
26. Find two consecutive odd positive integers, sum of whose squares is 394.

27. If the roots of the equation \((b - c)x^2 + (c - a)x + (a - b) = 0\) are equal, then prove that \(2b = a + c\).

28. Find the nature of the roots of the following quadratic equations. If roots are real, find them.

   (a) \(5x^2 - 3x + 2 = 0\).

   (b) \(2x^2 - 9x + 9 = 0\).

29. Sum of two numbers is 15, if sum of their reciprocal is \(\frac{3}{10}\). Find the numbers.

30. Solve the following quadratic equations

   \(x^2 - 8x + 16 = 0\)

31. \(a^2x^2 + (a^2 - b^2)x - b^2 = 0\).

32. \(4\sqrt{3}x^2 + 5x - 2\sqrt{3} = 0\).

33. \(abx^2 + (b^2 - ac)x - bc = 0\).

34. \(\frac{x - 1}{x - 2} + \frac{x - 3}{x - 4} = \frac{10}{3}\), \(x \neq 2, x \neq 4\).

35. \(\frac{1}{x + 4} - \frac{1}{x - 7} = \frac{11}{30}\), \(x \neq -4, x \neq 7\).

36. \(3x^2 + 2\sqrt{5}x - 5 = 0\).

37. \(\frac{1}{a} + \frac{1}{b} + \frac{1}{x} = \frac{1}{a + b + x}\), \(a \neq 0, b \neq 0, x \neq 0, x \neq -(a + b)\).

38. A two digit number is such that the product of digit is 35, when 18 is added to the number, the digits inter change their places. Find the number.

39. Find two numbers whose sum is 27 and product is 182.

40. A motor boat whose speed is 9 km/h in still water goes 12 km down stream and comes back in a total time 3 hours. Find the speed of the stream.
41. A train travels 360 km at uniform speed. If the speed had been 5 km/hr more it would have taken 1 hour less for the same journey. Find the speed of the train.

42. The hypotenuse of right angled triangle is 6 cm more than twice the shortest side. If the third side is 2 cm less than the hypotenuse, find the sides of the triangle.

43. By a reduction of Rs. 2 per kg in the price of sugar, Anita can purchase 2 kg sugar more for Rs. 224. Find the original price of sugar per kg.

44. Rs. 9000 were divided equally among a certain number of students. Had there been 20 more students, each would have got Rs. 160 less. Find the original number of students.

45. An aeroplane takes an hour less for a journey of 1200 km, if the speed is increased by 100 km/hr from its usual speed. Find the usual speed of the aeroplane.

46. 7 years ago age of Aditi was five times the square of the age of Sarthak. After 3 years, age of Sarthak will be \( \frac{2}{5} \) of the age of Aditi. Find their present ages.

47. Two years ago a man's age was three times the square of his son's age. Three years hence his age will be four times his son's age. Find their present ages.

48. In a cricket match against Sri Lanka, Sehwag took one wicket less than twice the number of wickets taken by Amit Mishra. If the product of the number of wickets taken by these two is 15, find the number of wickets taken by each.

49. A peacock is sitting on the top of a pillar, which is 9 metre high from a point 27 metre away from the bottom of the pillar, a snake is coming to its hole at the base of the pillar. Seeing the snake, the peacock pounces on it. If their speeds are equal, at what distance from the hole is the snake caught?

50. The numerators of a fraction is 1 less than its denominator. If three is added to each of the numerator and denominator, the fraction is increased by \( \frac{3}{28} \). Find the fraction.
1. $b$  
2. $c$  
3. $a$  
4. $c$  
5. $a$  
6. $d$  
7. $d$  
8. $b$  
9. $a$  
10. $a$  
11. $b$  
12. $c$  
13. $b$  
14. $a$  
15. $a$  
16. $k = 10$, second root $= -5$  
17. $\pm 2\sqrt{6}$  
18. $p \geq 6$ or $p \leq -6$  
19. $x^2 + 2x - 63 = 0$  
20. $4, \frac{1}{4}$  
21. $-\frac{5}{\sqrt{2}}, -\sqrt{2}$  
22. $9, 42$  
23. $k = 14$  
24. (a) $\frac{3}{2}, 1$  
(b) $\frac{-5 + \sqrt{13}}{6}, \frac{-5 - \sqrt{13}}{6}$.  
25. $\frac{-3 + \sqrt{3}}{3}, \frac{-3 - \sqrt{3}}{3}$.  
26. $13, 15$  
27. **Hint**: For equal roots $D = 0$.  
28. (a) Not real roots.  
29. $5, 10$  
(b) Roots are real, $3, \frac{3}{2}$.  
30. $4, 4$  
31. $-1, \frac{b^2}{a^2}$
32. \( \frac{\sqrt{3}}{4}, -\frac{2}{\sqrt{3}} \)

33. \( \frac{c}{b}, -\frac{b}{a} \)

34. 5, \( \frac{5}{2} \)

35. 1, 2

36. \( \frac{\sqrt{5}}{3}, -\sqrt{5} \)

37. \(-\mathbf{a}, -\mathbf{b}\).

38. 57

39. 13, 14

40. 3 km/hr.

41. 40 km/hr.

42. 26 cm, 24 cm, 10 cm

43. Rs. 16

44. 25 students

45. 300 km/hr.

46. Aditi’s age = 27 yrs., Sarthak’s age = 9 yrs.

47. 27 yrs., 5 yrs.


49. 12 m.

50. \( \frac{3}{4} \).
CHAPTER 2

ARITHMETIC PROGRESSION

KEY POINTS

1. **Sequence**: A set of numbers arranged in some definite order and formed according to some rules is called a sequence.

2. **Progression**: The sequence that follows a certain pattern is called progression.

3. **Arithmetic Progression**: A sequence in which the difference obtained by subtracting from any term its preceding term is constant throughout, is called an arithmetic sequence or arithmetic progression (A.P.).

   The general form of an A.P. is \( a, a + d, a + 2d, \ldots \) (\( a \) : first term, \( d \) : common difference).

4. **General Term**: If '\( a \)' is the first term and '\( d \)' is common difference in an A.P., then \( n^{th} \) term (general term) is given by

   \[ a_n = a + (n - 1) \times d. \]

5. **Sum of \( n \) Terms of An A.P.**: If '\( a \)' is the first term and '\( d \)' is the common difference of an A.P., then sum of first \( n \) terms is given by

   \[ S_n = \frac{n}{2} \{ 2a + (n - 1) \times d \}. \]

   If 'l' is the last term of a finite A.P., then the sum is given by

   \[ S_n = \frac{n}{2} \{ a + l \}. \]

6. (i) If \( a_n \) is given, then common difference \( d = a_n - a_{n-1} \).

   (ii) If \( s_n \) is given, then \( n^{th} \) term is given by \( a_n = s_n - s_{n-1} \).

   (iii) If '\( a, b, c \)' are in A.P., then \( 2b = a + c \).

   (iv) If a sequence has \( n \) terms, its \( r^{th} \) term from the end = \( (n - r + 1)^{th} \) term from the beginning.
MULTIPLE CHOICE QUESTIONS

1. Next term of the A.P. 9, 11, 13, 15, ________ is
   (a) 17       (b) 18
   (c) 19       (d) 20

2. In $n^{th}$ term of an A.P. is $2n + 7$, then $7^{th}$ term of the A.P. is
   (a) 15       (b) 21
   (c) 28       (d) 25

3. If the sum of $n$ terms of an A.P. is $n^2 + 3n$, then sum of its 15 terms is
   (a) 250       (b) 230
   (c) 225       (d) 270

4. If $n^{th}$ term of the A.P. 4, 7, 10, ________ is 82, then the value of $n$ is
   (a) 29       (b) 27
   (c) 30       (d) 26

5. If $a$, $b$ and $c$ are A.P. then
   (a) $a = \frac{b + c}{2}$       (b) $b = \frac{a + c}{2}$
   (c) $c = \frac{a + b}{2}$       (d) $b = a + c$

6. $12^{th}$ term of the A.P. 3, 8, 13, ________ is
   (a) 56       (b) 57
   (c) 58       (d) 59

7. Common difference of A.P. $8\frac{1}{8}, 8\frac{2}{8}, 8\frac{3}{8}$, ________ is
   (a) $\frac{1}{8}$       (b) $1\frac{1}{8}$
8. \( n^{th} \) term of the A.P. \(-5, -2, 1, \ldots \) is

(a) \( 3n + 5 \)
(b) \( 8 - 3n \)
(c) \( 8n - 5 \)
(d) \( 3n - 8 \)

9. If \( n^{th} \) term of an A.P. is \( 5 - 3n \), then common difference of the A.P. is

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

10. If 5, \( 2k - 3 \), 9 are in A.P., then the value of ‘\( k \)’ is

(a) \( 4 \)
(b) \( 5 \)
(c) \( 6 \)
(d) \( -5 \)

11. Sum of first 10 natural numbers is

(a) \( 50 \)
(b) \( 55 \)
(c) \( 60 \)
(d) \( 65 \)

12. 9\(^{th} \) term from the end of the A.P. 7, 11, 15, \ldots 147 is

(a) \( 135 \)
(b) \( 125 \)
(c) \( 115 \)
(d) \( 110 \)

13. If the sum of \( n \) terms of an A.P. is \( n^2 \), then its \( n^{th} \) term is

(a) \( 2n - 1 \)
(b) \( 2n + 1 \)
(c) \( n^2 - 1 \)
(d) \( 2n - 3 \)

14. The sum of 3 numbers in A.P. is 30. If the greatest number is 13, then its common difference is

(a) \( 4 \)
(b) \( 3 \)
(c) \( 2 \)
(d) \( 5 \)

15. The sum of 6\(^{th} \) and 7\(^{th} \) terms of an A.P. is 39 and common difference is 3, then the first terms of the A.P. is
LONG ANSWER TYPE QUESTIONS

16. Is $\sqrt{2}$, $\sqrt{8}$, $\sqrt{18}$, $\sqrt{32}$, _____ on A.P.? If yes, then find its next two terms.

17. Find an A.P. whose $2^{nd}$ term is 10 and the $6^{th}$ term exceeds the $4^{th}$ term by 12.

18. Which term of the A.P. 41, 38, 35 _____ is the first negative term? Find the term also.

19. Nidhi saves Rs. 2 on day 1, Rs. 4 on day 2, Rs. 6 on day 3 and so on. How much money she save in month of Feb. 2011?

20. Find an A.P., whose $3^{rd}$ term is –13 and $6^{th}$ term is 2.

21. How many two digits numbers between 6 and 102 are divisible by 6.

22. If $s_n$ the sum of first $n$ terms of an A.P. is given by $s_n = 3n^2 - 4n$, then find its $n^{th}$ term and common difference.

23. The sum of $4^{th}$ and $8^{th}$ terms of an A.P. is 24 and sum of $6^{th}$ and $10^{th}$ terms is 44. Find A.P.

24. Find the sum of odd positive integers between 1 and 199.

25. How many terms of the A.P. 22, 20, 18, _____ should be taken so that their sum is zero?

26. The angles of a triangle are in A.P. If the smallest angle is one fifth the sum of other two angles. Find the angles.

27. If 11 times of $11^{th}$ term is equal to 17 times of $17^{th}$ term of an A.P. find its $28^{th}$ term.

28. Find an A.P. of 8 terms, whose first term is $\frac{1}{2}$ and last term is $\frac{17}{6}$.

29. The fourth term of an A.P. is equal to 3 times the first term and the seventh term exceeds twice the third term by 1. Find the first term and common difference of the A.P.
30. Find the sum of A.P. 4 + 9 + 14 + _____ + 249.

31. If 2\textsuperscript{nd}, 31\textsuperscript{st} and last terms of an A.P. are \(\frac{31}{4}, \frac{1}{2}\) and \(-\frac{13}{2}\) respectively. Find the number of terms in the A.P.

32. Find the number of terms of the A.P. 57, 54, 51, _____ so that their sum is 570. Explain the double answer.

33. The sum of three numbers in A.P. is 24 and their product is 440. Find the numbers.

34. Find the sum of the first 40 terms of an A.P. whose \(n\)\textsuperscript{th} term is \(3 - 2n\).

35. If \(m\)\textsuperscript{th} and \(n\)\textsuperscript{th} terms of an A.P. are \(\frac{1}{n}\) and \(\frac{1}{m}\) respectively, then find the sum of \(mn\) terms.

36. If \(n\)\textsuperscript{th} term of an A.P. is 4, common difference is 2 and sum of \(n\) terms is \(-14\), then find first term and the number of terms.

37. Find the sum of all the three digits numbers each of which leaves the remainder 3 when divided by 5.

38. The sum of first six terms of an A.P. is 42. The ratio of the 10\textsuperscript{th} term to the 30\textsuperscript{th} term is 1 : 3. Find first term and 11\textsuperscript{th} term of the A.P.

39. The sum of \(n\) terms of two A.P.'s are in the ratio \(3n + 8 : 7n + 15\). Find the ratio of their 12\textsuperscript{th} terms.

40. If \(p\)\textsuperscript{th}, \(q\)\textsuperscript{th} and \(r\)\textsuperscript{th} terms of an A.P. are \(l, m\) and \(n\) respectively then prove that \(p (m - n) + q (n - l) + r (l - m) = 0\).

41. The sum of first 8 terms of an A.P. is 140 and sum of first 24 terms is 996 find the A.P.

42. The digits of a three digits positive number are in A.P. and the sum of digits is 15. On subtracting 594 from the number the digits are interchanged. Find the number.

43. A picnic group for Shimla consists of students whose ages are in A.P., the common difference being 3 months. If the youngest student Neeraj is just 12 years old and the sum of ages of all students is 375 years. Find the number of students in the group.
44. If the sum of first 20 terms of an A.P. is one third of the sum of next 20 terms. If first term is 1, then find the sum of first 30 terms.

45. The sum of first 16 terms of an A.P. is 528 and sum of next 16 terms is 1552. Find the first term and common difference of the A.P.

46. Kriti, starts a game and scores 200 points in the first attempt and she increases the points by 40 in each attempt. How many points will she score in the 30th attempt?

47. If the roots of the equation $a(b - c)x^2 + b(c - a)x + c(a - b) = 0$ are equal, then show that $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in A.P.

48. If the sum of $m$ terms of an A.P. is $n$ and the sum of $n$ terms is $m$, then show that the sum of $(m + n)$ terms is $-(m + n)$.

49. The sum of 5th and 9th terms of an A.P. is 8 and their product is 15. Find the sum of first 28 terms of the A.P.

50. Anurag arranged balls in rows to form an equilateral triangle. The first row consists of one ball, the second of two balls, and so on. If 669 more balls are added, then all the balls can be arranged in the shape of a square and each of its sides then contains 8 ball less than each side of the triangle. Determine the initial number of balls, Anurag has.

**ANSWERS**

1. $a$
2. $b$
3. $d$
4. $b$
5. $b$
6. $c$
7. $a$
8. $d$
9. $b$
10. $b$
11. $b$
12. $c$
13. $a$
14. $b$
15. $d$
16. Yes, $\sqrt{50}, \sqrt{72}$
17. 4, 10, 16, ______ 18. 15\textsuperscript{th} term, −1
19. Rs. 812 20. −23, −18, −13, ______
21. 15 22. 6n − 7, Common difference = 6
23. −13, −8, −3, 2 ______ 24. 9800
25. 23 26. 30°, 60°, 90°
27. 0 28. \frac{1}{5}, \frac{5}{6}, \frac{7}{6}, __________
29. First term = 3, common difference = 2 30. 6325
31. 59 32. 19 or 20, (20\textsuperscript{th} term is zero)
33. 5, 8, 11 34. −1520
35. \frac{1}{2} (mn + 1) 36. First term = −8, Number of terms
= 7
37. 99090 38. First term = 2, 11\textsuperscript{th} term = 22
39. 7 : 16 40. \textbf{Hint} : \(a_n = a + (n - 1)\ d\)
41. 7, 10, 13, 16, ______ 42. 852
43. 25 students 44. 450
45. First term = 3, Common difference = 4 46. 1360
47. \textbf{Hint} : In quadratic equation, \(D = 0\), for equal roots.
48. \textbf{Hint} : \(s_n = \frac{n}{2} \left(2a + (n - 1)\ d\right)\) 49. 115, 45 \left\{ d = \pm \frac{1}{2} \right\}
50. 1540 balls.
CHAPTER 3

CO-ORDINATE GEOMETRY

KEY POINTS

1. The length of a line segment joining \(A\) and \(B\) is the distance between two points \(A(x_1, y_1)\) and \(B(x_2, y_2)\) is \(\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}\).

2. The distance of a point \((x, y)\) from the origin is \(\sqrt{x^2 + y^2}\). The distance of \(P\) from \(x\)-axis is \(y\) units and from \(y\)-axis is \(x\) units.

3. The co-ordinates of the points \(P(x, y)\) which divides the line segment joining the points \(A(x_1, y_1)\) and \(B(x_2, y_2)\) in the ratio \(m_1 : m_2\) are

\[ \left( \frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2} \right) \]

we can take ratio as \(k : 1, k = \frac{m_1}{m_2}\).

4. The mid-points of the line segment joining the points \(P(x_1, y_1)\) and \(Q(x_2, y_2)\) is

\[ \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right) \]

5. The area of the triangle formed by the points \((x_1, y_1), (x_2, y_2)\) and \((x_3, y_3)\) is the numeric value of the expressions

\[ \frac{1}{2} \left[ x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) \right]. \]

6. If three points are collinear then we can not draw a triangle, so the area will be zero \(i.e.\)

\[ x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2) = 0 \]
MULTIPLE CHOICE QUESTIONS

1. \( P \) is a point on \( x \) axis at a distance of 3 unit from \( y \) axis to its left. The coordinates of \( P \) are
   (a) (3, 0)   (b) (0, 3)
   (c) (–3, 0)  (d) (0, –3)

2. The distance of point \( P \) (3, –2) from \( y \)-axis is
   (a) 3 units   (b) 2 units
   (c) –2 units  (d) \( \sqrt{13} \) units

3. The coordinates of two points are (6, 0) and (0, –8). The coordinates of the mid point are
   (a) (3, 4)    (b) (3, –4)
   (c) (0, 0)    (d) (–4, 3)

4. If the distance between \( (4, 0) \) and \( (0, x) \) is 5 units, the value of \( x \) will be
   (a) 2    (b) 3
   (c) 4    (d) 5

5. The coordinates of the point where line \( \frac{x}{a} + \frac{y}{b} = 7 \) intersects \( y \)-axis are
   (a) \((a, 0)\)   (b) \((0, b)\)
   (c) \((0, 2b)\)  (d) \((2a, 0)\)

6. The area of triangle \( OAB \), the coordinates of the points \( A \) (4, 0) \( B \) (0, –7) and \( O \) is origin is
   (a) 11 sq. units   (b) 18 sq. units
   (c) 28 sq. units   (d) 14 sq. units

7. The distance between the points \( P \left(-\frac{11}{3}, 5\right) \) and \( Q \left(-\frac{2}{3}, 5\right) \) is
   (a) 6 units   (b) 4 units
   (c) 3 units   (d) 2 units
8. The line \( \frac{x}{2} + \frac{y}{4} = 1 \) intersects the axes at \( P \) and \( Q \), the coordinates of the mid point of \( PQ \) are
   (a) \( (1, 2) \)  
   (b) \( (2, 0) \)
   (c) \( (0, 4) \)  
   (d) \( (2, 1) \)

9. The coordinates of vertex \( A \) of \( \triangle ABC \) are \((–4, 2)\) and point \( D(2, 5) \), \( D \) is mid point of \( BC \). The coordinates of centroid of \( \triangle ABC \) are
   (a) \( (0, 4) \)
   (b) \( \left(-1, \frac{7}{2}\right)\)
   (c) \( \left(-2, \frac{7}{3}\right)\)
   (d) \( (0, 2) \)

10. The distance between the line \( 2x + 4 = 0 \) and \( x – 5 = 0 \) is
    (a) 9 units  
    (b) 1 unit
    (c) 5 units
    (d) 7 units

11. The distance between the points \((5 \cos 35^\circ, 0)\) and \((0, 5 \cos 55^\circ)\) is
    (a) 10 units
    (b) 5 units
    (c) 1 unit
    (d) 2 units

12. If \( a \) is any positive integer such that the distance between the points \( P(a, 2) \) and \( (3, –6) \) is 10 units then \( a \) is
    (a) \(-3\)
    (b) \(6\)
    (c) \(9\)
    (d) \(3\)

13. The perimeter of triangle formed by the points \((0, 0)\), \((2, 0)\) and \((0, 2)\) is
    (a) 4 units
    (b) 6 units
    (c) \(6\sqrt{2} \) units
    (d) \(4 + 2\sqrt{2} \) units

14. If the points \((1, 2)\), \((-5, 6)\) and \((a, -2)\) are collinear the value of \( a \) is
    (a) \(-3\)
    (b) \(7\)
    (c) \(2\)
    (d) \(5\)
15. If the centroid of the triangle formed by \((9, a), (b, -4)\) and \((7, 8)\) is \((6, 8)\) then \((a, b)\) is

(a) \((4, 5)\)  
(b) \((5, 4)\)  
(c) \((5, 2)\)  
(d) \((3, 2)\)

**SHORT ANSWER TYPE QUESTIONS**

16. Find the value of \(a\) so that the point \((3, a)\) lies on the line represented by \(2x - 3y = 5\).

17. A line is drawn through a point \(P(3, 2)\) parallel to \(x\)-axis. What is the distance of the line from \(x\)-axis?

18. What is the value of \(a\) if the points \((3, 5)\) and \((7, 1)\) are equidistant from the point \((a, 0)\)?

19. What is the value of \(p\) and \(q\) if \((2, -3)\) is the mid point of the line segment joining \((2, p)\) and \((q, -1)\)?

20. \(AB\) is diameter of circle with centre at origin. What are the coordinates of \(B\) if coordinates of \(A\) are \((3, -4)\)?

21. If the mid point of the line segment joining the points \(p\) \((6, b - 2)\) and \(Q\) \((-2, 4)\) is \((2, -3)\). What is the value of \(b\)?

22. For what value of \(p\), are the points \((-3, 9), (2, p)\) and \((4, -5)\) collinear?

23. Find the relation between \(x\) and \(y\) such that the point \((x, y)\) is equidistant from the points \((7, 1)\) and \((3, 5)\).

24. Find the coordinates of point \(P\) if \(P\) and \(Q\) trisect the line segment joining the points \(A(1, -2)\) and \(B\) \((-3, 4)\).

25. Find \(x\) if the distance between the points \((x, 2)\) and \((3, 4)\) be \(\sqrt{8}\) units.

26. Find the area of triangle whose vertices are \((1, -1), (-3, 5)\) and \((2, -7)\).

27. Find a point on \(y\)-axis which is equidistant from the points \((-2, 5)\) and \((2, -3)\).

28. The mid point of the line segment joining the points \((5, 7)\) and \((3, 9)\) is also the mid point of the line segment joining the points \((8, 6)\) and \((a, b)\). Find \(a\) and \(b\).
29. Find the coordinates of the points which divides the line segment joining the points (1, 3) and (2, 7) in the ratio 3 : 4.

30. $P$ and $Q$ are the points (1, 2) and (2, 3). Find the coordinates of a point $R$ on the line segment $PQ$ such that $\frac{PR}{RQ} = \frac{4}{3}$.

31. The point $K$ (1, 2) lies on the perpendicular bisector of the line segment joining the points $E$ (6, 8) and $F$ (2, 4). Find the distance of the point $K$ from the line segment $EF$.

32. The vertices of $\triangle ABC$ are $A$ (–1, 3), $B$ (1, –1) and $C$ (5, 1). Find the length of the median drawn from the vertex $A$.

33. Find the distance between the points $A$ ($a$, $b$) and $B$ ($b$, $a$) if $a - b = 4$.

34. Three vertices of a parallelogram taken in order are (–3, 1), (1, 1) and (3, 3). Find the coordinates of fourth vertex.

35. Triangle $ABC$ is an isosceles triangle with $AB = AC$ and vertex $A$ lies on $y$-axis. If the coordinates of $B$ and $C$ are (–5, –2) and (3, 2) respectively then find the coordinates of vertex $A$.

36. Point $P(K, 3)$ is the mid point of the line segment $AB$. If $AB = \sqrt{52}$ If units and coordinates of $A$ are (–3, 5), then find the value of $K$.

37. Find the coordinates of a point which is $\frac{3}{4}$ of the way (3, 1) to (–2, 5).

38. The area of a triangle with vertices (6, –3), (3, $K$) and (–7, 7) is 15 sq. unit. Find the value of $K$.

39. Find the abscissa of a point whose ordinate is 4 and which is $a + a$ distance of 5 units from (5, 0).

40. A point $P$ on the $x$-axis divides the line segment joining the points (4, 5) and (1, –3) in certain ratio. Find the coordinates of point $P$.

41. In right angled $\triangle ABC$, $\angle B = 90^\circ$ and $AB = \sqrt{34}$ unit. The coordinates of points $B$ and $C$ are (4, 2) and (–1, $y$) respectively. If $ar (\triangle ABC) = 17$ sq. unit, then find the value of $y$.

42. If $A$ (–3, 2) $B$ (x, y) and $C$ (1, 4) are the vertices of an isosceles triangle with $AB = BC$. Find the value of (2x + y).
43. If the point $P (3, 4)$ is equidistant from the points $A (a + b, b - a)$ and $B (a - b, a + b)$ then prove that $3b - 4a = 0$.

44. The vertices of quadrilateral $ABCD$ are $A (-5, 7), B (-4, 5), C (-1, -6)$ and $D (4, 5)$. Find the area of quadrilateral $ABCD$.

45. Find the ratio in which the line $3x + y = 12$ divides the line segment joining the points $(1, 3)$ and $(2, 7)$.

46. The line segment joining the points $A (2, 1)$ and $B (5, -8)$ is trisected at the points $P$ and $Q$ such that $P$ is nearer to $A$. If $P$ is also lies on line given by $2x - y + k = 0$, find the value of $K$.

47. The line segment joining the points $(3, -4)$ and $(1, 2)$ is trisected at the point $P$ and $Q$. If the coordinates of $P$ and $Q$ are $(p - 2)$ and $\left(\frac{5}{3}, q\right)$ respectively, find the values of $p$ and $q$.

48. In $\triangle ABC$, the coordinates of $A$ are $(3, 2)$ and the coordinates of the mid point of $AC$ and $AB$ are $(2, -1)$ and $(1, 2)$ respectively. Find the coordinates of mid point of $BC$.

49. For the $\triangle ABC$ with vertices $A (5, 2), B (-5, -1)$ and $C (3, -5)$. Show that the median $AD$ divides the triangle into two triangles of equal area.

50. If $P (x, y)$ is any point on the line joining the points $A(a, 0)$ and $B (0, b)$, then show that $\frac{x}{a} + \frac{y}{b} = 1$.

51. If the points $(x, y), (-5, -2)$ and $(3, -5)$ are collinear, prove that $3x + 8y + 31 = 0$.

**ANSWERS**

1. $c$  
2. $a$  
3. $b$  
4. $b$  
5. $c$  
6. $d$  
7. $c$  
8. $a$  
9. $a$  
10. $d$
11. $b$
13. $d$
15. $c$
17. 2 units
19. $p = -5, q = 2$
21. $b = -8$
23. $x - y = 2$
25. $x = 1, 5$
27. $(0, 1)$
29. $\left( \frac{10}{7}, \frac{33}{7} \right)$
31. 5 units
33. $4\sqrt{2}$ units
35. $(0, -2)$
37. $\left( -\frac{3}{4}, 4 \right)$
39. 2, 8
41. $-1$
43. 72 sq. unit
45. 6 : 1
46. $K = -8$
48. $(0, -1)$. 

12. $c$
14. $b$
16. $a = \frac{1}{3}$
18. $a = 2$
20. $(3, 4)$
22. $p = -1$
24. $\left( -\frac{3}{7}, 0 \right)$
26. 5 sq. unit
28. $a = 0, b = 10$
30. $\left( \frac{11}{7}, \frac{18}{7} \right)$
32. 5 units
34. $(-1, 3)$
36. $K = 0, -6$
38. $K = \frac{21}{13}$
40. $\left( \frac{17}{8}, 0 \right)$
42. 1
44. 6 : 1
47. $p = \frac{7}{3}, q = 0$
CHAPTER 4

SOME APPLICATIONS OF TRIGONOMETRY

KEY POINTS

1. **Line of Sight**: The line of sight is the line drawn from the eye of an observer to the point in the object viewed by the observer.

2. **Angle of Elevation**: The angle of elevation is the angle formed by the line of sight with the horizontal, when it is above the horizontal level i.e. the case when we raise our head to look at the object.

3. **Angle of Depression**: The angle of depression is the angle formed by the line of sight with the horizontal when it is below the horizontal i.e. case when we lower our head to look at the object.

MULTIPLE CHOICE QUESTIONS

1. The length of the shadow of a man is equal to the height of man. The angle of elevation is

   (a) 90°  
   (b) 60°  
   (c) 45°  
   (d) 30°

2. The length of the shadow of a pole 30m high at some instant is $10\sqrt{3}$ m. The angle of elevation of the sun is

   (a) 30°  
   (b) 60°  
   (c) 45°  
   (d) 90°

3. In given fig. 1 $CE \parallel AB$. The angle of elevation at points $A$ and $D$ respectively are
4. The tops of two poles of height 10m and 18m are connected with wire. If wire makes an angle of 30° with horizontal, then length of wire is
   (a) 10m  (b) 18m  (c) 12m  (d) 16m

5. From a point 20m away from the foot of the tower, the angle of elevation of the top of the tower is 30°. The height of the tower is
   (a) $20\sqrt{3}$ m  (b) $\frac{20}{\sqrt{3}}$ m  
   (c) $40\sqrt{3}$ m  (d) $\frac{40}{\sqrt{3}}$ m

6. The ratio of the length of a tree and its shadow is $1 : \frac{1}{\sqrt{3}}$. The angle of elevation of the sun is
   (a) 30°  (b) 45°  (c) 60°  (d) 90°
7. A kite is flying at a height of $50\sqrt{3}$ m above the level ground, attached to string inclined at 60° to the horizontal, the length of string is

(a) 100 m  
(b) 50 m  
(c) 150 m  
(d) 75 m

8. In given fig. 2 the perimeter of rectangle $ABCD$ is

![Fig. 2]

(a) 40 m  
(b) $20(\sqrt{3} + 1)$ m  
(c) 60 m  
(d) $10(\sqrt{3} + 1)$ m

9. A tree is broken at a height of 10 m above the ground. The broken part touches the ground and makes an angle of 30° with the horizontal. The height of the tree is

(a) 30 m  
(b) 20 m  
(c) 10 m  
(d) 15 m

10. In given fig. 3 $\tan \alpha = \frac{3}{4}$, if $AB = 12$m, then height $BC$ is

(a) 8 m  
(b) 12 m  
(c) 9 m  
(d) 10 m
11. In given fig. 4 $D$ is mid point of $BC$, $\angle CAB = \alpha_1$ and $\angle DAB = \beta_2$ then $\tan \alpha_1 : \tan \beta_2$ is equal to

(a) $2 : 1$  (b) $1 : 2$
(c) $1 : 1$  (d) $1 : 3$

12. In given fig. 5, $\tan \theta = \frac{8}{15}$ if $PQ = 16$ m, then the length of $PR$ is

(a) 16 m  (b) 34 m
(c) 32 m  (d) 30 m
13. The height of a tower is 50 m. When angle of elevation changes from 45° to 30°, the shadow of tower becomes \(x\) metres more, the value of \(x\) is

(a) 50 m  
(b) \(50\left(\sqrt{3} - 1\right)\) m

(c) \(50\sqrt{3}\) m  
(d) \(\frac{50}{\sqrt{3}}\) m

14. The angle of elevations of a building from two points on the ground 9m and 16m away from the foot of the building are complementary, the height of the building is

(a) 18 m  
(b) 16 m

(c) 10 m  
(d) 12 m

**LONG ANSWER TYPE QUESTIONS**

15. A pole of height 5m is fixed on the top of the tower. The angle of elevation of the top of the pole as observed from a point \(A\) on the ground is 60° and the angle of depression of the point \(A\) from the top of the tower is 45°. Find the height of tower. \(\text{(Take } \sqrt{3} = 1.732)\)

16. From a point on the ground the angle of elevations of the bottom and top of a water tank kept on the top of the 30m high building are 45° and 60° respectively. Find the height of the water tank.

17. The shadow of a tower standing on the level ground is found to be 60m shorter when the sun’s altitude changes from 30° to 60°, find the height of tower.
18. A tree breaks due to storm and the broken part bends so that the top of the tree touches the ground making an angle 60° with the ground. The distance from the foot of the tree to the point where the top touches the ground is 5m. Find the total height of the tree.

19. The angle of elevation of a bird from a point on the ground is 60°, after 50 seconds flight the angle of elevation changes to 30°. If the bird is flying at the height of $500\sqrt{3}$ m. Find the speed of the bird.

20. The angle of elevation of a jet fighter plane from a point $A$ on the ground is 60°. After a flight of 15 seconds, the angle of elevation changes to 30°. If the jet is flying at a speed of 720 km/h. find the constant height at which the jet is flying. (Take $\sqrt{3} = 1.732$).

21. From a window 20m high above the ground in a street, the angle of elevation and depression of the top and the foot of another house opposite side of the street are 60° and 45° respectively. Find the height of opposite house.

22. An aeroplane flying at a height of 1800m observes angles of depressions of two points on the opposite bank of the river to be 60° and 45°, find the width of the river.

23. The angle of elevation of the top of the tower from two points $A$ and $B$ which are 15m apart, on the same side of the tower on the level ground are 30° and 60° respectively. Find the heignt of the tower and distance of point $B$ from he base of the tower. (Take $\sqrt{3} = 1.732$)

24. The angle of elevation of the top of a 10m high building from a point $P$ on the ground is 30°. A flag is hoisted at the top of the building and the angle of elevation of the top of the flag staff from $P$ is 45°. Find the length of the flag staff and the distance of the building from point $P$.

25. The angle of elevation of a bird from a point 12 metres above a lake is 30° and the angle of depression of its reflection in the lake is 60°. Find the distance of the bird from the point of observation.

26. The angle of elevation of the cloud from a point 60m above a lake is 30° and angle of depression of the reflection of the cloud in the lake is 60°, find the height of the cloud.

27. A man on a cliff observes a boat at an angle of depression of 30°, which is approaching the shore to point ‘$A$’ on the immediately beneath the observer.
with a uniform speed, 12 minutes later, the angle of depression of the boat is found to be 60°. Find the time takes by the boat to reach the shore.

28. A man standing on the deck of a ship, 18m above the water level observes that the angle of elevation and depression of the top and the bottom of a cliff are 60° and 30° respectively. Find the distance of the cliff from the ship and height of the cliff.

29. A person standing on the bank of a river observes that the angle of elevation of the top of a tree standing on the opposite bank is 60°. When he moves 40m away from the bank he finds the angle of elevation to be 30°. Find the height of the tree and the width of the river.

30. An aeroplane, when 300 m high, passes vertically above another plane at an instant when the angle of elevation of two aeroplanes from the same point on the ground are 60° and 45° respectively. Find the vertical distance between the two planes.

31. The angle of depression of the top and bottom of a 10m tall building from the top of a tower are 30° and 45° respectively. Find the height of the tower and distance between building and tower.

32. A boy standing on a horizontal plane, finds a bird flying at a distance of 100m from him at an elevation of 30°. A girl, standing on the root of 20m high building, finds the angle of elevation of the same bird to be 45°. Both the boy and girl are on the opposite sides of the bird. Find the distance of bird from the girl.

33. At a point ‘P’ on the level ground, the angle of elevation of a vertical tower is found to be such that its tangent is $\frac{3}{4}$. On walking 192 metres away from P the tangent of the angle is $\frac{5}{12}$. Find the height of the tower.

34. The angle of elevation of a building from two points P and Q on the level ground on the same side of the building are 36° and 54° respectively. If the distance of the points P and Q from the base of the building are 10m and 20m respectively, find the height of the building. (Take $\sqrt{2} = 1.414$)

35. A round balloon of radius ‘r’ subtends an angle ‘θ’ at the eye of the observer while the angle of elevation of its centre is $\alpha$. Prove that the height of the centre of the balloon is $r \sin \alpha \csc \left(\frac{\theta}{2}\right)$. 

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## ANSWERS

1. \( c \)  
2. \( b \)  
3. \( a \)  
4. \( d \)  
5. \( b \)  
6. \( c \)  
7. \( a \)  
8. \( b \)  
9. \( a \)  
10. \( c \)  
11. \( a \)  
12. \( b \)  
13. \( b \)  
14. \( d \)  
15. 6.83 m  
16. \( 30(\sqrt{3} - 1) \) m  
17. \( 30\sqrt{3} \) m  
18. \( 5(2 + \sqrt{3}) \) m  
19. 20 m/sec.  
20. 2598 m  
21. \( 20(\sqrt{3} + 1) \) m  
22. \( 600(3 + \sqrt{3}) \) m  
23. Height = 12.97 m, distance = 7.5 m  
24. Length of flag staff = \( 10(\sqrt{2} - 1) \) m, Distance of the building = \( 10\sqrt{3} \) m.  
25. \( 24\sqrt{3} \) m  
26. 120 cm  
27. 18 minutes  
28. \( 18\sqrt{3} \) m, 72 m  
29. Height = 34.64 m, Width of the river = 20 m.  
30. \( 1000\left(3 - \sqrt{3}\right) \) m  
31. Height = \( 5\left(3 + \sqrt{3}\right) \) m, distance = \( 5\left(3 + \sqrt{3}\right) \) m  
32. 30 m  
33. 180 m  
34. 14.14 m
CHAPTER 5

CIRCLE

KEY POINTS

1. **Tangent to a Circle**: It is a line that intersects the circle at only one point.

2. There is only one tangent at a point of the circle.

3. The proofs of the following theorems can be asked in the examination:
   
   (i) The tangent at any point of a circle is perpendicular to the radius through the point of contact.

   (ii) The lengths of tangents drawn from an external point to a circle are equal.

MULTIPLE CHOICE QUESTIONS

1. In the given fig. 1 $PQ$ is tangent then $\angle POQ + \angle QPO$ is equal to

   ![Fig. 1](image)

   (a) $120^\circ$  
   (b) $90^\circ$  
   (c) $80^\circ$  
   (d) $100^\circ$
2. If $PQ$ is a tangent to a circle of radius 5 cm and $PQ = 12$ cm, $Q$ is point of contact, then $OP$ is

(a) 13 cm (b) 17 cm
(c) 7 cm (d) $\sqrt{119}$ cm

3. In the given fig. 2 $PQ$ and $PR$ are tangents to the circle, $\angle QOP = 70^\circ$, then $\angle QPR$ is equal to

(a) $35^\circ$ (b) $70^\circ$
(c) $40^\circ$ (d) $50^\circ$

4. In the given fig. 3 $PQ$ is a tangent to the circle, $PQ = 8$ cm, $OQ = 6$ cm then the length of $PS$ is

(a) 10 cm (b) 2 cm
(c) 3 cm (d) 4 cm

5. In the given fig. 4 $PQ$ is tangent to outer circle and $PR$ is tangent to inner circle. If $PQ = 4$ cm, $OQ = 3$ cm and $OR = 2$ cm then the length of $PR$ is
6. In the given fig. 5, P, Q, and R are the points of contact. If $AB = 4 \text{ cm}$, $BP = 2 \text{ cm}$ then the perimeter of $\triangle ABC$ is

(a) 5 cm  
(b) $\sqrt{21} \text{ cm}$  
(c) 4 cm  
(d) 3 cm

7. In the given fig. 6 the perimeter of $\triangle ABC$ is

(a) 12 cm  
(b) 8 cm  
(c) 10 cm  
(d) 9 cm
8. The distance between two tangent parallel to each other to a circle is 12 cm. The radius of circle is
(a) 13 cm  
(b) 6 cm  
(c) 10 cm  
(d) 8 cm

9. In the given fig. 7 a circle touches all sides of a quadrilateral. If $AB = 6$ cm, $BC = 5$ cm and $AD = 8$ cm. Then the length of side $CD$ is
(a) 6 cm  
(b) 8 cm  
(c) 5 cm  
(d) 7 cm
10. In a circle of radius 17 cm, two parallel chords are drawn on opposite side of diameter. The distance between two chords is 23 cm and length of one chord is 16 cm, then the length of the other chord is
   (a) 34 cm  
   (b) 17 cm  
   (c) 15 cm  
   (d) 30 cm

11. In the given fig. 8 \( P \) is point of contact then \( \angle OPB \) is equal to
   \[
   \begin{array}{c}
   \text{(a)} \ 50^\circ \\
   \text{(b)} \ 40^\circ \\
   \text{(c)} \ 35^\circ \\
   \text{(d)} \ 45^\circ 
   \end{array}
   \]

12. In the given fig. 9 \( PQ \) and \( PR \) are tangents to the circle with centre \( O \), if \( \angle QPR = 45^\circ \) then \( \angle QOR \) is equal to
   \[
   \begin{array}{c}
   \text{(a)} \ 90^\circ \\
   \text{(b)} \ 110^\circ \\
   \text{(c)} \ 135^\circ \\
   \text{(d)} \ 145^\circ 
   \end{array}
   \]

13. In the given fig. 10 \( O \) is centre of the circle, \( PA \) and \( PB \) one tangents to the circle, then \( \angle AQB \) is equal to
14. In the given fig. 11 \( \triangle ABC \) is circumscribed touching the circle at \( P, Q \) and \( R \). If \( AP = 4 \text{ cm}, BP = 6 \text{ cm}, AC = 12 \text{ cm}, \) then value of \( BC \) is

\[ \begin{align*}
(a) & \quad 70^\circ \\
(b) & \quad 80^\circ \\
(c) & \quad 60^\circ \\
(d) & \quad 75^\circ
\end{align*} \]

15. In the given fig. 12 \( \triangle ABC \) is subscribing a circle and \( P \) is mid point of side \( BC \). If \( AR = 4 \text{ cm}, AC = 9 \text{ cm}, \) then of \( BC \) is equal to

\[ \begin{align*}
(a) & \quad 6 \text{ cm} \\
(b) & \quad 14 \text{ cm} \\
(c) & \quad 10 \text{ cm} \\
(d) & \quad 18 \text{ cm}
\end{align*} \]
SHORT ANSWER TYPE QUESTIONS

16. \( AB \) and \( AC \) are two tangents to a circle with centre \( O \). If \( \angle BOA = 2x \) and \( \angle OAB = x \), then find the value of \( x \).

17. An incircle is drawn touching the equal sides of an isosceles triangle at \( E \) and \( F \). Show that the point \( D \), where the circle touches the third side is the mid point of that side.

18. The length of tangent to a circle of radius 2.5 cm from an external point \( P \) is 6 cm. Find the distance of \( P \) from the nearest point of the circle.

19. \( TP \) and \( TQ \) are the tangents from the external point of a circle with centre \( O \). If \( \angle OPQ = 30^\circ \), then find the measure of \( \angle TQP \).

20. In the given fig. 13 \( AP = 4 \) cm, \( BQ = 6 \) cm and \( AC = 9 \) cm. Find the semi perimeter of \( \triangle ABC \).

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21. In the given fig. 14 \( OP \) is equal to diameter of the circle with centre \( O \). Prove that \( \triangle ABP \) is an equilateral triangle.

22. In the given fig. (15) a semicircle is drawn outside the bigger semicircle. Diameter \( BE \) of smaller semicircle is half of the radius \( BF \) of the bigger semicircle. If radius of bigger semicircle is \( 4\sqrt{3} \) cm. Find the length of the tangent \( AC \) from \( A \) on a smaller semicircle.
23. In the fig. (16) PA and PB are tangent to circle with centre O. Find the value of \( x \).

![Fig. 16](image)

24. On the side AB as diameter of a right angled triangle ABC a circle is drawn intersecting the hypotenuse AC in P. Prove that PB = PC.

25. In the given fig. (17) PQ is tangent to the circle with centre O. \( AP = 8 \) cm and length of tangent exceeds the radius by 1. Find the radius of the circle.

![Fig. 17](image)

26. A chord AB of 8 cm is drawn in a circle with centre O of radius 5 cm. Find the length of tangents from external point P to A and B.

27. In the given fig. (18) AB = AC, D is the mid point of AC, BD is the diameter of the circle, then prove that \( AE = \frac{1}{4} AC \).

![Fig. 18](image)
28. In the given fig. (19) radii of two concentric circles are 5 cm and 8 cm. The length of tangent from P to bigger circle is 15 cm. Find the length of tangent to smaller circle.

![Fig. 19](image)

29. An incircle is drawn touching the sides of a right angled triangle, the base and perpendicular of the triangle are 6 cm and 2.5 cm respectively. Find the radius of the circle.

30. In the given fig. (20) AB = 13 cm, BC = 7 cm. AD = 15 cm. Find PC.

![Fig. 20](image)

31. In the given fig. (21) find the radius of the circle.
32. In the given fig. (22) if radius of circle $r = 3$ cm. Find the perimeter of $\triangle ABC$.

33. PQ is a diameter of a circle and PR is the chord such that $\angle RPQ = 30^\circ$. The tangent at R intersects PQ produced at S. Prove that $RQ = QS$.

34. In the given fig. (23) XP and XQ are tangents from X to the circle with centre O. R is a point on the circle. Prove that $XA + AR = XB + BR$. 
LONG ANSWER TYPE QUESTIONS

35. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

Rider:

1. Prove that in two concentric circles the chord of the larger circle which touches the smaller circle is bisected at the point of contact.

2. PT is a tangent to the circle with centre O and T is point of contact. If OT = 6 cm, OP = 10 cm find the length of tangent PT.

3. In the given fig. (24) PQ is tangent and PB is diameter. Find the value of x and y.

4. In the given fig. (25) AC is diameter of the circle with centre O and A is point of contact, then find x.
36. Prove that the length of tangents, drawn from an external point to a circle are equal.

**Rider:**

1. In the given fig. (26) PA and PB are tangents from point P. Prove that KN = AK + BN.

2. Two concentric circles are of radii 5 cm and 3 cm. Find the length of the chord of the larger circle which is tangent to the smaller circle.

3. In the given fig. (27) PA and PB are tangents to the circle with centre O. Prove that OP is perpendicular bisector of AB.
4. In the given fig. (28) PQ is chord of length 6 cm of the circle of radius 6 cm. TP and TQ are tangents. Find \( \angle PTQ \).

**Fig. 28**

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**ANSWERS**

1. \( b \) 
2. \( d \)
3. \( c \) 
4. \( d \)
5. \( b \) 
6. \( a \)
7. \( c \) 
8. \( b \)
9. \( d \) 
10. \( a \)
11. \( a \) 
12. \( c \)
13. \( a \) 
14. \( b \)
15. \( a \) 
16. \( 30° \)
17. \( 4 \) cm 
18. \( 60° \)
19. \( 15 \) cm 
20. \( 12 \) cm 
21. \( 4 \) cm 
22. \( 20/3 \) cm 
23. \( \) cm 
24. \( \) cm 
25. \( \) cm 
26. \( \) cm 
27. \( \) cm 
28. \( \) cm 
29. \( \) cm 
30. \( \) cm 
31. \( \) cm 
32. \( \) cm 
33. \( \) cm 
34. \( \) cm 
35. \( \) cm 
36. \( \) cm
CHAPTER 6

CONSTRUCTIONS

KEY POINTS

1. Construction should be neat and clean and as per scale given in question.
2. Steps of construction should be provided only to those questions where it is mentioned.

QUESTIONS

1. Draw a line segment AB = 7 cm. Take a point P on AB such that AP : PB = 3 : 4.

2. Draw a line segment PQ = 10 cm. Take a point A on PQ such that \( \frac{PA}{PQ} = \frac{2}{5} \). Measure the length of PA and AQ.

3. Construct a \( \triangle ABC \) in which BC = 6.5 cm, AB = 4.5 cm and \( \angle ACB = 60^\circ \). Construct another triangle similar to \( \triangle ABC \) such that each side of new triangle is \( \frac{4}{5} \) of the corresponding sides of \( \triangle ABC \).

4. Draw a triangle XYZ such that XY = 5 cm, YZ = 7 cm and \( \angle XYZ = 75^\circ \). Now construct a \( \triangle X'YZ' \sim \triangle XYZ \) with its sides \( \frac{3}{2} \) times of the corresponding sides of \( \triangle XYZ \).

5. Construct an isosceles triangle whose base is 8 cm and altitude 5 cm and then construct another triangle whose sides are \( \frac{3}{4} \) times the corresponding sides of the given triangle.
6. Draw an isosceles $\triangle ABC$ with $AB = AC$ and base $BC = 7$ cm and vertical angle is $120^\circ$. Construct $\triangle AB'C' \sim \triangle ABC$ with its sides $\frac{1}{3}$ times of the corresponding sides of $\triangle ABC$.

7. Draw $\triangle PQR$ in which $\angle Q = 90^\circ$, $PQ = 6$ cm, $QR = 8$ cm. Construct $\triangle P'QR'$ $\sim \triangle PQR$ with its sides equal to $2/3$rd of corresponding sides of $\triangle PQR$.

8. Construct a right angled triangle in which base is $2$ times of the perpendicular. Now construct a triangle similar to it with base $1.5$ times of the original triangle.

9. Draw an equilateral triangle $PQR$ with side $5$ cm. Now construct $\triangle PQ'R'$ such that $\frac{PQ}{PQ'} = \frac{1}{2}$. Measure $PQ'$.

10. Draw a circle of radius $4$ cm with centre $O$. Take a point circle from $P$ such that $OP = 6$ cm. Draw tangents $PA$ and $PB$ to circle $P$. Measure the length of $PA$ and $PB$.

11. Draw a line segment $AB = 8$ cm. Taking $AB$ as diameter a circle with centre $O$. Now draw $OP \perp AB$. Through $P$ draw a tangent to the circle.

12. Draw a circle of radius $OP = 3$ cm. Draw $\angle POQ = 45^\circ$ such that $OQ = 5$ cm. Now draw two tangents from $Q$ to given circle.

13. Draw a circle with centre $O$ and radius $3.5$ cm. Now draw two tangents $PQ$ and $PB$ from an external point draw two tangents $PA$ and $PB$ from an external point $P$ such that $\angle APB = 45^\circ$. What is the value of $\angle AOB + \angle APB$.

14. Draw a circle of radius $4$ cm. Now draw a set of tangents from an external point $P$ such that the angle between the two tangents is half of the central angle made by joining the point of contact to the centre.

15. Draw a line segment $AB = 9$ cm. Taking $A$ and $B$ as centres draw two circles of radius $5$ cm and $3$ cm respectively. Now draw tangents to each circle from the centre of the other.

16. Draw a circle of radius $3.5$ cm with centre $O$. Take point $P$ such that $OP = 6$ cm. $OP$ cuts the circle at $T$. Draw two tangents $PQ$ and $PR$. Join $Q$ to $R$. Through $T$ draw $AB$ parallel to $QR$ such that $A$ and $B$ are point on $PQ$ and $PR$. 

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17. Draw a circle of diameter 7 cm. Draw a pair of tangents to the circle, which are inclined to each other at an angle of 60°.

18. Draw a circle with centre O and radius 3.5 cm. Take a horizontal diameter. Extend it to both sides to point P and Q such that OP = OQ = 7 cm. Draw tangents PA and QB one above the diameter and the other below the diameter. Is PA || BQ.
CHAPTER 7

MENSURATION (CONTINUED)
SURFACE AREAS AND VOLUMES

KEY POINTS

1. \( c = 2\pi r \) where \( c \rightarrow \) circumference of the circle \( \pi \) be taken as 22/7 or 3.14 (app.) and ‘\( r \)’ be the radius of the circle.

2. Area of circle = \( \pi r^2 \) where ‘\( r \)’ is the radius of the circle.

3. Area of Semi circle = \( \frac{\pi r^2}{2} \).

4. Area enclosed by two concentric circles
   \[ = \pi \left( R^2 - r^2 \right) \]
   \[ = \pi \left( R + r \right) \left( R - r \right); \quad R > r \]
   where ‘\( R \)’ and ‘\( r \)’ are radii of two concentric circles.

5. The arc length ‘\( l \)’ of a sector of angle ‘\( \theta \)’ in a circle of radius ‘\( r \)’ in given by
   \[ l = \frac{\theta}{360^\circ} \times \text{(circumference of the circle)} \]
   \[ = \frac{\theta}{360^\circ} \times 2\pi r \]
   \[ l = \frac{\theta}{180^\circ} \times \pi r \]

6. If the arc subtends an angle \( \theta \), then area of the corresponding sector is
   \[ \frac{\theta}{360^\circ} \times \pi r^2. \]
7. Angle described by minute hand in 60 minutes = 360°. Angle described by minute hand in 1 minute = \( \frac{360°}{60} \) = 6°.

8. Total Surface area of cube of side a units = 6a² units.

9. Volume of cube of side a units = a³ cubic units.

10. Total surface area of cuboid of dimensions l, b and h = 2(l × b + b × h + h × l) square units.

11. Volume of cuboid of cylinder of dimensions l, b and h = l × b × h cubic units.

12. Curved surface area of cylinder of radius r and height h = 2πrh square units.

13. Total surface area of cylinder of radius r and height h = 2πr (r + h) square units.

14. Volume of cylinder of radius r and height h = πr²h cubic units.

15. Curved surface area of cone of radius r height h and slant height \( l = \sqrt{r^2 + h^2} \) square units where \( l = \sqrt{r^2 + h^2} \).

16. Total surface area of cone = πr (l + r) sq. units.

17. Volume of cone = \( \frac{1}{3} \) πr²h units.

18. Total curved surface area of sphere of radius r units = 4πr² sq. units.

19. Curved surface area of hemisphere of radius r units 2πr² sq. units.

20. Total surface area of hemisphere of radius r units = 3πr² sq. units.

21. Volume of sphere of radius r units = \( \frac{4}{3} \) πr³ cubic units.

22. Volume of hemisphere of radius r units = \( \frac{2}{3} \) πr³ cubic units.

23. Curved surface of frustum = \( πl(r + R) \) sq. units, where \( l \) slant height of frustum and radii of circular ends are r and R.
24. Total surface area of frustum = \( \pi l (r + R) + \pi (r^2 + R^2) \) sq. units.

25. Volume of Frustum = \( \frac{1}{3} \pi h (r^2 + R^2 + rR) \) cubic units.

**MULTIPLE CHOICE QUESTIONS**

1. Find the area of circle whose diameter is ‘d’

   (a) \( 2\pi d \)  
   (b) \( \frac{\pi d^2}{4} \)  
   (c) \( \pi d \)  
   (d) \( \pi d^2 \)

2. If the circumference and area of a circle are numerically equal then what is the radius of the circle equal to

   (a) \( r = 1 \)  
   (b) \( r = 7 \)  
   (c) \( r = 2 \)  
   (d) \( r = c \)

3. The radius of a circle is 7 cm. What is the perimeter of the semi circle?

   (a) 36 cm  
   (b) 14 cm  
   (c) 7\( \pi \)  
   (d) 14\( \pi \)

4. The radius of two circles are 13 cm and 6 cm respectively. What is the radius of the circle which has circumference equal to the sum of the circumference of two circles?

   (a) 19\( \pi \)  
   (b) 19 cm  
   (c) 25 cm  
   (d) 32 cm

5. The circumference of two circles are in the ratio 4 : 5 what is the ratio of the areas of these circles.

   (a) 4 : 5  
   (b) 16 : 25  
   (c) 64 : 125  
   (d) 8 : 10

6. The area of an equilateral triangle is \( \sqrt{3} \) m\(^2\) its one side is

   (a) 4 m  
   (b) 3\( \sqrt{3} \) m  
   (c) \( \frac{3\sqrt{3}}{4} \) m  
   (d) 2 m
7. The volume of a cuboid is 440 cm\(^3\). The area of its base is 66 cm\(^2\). What is its height?

(a) \[ \frac{40}{3} \text{ cm} \]  
(b) \[ \frac{20}{3} \text{ cm} \]  
(c) 440 cm  
(d) 66 cm

8. Volume of the cubes is in the ratio of 8 : 125. The ratio of their surface areas is

(a) 8 : 125  
(b) 2 : 5  
(c) 4 : 25  
(d) 16 : 25

9. If the perimeter of a sector is 'l' and radius is 'r' then the area of the sector is

(a) \[ l \cdot r \]  
(b) \[ l \cdot r^2 \]  
(c) \[ \frac{lr^2}{2} \]  
(d) \[ l^2 \cdot r \]

10. An arc of a circle is of length 5\(\pi\) cm and the section it bounds has an area of 10\(\pi\) cm\(^2\). Then the radius of circle is :

(a) 2 cm  
(b) 4 cm  
(c) 2\(\sqrt{2}\) cm  
(d) 8 cm

11. Three cubes each of side ‘a’ are joined from end to end to form a cuboid. The volume of the new cuboids :

(a) \[ a^2 \]  
(b) \[ 3a^3 \]  
(c) \[ a^3 \]  
(d) \[ 6a^3 \]

12. A wire is in the form of a circle of radius 7 cm. It is bent into a square the area of the square is :

(a) 11 cm\(^2\)  
(b) 121 cm\(^2\)  
(c) 154 cm\(^2\)  
(d) 44 cm\(^2\)
SHORT ANSWER TYPE QUESTIONS

13. The volume and surface area of a sphere are numerically equal. Find the radius of the sphere.

14. Find the perimeter of the figure in which a semicircle is drawn on BC as diameter. \( \angle BAC = 90^\circ \).

![Diagram](image)

15. Find the area of shaded region in the figure.

![Diagram](image)

16. The numerical difference between circumference and diameter is 30 cm. What is the radius of the circle?

17. What is the perimeter of a sector of angle 45° of a circle with radius 7 cm.

18. From each vertex of trapezium a sector of radius 7 cm has been cut off. Write the total area cut off.

19. Write the ratio of the areas of two sectors having angles 120° and 90°.

20. How many cubes of side 4 cm can be cut from a cuboid measuring \((16 \times 12 \times 8)\) cm³.
21. The diameter and height of a cylinder and a cone are equal. What is the ratio of their volume.

22. A cylinder, a cone and a hemisphere are of equal base and have the same height. What is the ratio in their volumes?

23. A bicycle wheel makes 5000 revolutions in moving 10 km. Write the perimeter of wheel.

24. The sum of the radius of the base and the height of a solid cylinder is 15 cm. If total surface area is 660 cm². Write the radius of the base of cylinder.

25. Find the height of largest right circular cone that can be cut out of a cube whose volume is 729 cm³.

26. What is the ratio of the areas of a circle and an equilateral triangle whose diameter and a side of triangle are equal.

27. If the circumference of the circle exceeds its diameter by 30 cm. What is the diameter of the circle.

28. The length of an arc of a circle of radius 12 cm is 10π cm. Write the angle measure of this arc.

29. The cost of fencing a circular field of the rate of Rs. 10 per meter is Rs. 440. What is the radius of the circular field?

30. Find the perimeter of the protractor if its diameter is 14 cm.

31. A path of 5 m is build round the circular park of radius 15m. Find the area of the path.

32. The radii of two circles are 4 cm and 3 cm respectively. Find the radius of a circle having area equal to the sum of the areas of the circles.

33. In the figure find length of arc AB if ‘O’ is the centre of the circle and radius is 14 cm. \( \pi = \frac{22}{7} \)
34. ABC is an equilateral triangle of side 30m. A Cow is tied at vertex A by mean of the 10m long rope. What is the area the Cow can graze in?

35. Find the area of the four blades of same size of radius 20 cm and central angle 45° of a circular fan.

36. Find the perimeter of the shaded region.

37. Two concentric circle with centre ‘O’ and radius 7 cm and 14 cm. If ∠AOC = 120° what is the area of shaded region?
38. Find the perimeter of the shaded portion.

39. Find the circumference of the circle with centre ‘O’.

40. The radius of two circles are in the ratio 3 : 4 and sum of the areas of two circles is equal to the area of third circle. What is the radius of third circle. If the radius of first is 6 cm.

41. What is the area of the largest triangle that can be inscribed in a semicircle of radius r cm.

42. A piece of wire 20 cm long is bent into an arc of a circle subtending an angle of 60° at the centre then what is the radius of the Circle?

43. The minute hand of a clock is $\sqrt{12}$ cm long. What is the area described by the minute hand between 8.00 a.m to 8.05 a.m.?

44. Find the area of shaded portion.
45. Find the area of shaded portion.

46. In the figure find the area of sector.

47. ABCD is a square kite of side 4 cm. What is the area of the shaded portion.

48. The volume of cube is \(8a^3\). Find its surface area.

49. The length of a diagonal of a cube is 17.32 cm. Find the volume of cube (use \(\sqrt{3} = 1.732\)).
50. Three cubes of the same metal, whose edges are 6, 8, 10 cm are melted and formed into a Single cube. Find the diagonal of the single cube.

LONG ANSWER TYPE QUESTIONS

51. The height of frustum is 4 cm and the radii of two bases are 3 cm and 6 cm respectively. Find the slant height of the frustum.

52. Volume of right circular cylinder is \(448\pi\) cm\(^3\) height of cylinder is 7 cm. Find the radius.

53. If lateral surface area of a cube is 64 cm\(^2\). What is its edge?

54. The area of a rhombus is 24 cm\(^2\) and one of its diagonal is 8 cm. What is other diagonal of the rhombus?

55. What is the length of the largest rod that can be put in a box of inner dimensions 30 cm, 24 cm and 18 cm?

56. Curved surface area of a cylinder is \(16\pi\) cm\(^2\), radius is 4 cm, then find its height.

57. 50 circular plates each of equal radius of 7 cm are placed one over the other to form a cylinder. Find the height and volume of the cylinder if thickness of plate is \(\frac{1}{2}\) cm.

58. A well of diameter 2 m is dug 14 m deep. Find the volume of the earth dug out.

59. A largest sphere is carved out of a cube of side 7 cm. Find the radius.

60. If the semi vertical angle of a cone of height 3 cm is 60°. Find its volume.

61. Find the edge of cube if volume of the cube is equal to the volume of cuboid of dimensions \(8 \times 4 \times 2\) cm.

62. Find the volume of cone of height 2h and radius r.

63. Is it possible to have a right circular cylinder closed at both ends, whose flat area is equal to its total curve surface.

64. In a shower, there is 5 cm rain falls. Find in cubic meter the volume of water that falls on 2 hectares of ground. \((1\ \text{hectare} = 10000\ \text{m}^2)\).
65. What is the total surface area of a solid hemisphere of radius \( R \).

66. In figure, \( \triangle ABC \) is equilateral triangle. The radius of the circle is 4 cm. Find the area of shaded portion.

![Diagram of an equilateral triangle and circle with radius 4 cm.](image)

67. Find the area of Shaded portion.

![Diagram of a solid cylinder and cone with a radius of 6 cm and height of 12 cm.](image)

68. Four Cows are tied with a rope of 7 cm at four corners of a quadrilateral field of unequal sides. Find the total area grazed.

69. A solid consists of a right circular cylinder with a right circular cone at the top. The height of cone is ‘\( h \)’ cm. The total volume of the solid is 3 times the volume of the cone. Find the height of the cylinder.
70. A cylindrical vessel of 36 cm height and 18 cm radius of the base is filled with sand. The sand is emptied on the ground and a conical heap of sand is formed. The height of conical heap is 27 cm. Find the radius of base of sand.

71. The radii of circular ends of bucket are 5.5 cm and 15.5 cm and its height is 24 cm. Find the surface area of bucket.

72. Water flow out through a circular pipe whose internal diameter is 2 cm at the rate of 6 m/sec. into a cylindrical tank. If radius of base of the tank is 60 cm. How much will the level of the water rise in half an hour?

73. In the figure along side. Find the area of the Shaded portion.

74. Find the shaded area.
75. Find the shaded area.

76. AB and CD are two perpendicular diameters and CD = 8 cm find the area of Shaded portion.

77. In the adjoining figure ABC is a right angled triangle, right angled at A. Semi circle are drawn on AB, AC and BC as diameters. Find the area of shaded portion.
78. A toy is in the form of a cone mounted on a cone frustum. If the radius of the top and bottom are 14 cm and 7 cm and the height of cone and toy are 5.5 cm and 10.5 cm respectively. Find the volume of toy.

79. In the adjoining figure, ABC is a right angled triangle at A. Find the area of Shaded region if AB = 6 cm, BC = 10 cm and 0 is the centre of the incircle of ΔABC (take π = 3.14).
1. b  
2. c  
3. a  
4. b  
5. b  
6. d  
7. b  
8. c  
9. c  
10. b  
11. b  
12. b  
13. 3 units  
14. $37 \frac{3}{7}$ cm.  
15. 49 cm²  
16. 14 cm  
17. 19.5 cm  
18. 154 cm²  
19. 4 : 3  
20. 24  
21. 3 : 1  
22. 3 : 1 : 2  
23. 2 m  
24. 7 cm  
25. 27 cm  
26. $\pi : \sqrt{3}$  
27. 14 cm  
28. 150°
29. 7 m
30. 36 cm
31. 550 m²
32. 5 cm
33. 22 cm
34. \(\frac{50}{3}\) m²
35. 200π
36. (16 + π) cm
37. 154 cm²
38. 42π
39. 25π
40. 10 cm
41. \(r^2\)
42. \(\frac{60}{\pi}\) cm
43. π cm
44. 86 cm²
45. (25 - 4π) cm²
46. 3π cm²
47. (16 - 4π) cm²
48. 24 a²
49. 1000 cm³
50. 12√3 cm
51. 5 cm
52. 8 cm
53. 4 cm
54. 6 cm
55. 30√2 cm
56. 2 cm
57. 25 cm; 3850 cm³
58. 44 m³
59. 3.5 cm
60. 27π
61. 4 cm
62. \(\frac{2}{3}\)π • \(r^2\) • h
63. Yes, when \(r = h\)
64. 1000 m³
65. 3πR²
66. 29.46 cm³
67. \(\left(\frac{660}{7} + 36\sqrt{3}\right)\) cm²
68. 154 cm²
69. \(\frac{2}{3}\) h.

70. 36 cm

71. 1716 cm²

72. 3 m

73. \(\frac{1019}{14}\) cm²

74. 154 m²

75. 77 cm²

76. \(\frac{108}{7}\) cm²

77. 6 cm²

78. 2926 cm³

79. 11.44 cm².

**Hint:** Join 0 to A, B and C.

area of \(\triangle ABC\) = area of \(\triangle OAB\) + area of \(\triangle OBC\) + area of \(\triangle OAC\)

\[
= \frac{1}{2} AB \times r + \frac{1}{2} BC \times r + \frac{1}{2} AC \times r
\]

\[
\Rightarrow \quad (r = 2\text{ cm})
\]
CHAPTER 8

PROBABLITY

1. The Theoretical probability of an event E written as \( P(E) \) is

\[
P(E) = \frac{\text{Number of outcomes favourable to } E}{\text{Number of all possible outcomes of the experiment.}}
\]

2. The sum of the probability of all the elementary events of an experiment is 1.

3. The probability of a sure event is 1 and probability of an impossible event is 0.

4. If \( E \) is an event, in general, it is true that \( P(E) + P(\overline{E}) = 1. \)

5. From the definition of the probability, the numerator is always less than or equal to the denominator therefore \( 0 \leq P(E) \leq 1. \)

MULTIPLE CHOICE QUESTIONS

1. If \( E \) is an event then \( P(E) + P(\overline{E}) = \ldots \) ?

   (a) 0  (b) 1  (c) 2  (d) –1

2. The probability of an event that is certain to happen is:

   (a) 0  (b) 2  (c) 1  (d) –1

3. Which of the following can not be the probability of an event:

   (a) \( \frac{2}{3} \)  (b) \( -\frac{3}{2} \)
   (c) 15\%  (d) 0.7
4. If \( P(E) \) is .65 what is \( P(\text{Not } E) \)?
   (a) .35  
   (b) .25  
   (c) 1  
   (d) 0

5. If \( P(E) \) is 38\% of an event what is the probability of failure of this event?
   (a) 12\%  
   (b) 62\%  
   (c) 1  
   (d) 0

6. A bag contains 9 Red and 7 blue marbles. A marble is taken out randomly, what is the \( P(\text{red marble}) \)?
   (a) \( \frac{7}{16} \)  
   (b) \( \frac{9}{16} \)  
   (c) \( \frac{18}{16} \)  
   (d) \( \frac{14}{16} \)

7. In a Survey it is found that every fifth person possess a vehicle what is the probability of a person not possessing the vehicle?
   (a) \( \frac{1}{5} \)  
   (b) \( \frac{4}{5} \)  
   (c) \( \frac{3}{5} \)  
   (d) 1

8. Anand and Sumit are friends what is the probability that they both have birthday on 11th Nov. (ignoring leap year).
   (a) \( \frac{1}{12} \)  
   (b) \( \frac{1}{7} \)  
   (c) \( \frac{1}{365} \)  
   (d) \( \frac{1}{366} \)

9. The number of face cards in a well shuffled pack of cards are :
   (a) 12  
   (b) 16  
   (c) 4  
   (d) 52
10. A die is thrown once. What is the probability of getting an even prime number?

(a) \(\frac{3}{6}\)  \hspace{1cm} (b) \(\frac{1}{6}\)

(c) \(\frac{1}{2}\)  \hspace{1cm} (d) \(\frac{1}{3}\)

11. The probability of an impossible event is:

(a) 0  \hspace{1cm} (b) 1

(c) –1  \hspace{1cm} (d) ∞

12. Cards marked with numbers 1 to 20 are placed in a bag and mixed. One card is drawn what is the probability that card drawn is between 8 and 15.

(a) \(\frac{8}{20}\)  \hspace{1cm} (b) \(\frac{6}{20}\)

(c) \(\frac{15}{20}\)  \hspace{1cm} (d) 0

**SHORT ANSWER TYPE QUESTIONS**

13. A game of chance of a spinning wheel has number 1 to 10. What is the probability of getting a number less than equal to 5 when wheel comes to rest?

14. Two dice are rolled once what is the probability of getting a doublet?

15. A die is rolled once. What is the probability of getting a prime number?

16. A bank A.T.M. has notes of denomination 100, 500 and 1000 in equal numbers. What is the probability of getting a note of Rs. 1000.

17. What is the probability of getting a number greater than 6 in a single throw of a die.

18. A selection committee interviewed 50 people for the post of sales manager. Out of which 35 are males and 15 are females. What is the probability of a female candidate being Selected.
19. A bag contains cards numbering from 5 to 25. One card is drawn from the bag. Find the probability that the card has numbers from 10 to 15.

20. In 1000 lottery tickets there are 5 prize winning tickets. Find the probability of winning a prize if a person buys one ticket.

21. It is known that in a box of 600 screws, 42 screws are defective. One screw is taken out at random from this box. Find the probability that it is not defective.

22. Write all the possible outcomes when a coin is tossed twice.

23. Two dice are rolled simultaneously. Find the probability that the sum is more than and equal to 10.

24. From the well shuffled pack of 52 cards. Two Black king and Two Red Aces are removed. What is the probability of getting a face card.

25. In a leap year what is the probability of 53 Sundays.

26. A box contains card numbered from 2 to 101. One card is drawn at random. What is the probability of getting a number which is a perfect square.

27. A box contains orange, mango and lemon flavoured candies. A candy is drawn randomly. (If \( P(\text{not lemon}) = \frac{11}{15} \) and \( P(\text{mango}) = \frac{1}{3} \) then what is \( P(\text{orange}) \)?

28. From the well shuffled pack of 52 cards. Few cards of same colour are missing. If \( P(\text{Red card}) = \frac{1}{3} \) and \( P(\text{Black card}) = \frac{2}{3} \) then which colour of cards are missing and how many?

29. A bag contains 5 red balls and ‘n’ green balls. If the \( P(\text{green ball}) = 3 \times P(\text{red ball}) \) then what is the value of \( n \).

30. If from the well shuffled pack of cards all the aces are removed, find the probability of getting red card.

31. What is the probability of getting a total of less than 12 in the throws of two dice?

32. From the data (1, 4, 9, 16, 25, 29). If 29 is removed what is the probability of getting a prime number.
33. A card is drawn from an ordinary pack of playing cards and a person bets that it is a spade or an ace. What are the odds against his winning the bet.

**LONG ANSWER TYPE**

34. A coin is tossed thrice then find the probability of

(i) 2 heads  (ii) 2 tails  (iii) 3 heads.

35. The king, queen and jack of clubs are removed from a deck of 52 playing cards and the remaining cards are shuffled. A card is drawn from the remaining cards. Find the probability of getting a card of (i) heart; (ii) queen; (iii) Clubs.

36. A box contains 5 Red balls, 8 white balls and 4 Green balls. One ball is taken out of the box at random. What is the probability that ball is (i) red; (ii) white; (iii) Not green.

37. 12 defective pens are mixed with 120 good ones. One pen is taken out at random from this lot. Determine the probability that the pen taken out is not defective.

38. (i) A lot of 20 bulbs contain 5 defective bulbs. One bulb is drawn at random from the lot. What is the probability that this bulb is defective.

(ii) Suppose the bulb drawn in (i) is not defective and is not replaced. Now one bulb is drawn at random from the rest. What is the probability that this bulb is not defective.

39. A box contains 90 discs which are numbered from 1 to 90. If one disc is drawn at random from the box, find the probability that it bears (i) a two digit number (ii) a perfect square number (ii) a number divisible by 5.

40. A game consists of tossing a one rupee coin 3 times and noting its outcome each time. Anand wins if all the tosses give the same result i.e., three heads or three tails and loses otherwise. Calculate the probability that Anand will lose the game.

41. A die is thrown twice. What is the probability of getting : (i) The Sum of 7; (ii) The sum of greater than 10; (iii) 5 will not come up either time.

42. A box contains 12 balls out of which x are black. If one ball is drawn at random from the box, what is the probability that it will be black ball?
If 6 more black balls are put in the box, the probability of drawing a black ball is now double of what it was. Find $x$.

43. A jar contains 24 balls, some are green and other are blue. If a ball is drawn at random from the jar, the probability that it is green is $\frac{2}{3}$. Find the number of blue balls in the jar.

### ANSWERS

1. b 2. c
3. b 4. a
5. b 6. b
7. b 8. c
9. a 10. b
11. a 12. b
13. $\frac{1}{2}$ 14. $\frac{1}{6}$
15. $\frac{1}{2}$ 16. $\frac{1}{3}$
17. 0 18. $\frac{3}{10}$
19. $\frac{2}{7}$ 20. $\frac{1}{200}$
21. $\frac{93}{100}$ 22. $S = [HH, TT, HT, TH]$
23. $\frac{1}{6}$ 24. $\frac{5}{24}$
25. \(\frac{2}{7}\) 
26. \(\frac{9}{100}\)

27. \(\frac{2}{5}\) 
28. Red, 13

29. 15 
30. \(\frac{1}{2}\)

31. \(\frac{35}{36}\) 
32. zero

33. \(\frac{9}{13}\) 
34. (i) \(\frac{3}{8}\); (ii) \(\frac{3}{8}\);
(iii) \(\frac{1}{8}\)

35. (i) \(\frac{13}{49}\); (ii) \(\frac{3}{49}\); (iii) \(\frac{10}{49}\) 
36. (i) \(\frac{5}{17}\); (ii) \(\frac{8}{17}\);
(iii) \(\frac{13}{17}\)

37. \(\frac{9}{10}\) 
38. (i) \(\frac{1}{4}\); (ii) \(\frac{14}{19}\)

39. (i) \(\frac{9}{10}\); (ii) \(\frac{1}{10}\); (iii) \(\frac{1}{5}\) 
40. \(\frac{3}{4}\)

41. (i) \(\frac{1}{6}\); (ii) \(\frac{1}{12}\); (iii) \(\frac{25}{36}\) 
42. \(n = 3\)

43. 8.
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<th>Topic/Type</th>
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<th>SA (I) 2 Marks</th>
<th>SA (II) 3 Marks</th>
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<td>8 (16)</td>
<td>10 (30)</td>
<td>6 (24)</td>
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General Instructions

1. All questions are compulsory.
2. The question paper consists of 34 questions divided into four sections A, B, C and D. Section A comprises of 10 questions of 1 mark each. Section B comprises of 8 questions of 2 marks each. Section C comprises of 10 questions of 3 marks each and Section D comprises of 6 questions of 4 marks each.
3. Question numbers 1 to 10 in Section A are multiple choice questions where you are to select one correct option out of the given four.
4. There is no overall choice. However, internal choice has been provided in 1 question of 2 marks 3 questions of three marks each and 2 questions of 4 marks each. You have to attempt only one of the alternatives in all such questions.
5. Use of calculators is not permitted.

SECTION A

Question number 1 to 10 are of 1 mark each

1. If a number ‘x’ is selected at random from the number –3, –2, –1, 0, 1, 2, 3. The probability of |n| < 2 is –

(a) $\frac{5}{7}$  

(b) $\frac{2}{7}$

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2. If one root of \(3x^2 - 5x + k = 0\) is 1, then the value of ‘k’ is
(a) \(-2\) 
(b) \(-8\) 
(c) 8 
(d) 2

3. The sum of first \(n\) terms of A.P. is \(n^2\), then common difference is
(a) 1 
(b) 2 
(c) 3 
(d) 4

4. The distance between the points (3, 0) and (0, \(x\)) is 5 units, the value of \(x\) will be
(a) 3 
(b) 4 
(c) 5 
(d) 6

5. The length of the shadow of a pole 30m high at some instant is 10\(\sqrt{3}\) m. The angle of elevation of the sun is
(a) 60° 
(b) 30° 
(c) 45° 
(d) 90°

6. If \(n^{th}\) term of an A.P. 4, 9, 14, ........ is 124 then \(n\) is
(a) 25 
(b) 26 
(c) 27 
(d) 24

7. The coordinates of the point where the line \(\frac{x}{2} + \frac{y}{3} = 1\) intersect x axis is :
(a) (2, 0) 
(b) (0, 2) 
(c) (3, 0) 
(d) (0, 3)

8. If the roots of the quadratic equation \(ax^2 + bx + c = 0\), \(a \neq 0\) are equal, then \(C\) is
(a) \(-\frac{b}{2a}\)  
(b) \(\frac{b}{2a}\)  
(c) \(-\frac{b^2}{4a}\)  
(d) \(\frac{b^2}{4a}\)

9. In the given fig. PQ and PR are tangent to the circle, \(\angle QOP = 70^\circ\), then \(\angle QPR\) is equal to
   (a) \(35^\circ\)  
   (b) \(70^\circ\)  
   (c) \(40^\circ\)  
   (d) \(50^\circ\)

10. A wire is in the form of a circle of radius 14 cm. If it is bent in the form of square. The side of square is :
    (a) 44 cm  
    (b) 22 cm  
    (c) 88 cm  
    (d) 14 cm

SECTION B

11. In 8 times the 8th term is equal to 12 times the 12th term of an A.P. then find its 20th term.

12. An in-circle is drawn touching the equal sides of an isosceles triangle at E and F. Show that the point D, where circle touches the third side is the mid point of that side.

13. The wheel of a bicycle makes 5000 rounds to cover the distance of 11 km. Find the diameter of the wheel.

14. Find the area of triangle whose vertices are (1, –1), (–3, 5) and (2, –7).
15. If the product of two consecutive natural numbers is 30, then find the numbers.

16. The sum of n terms of two A.P.’s are in the ratio $3n + 8 : 7n + 15$. Find the ratio of their 9th terms.

17. The length of an area of a Sector is $5\pi$ cm and the area of sector is $20\pi$ cm$^2$. Find the radius of the circle.

18. Cards with numbers 2, 3, 4, ...... 101 are placed in a bag and mined thoroughly. One card is drawn at random. Find the probability that the number on the card is

   (i) an odd number

   (ii) A composite number less than 26.

OR

Two dice are rolled simultaneously. Find the probability that the sum is more than and equal to 10.

SECTION C

19. Find the roots of the quadratic equation $2x^2 + 5x - 7 = 0$ by the method of completing the square.

20. The sum of first 9 terms of an A.P. is 171 and sum of first 24 terms is 996, find A.P.

OR

The sum of first 16 terms of an A.P. is 528 and sum of next 16 terms is 1552. Find its 19th term.

21. Constant a $\triangle ABC$ in which BC = 6.5 cm, AB = 4.5 cm and $\angle ACB = 60^\circ$. Construct another triangle similar to $\triangle ABC$ such that each side of new triangle is $\frac{4}{5}$ of the corresponding sides of $\triangle ABC$.

22. PQ is a diameter of circle and PR is a chord such that $\angle RPO = 30^\circ$ and $\angle QSR = 30^\circ$. The tangent at R intersects PQ produced at S. Prove that RQ = QS.
OR

In given Fig. PQ is a chord of length 8 cm of a circle of radius 5 cm. The tangent at P and Q intersect at a point T. Find the length of TP.

23. Draw a circle of radius 3.5 cm with centre O. Now draw two tangents PA and PB from an external point P such that \( \angle APB = 45^\circ \). Measure the length of PA and PB.

24. Find the area of Shaded portion.

25. An observer 1.5 cm tall is 28.5 m away from a chimney. The angle of elevation of the top of the chimney from his eyes is 30°. Find the height of the chimney. (Take \( \sqrt{3} = 1.73 \)).

26. Find the ratio in which the line 3x + y = 12 divides the line segment joining the points (1, 3) and (2, 7).

OR

Show that the points (–2, 3), (8, 3) and (6, 7) are the vertices of a right angled triangle.

---

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27. A point P on x-axis divides the line segment joining the points (4, 5) and (1, –3) in certain ratio. Find the coordinates of point P.

28. There are 54 marbles of blue, green and white coloured in a jar. The probability to select a blue marble is \( \frac{1}{3} \) and the probability to select a green marble is \( \frac{4}{9} \). How many white marbles are there?

**SECTION D**

29. Prove that the length of tangents drawn from an external point to a circle are equal.

**OR**

Prove that the opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

30. A pole of height 5 m is fixed on the top of the tower. The angle of elevation of the top of the pole as observed from a point ‘A’ on the ground is 60° and the angle of depression of the point A from the top of the tower is 45°. Find the height of the tower. (Take \( \sqrt{3} = 1.732 \)).

31. The side of a square is 4 cm more than the other square. If the sum of areas of these two squares is 400 square cm. Find the sides of each square.

32. A cylinder whose height is two third of its diameter has the same volume as a sphere of radius solved 4cm. Calculate the radius of the base of the cylinder.

33. Marbles of diameter 1.4 cm are dropped in to a cylindrical beaker of diameter 7 cm containing some water find the number of Marble dropped so that water level rises by 536 cm.

34. Three cubes of metal whose edges are in the ratio 3 : 4 : 5 are melted into a single cube whose diagonal is 12\( \sqrt{3} \) cm find the edges of the three cubes.

**OR**
A cylindrical pipe has inner diameter of 4cm and water flows through it at the rate of 20m. per minute. How long would it take to fill a conical tank whose diameter of base is 80 cm and depth 72cm.

**ANSWERS**

1. c  
2. d  
3. b  
4. b  
5. a  
6. a  
7. a  
8. d  
9. c  
10. b  

11. Let first term and common difference of the A.P. are a and d respectively.

\[
8 (a + 7d) = 12 (a + 11d)
\]

\[
4a + 76d = 0
\]

\[
a + 19d = 0
\]

\[
a_{20} = 0.
\]

12. \(AB = AC\) (given)

AE = AF (length of tangents from an external point)
AB – AE = AC – AF
BE = CF
but BE = BD and CF = CD
.: BD = CD
or D is mid point of BC

13. 5000 rounds = 11 km
     = 11000 meter

     1 round = \frac{11000}{5000} m = \frac{11}{5} m = \frac{1100}{5} cm

     2\pi r = \frac{1100}{5} cm \Rightarrow 2r = 70 \text{ cm}.

14. \Delta = \frac{1}{2} \left[ x_1 (y_2 - y_3) + x_2 (y_3 - y_1) + x_3 (y_1 - y_2) \right]
      = \frac{1}{2} \left[ 1 (5 + 7) - 3 (-7 + 1) + 2 (-1 - 5) \right]
      = \frac{1}{2} \left[ 12 + 18 - 12 \right]
      = 9 \text{ sq. units}

15. Let two consecutive natural number are x and x + 1 :
    
    \begin{align*}
    x (x + 1) &= 30 \\
    x^2 + x - 30 &= 0 \\
    (x + 6) (x - 5) &= 0
    \end{align*}

    \begin{align*}
    x &= 5, \quad -6 \quad (\text{Not natural}), \quad \therefore \text{Natural numbers are 5 and 6.}
    \end{align*}

16. Let first terms and common differences of two A.P.'s are \(a_1, d_1\) and \(a_2, d_2\) respectively.
\[
\frac{n}{2} \left\{ 2a_1 + (n - 1) d_1 \right\} = \frac{3n + 8}{7n + 15}
\]
\[
\frac{n}{2} \left\{ 2a_2 + (n - 1) d_2 \right\} = \frac{3n + 8}{7n + 15}
\]
\[
\frac{2 \left\{ a_1 + \frac{n - 1}{2} d_1 \right\}}{2 \left\{ a_2 + \frac{n - 1}{2} d_2 \right\}} = \frac{3n + 8}{7n + 15}
\]
\[
\frac{a_1 + 8d_1}{a_2 + 8d_2} = \frac{3 \times 17 + 8}{7 \times 17 + 15} = \frac{59}{134}.
\]

(for 9th term)
\[
\frac{n - 1}{2} = 8
\]
\[
n = 17.
\]

\[\therefore \text{ratio of 9th terms is 59 : 134.}\]

17. Area of a Sector = \(\frac{1}{2} \cdot r \cdot \theta\)

\[\Rightarrow 20\pi = \frac{5\pi \cdot r}{2}\]

\[\Rightarrow r = 8\text{cm}\]

18. (i) Probability of an odd number = \(\frac{50}{100} = \frac{1}{2}\)

(ii) Probability of a composite number = \(\frac{15}{100} = \frac{3}{20}\)

OR

Probability = \(\frac{1}{9}\)
19. \[2x^2 + 5x - 7 = 0\]

\[x^2 + \frac{5}{2}x - \frac{7}{2} = 0\] (Dividing by 2)

\[x^2 + \frac{5}{2}x + \left(\frac{5}{4}\right)^2 = \frac{7}{2} + \left(\frac{5}{4}\right)^2\]

(Adding \(\frac{5}{4}\) in both sides)

\[\left(x + \frac{5}{4}\right)^2 = \frac{7}{2} + \frac{25}{16} - \frac{81}{16}\]

\[x + \frac{5}{4} = \pm \frac{9}{4}\]

\[x = 1, -\frac{7}{2}\]

20. Let first term and common difference of A.P. and \(a\) and \(d\) respectively

\[\frac{9}{2} [2a + 8d] = 171\]

\[a + 4d = 19\] ... (i)

\[\frac{24}{2} [2a + 3d] = 996\]

\[2a + 23d = 83\] ... (ii)

Solving (i) and (ii) \(a = 7, d = 3\)

\[\therefore\ A.P.\ is\ 7, 10, 13, \ldots..\]

OR
Let first term and common difference of the A.P. are $a$ and $d$ respectively.

\[ \frac{16}{2} \left\{ 2a + 15d \right\} = 528 \quad \{ S_{16} = 528 \} \]

\[ 2a + 15d = 66 \quad \text{...(i)} \]

\[ \frac{32}{2} \left\{ 2a + 31d \right\} = 528 = 1552 \quad \{ S_{22} - S_{16} = 1552 \} \]

\[ 2a + 31d = 130 \quad \text{...(ii)} \]

From (i) and (ii) $a = 3, d = 4$

\[ \therefore \text{ 19th term} = 3 + 18 \times 4 = 75. \]


22. \[ \angle RPQ = 30^\circ \]

\[ \Rightarrow \angle RQP = 60^\circ \]

\[ \Rightarrow \angle RQS = 120^\circ \]

\[ \Rightarrow \angle SRP = 30^\circ \]

Now \[ \angle RSQ = \angle SRQ = 30^\circ \]

\[ \Rightarrow QR = QS \]
Joint OT

Now $\triangle OPT \sim \triangle OMP$

$\Rightarrow \frac{OP}{OM} = \frac{PT}{MP}$

$\Rightarrow \frac{5}{3} = \frac{n}{4}$

$\Rightarrow n = \frac{20}{3}$ cm


24. Area of Shaded Portion $= \frac{Q}{360} \pi R^2 - \frac{Q}{360} \pi r^2$

$= \frac{30}{360} \pi \times 7^2 - \frac{30}{360} \pi \times (3.5)^2$
\[ = \frac{\pi}{12} \left[ 7^2 - \left( \frac{7}{2} \right)^2 \right] \]
\[ = \frac{22}{7 \times 12} \times 7^2 \left[ 1 - \frac{1}{4} \right] \]
\[ = \frac{22 \times 7 \times 7}{7 \times 12} \times \frac{3}{4} \]
\[ = \frac{77}{8} \text{ cm}^2 \]

25. In right \( \triangle ABC \),

\[ \frac{AB}{BC} = \tan 30^\circ \]

\[ \frac{AB}{28.5} = \frac{1}{\sqrt{3}} \]

\[ AB = 28.5 \times \frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} \]

\[ = 9.5 \times 1.73 \text{ m} \]

\[ = 16.46 \text{ m} \]

Height of the Chimney = 16.46 + 1.5 m

\[ = 17.96 \text{ m} \]
26. Let the required ratio be \( K : 1 \)

The coordinates of \( P \left( \frac{2k + 1}{k + 1}, \frac{7k + 3}{k + 1} \right) \)

\( P \) lies on line \( 3x + y = 12 \)

\[ 3 \left( \frac{2k + 1}{k + 1} \right) + \frac{7k + 3}{k + 1} = 12 \]

\[ 6k + 3 + 7k + 3 = 12k + 12 \]

\[ k = 6 \]

\( \therefore \) The required ratio is 6 : 1.

OR

\[ AB^2 = (8 + 2)^2 + (3 - 3)^2 \]

\[ = (10)^2 + (0)^2 \]

\[ = 100 \]

\[ BC^2 = (6 - 8)^2 + (7 - 3)^2 \]

\[ = (-2)^2 + (4)^2 \]

\[ = 20 \]

\[ AC^2 = (6 + 2)^2 + (7 - 3)^2 \]

\[ = (8)^2 + (4)^2 \]
\[ x^2 = 80 \]
\[
\therefore \ AB^2 = BC^2 + AC^2
\]
\[
\therefore \text{By converse of Pythagoras theorem, } \triangle ABC \text{ is a right angled triangle.}
\]

27. The coordinates of any point on x-axis be \((x, 0)\) Let the required ratio be \(K : 1\)

\[
\begin{align*}
A & \quad (4, 5) \\
K & \quad \text{P(x,0)} \\
I & \quad B \quad (1, -3)
\end{align*}
\]

\[
0 = \frac{-3k + 5}{k + 1}
\]

\[-3k + 5 = 0\]

\[
k = \frac{5}{3}
\]

Ratio = 5 : 3

\[
x = \frac{k + 4}{k + 1}
\]

\[
= \frac{\frac{5}{3} + 4}{\frac{5}{3} + 1}
\]

\[
= \frac{\frac{17}{3}}{\frac{8}{3}} = \frac{17}{8}
\]

The coordinates of \(P\) are \(\left(\frac{17}{8}, 0\right)\).

28. Let there are \(x\) blue marbles
y green marbles
and z white marbles
According to question \[ x + y + z = 54 \]

Probabilit of Selecting blue marbles \[ \frac{x}{54} = \frac{1}{3} \]

\[ \Rightarrow \quad x = \frac{54}{3} \]

\[ \Rightarrow \quad x = 18. \]

Similarly Prob. of selecting green marbles \[ \frac{y}{54} \]

But \[ \frac{y}{54} = \frac{4}{9} \]

\[ \Rightarrow \quad y = \frac{4 \times 54}{9} \]

\[ \Rightarrow \quad y = 24 \]

But \[ n + y + z = 54 \]
\[ \Rightarrow \quad 18 + 24 + z = 54 \]
\[ \Rightarrow \quad z = 12 \]

white marbles are 12. \[ \text{Ans.} \]

29. \[ \text{Fig. + given + To prove + const.} \]

Proof.
Join OP, OQ, OR and OS.

\( \triangle AOP \cong \triangle AOS \) (by SSS)

\[ \angle 1 = \angle 2, \quad \angle 3 = \angle 4, \quad \angle 5 = \angle 6, \quad \angle 7 = \angle 8 \]

\[ \angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 + \angle 7 + \angle 8 = 360 \]

\[ 2(\angle 2 + \angle 3 + \angle 6 + \angle 7) = 360 \]

\[ \angle AOD + \angle BOC = 180^\circ \]

30. Correct Fig.
In right $\triangle ABD$,

$$\frac{BD}{AB} = \tan 45^\circ$$

$$\frac{h}{x} = 1$$

$$h = x \quad \text{...(1)}$$

In right $\triangle ABC$, $\frac{BC}{AB} = \tan 60^\circ$

$$\frac{h + 5}{x} = \sqrt{3}$$

$$h + 5 = x\sqrt{3} \quad \text{...(ii)}$$

$$h(\sqrt{3} - 1) = 5$$

$$h = \frac{5(\sqrt{3} + 1)}{(\sqrt{3} - 1)(\sqrt{3} + 1)}$$

$$h = x = 6.83 \text{ m or height of tomer} = 6.83 \text{ m.}$$

31. Let the side of one square = $x$ cm

and side of other square = $(x - 4)$ cm

$$x^2 + (x - 4)^2 = 400$$

$$x^2 - 4x - 192 = 0$$

$$x = 16, \ -12$$

:. Sides of squares are 16 cm and 12 cm.

32. Let diameter of cylinder = $2r$ and radius is ‘$r$’

$\Rightarrow$ height of cylinder = $\frac{2}{3} \times 2r = \frac{4r}{3}$

Now volume of cylinder = $y$ of Sphere of radius 4 cm.
\[ \Rightarrow \quad \pi \cdot r^2 \times \frac{\frac{M}{\rho}}{3} = \frac{\frac{M}{\rho}}{3} \times 4 \times 4 \times 4 \]

\[ r^3 = 4^3 \]

\[ \Rightarrow \quad r = 4 \text{ cm.} \]

33. Let ‘n’ marbles are dropped

Now V of ‘n’ marbles = 4 of raised water in cylinder

\[ \Rightarrow \quad n \times \frac{4}{3} \pi \cdot r^3 = \pi r^2 \cdot H \]

\[ \Rightarrow \quad n \times \frac{4}{3} \pi \cdot \frac{14}{20} \times \frac{14}{20} \times \frac{14}{20} = \frac{\pi}{7} \times \frac{7}{2} \times 5.6 \]

\[ \Rightarrow \quad n = 150 \text{ marbles.} \]

34. Let the sides of the cubes are 3x, 4x and 5x

Therefore volumes of three cubes = (3x)^3 + (4x)^3 + (5x)^3

\[ = 27x^3 + 64x^3 + 125x^3 \]

\[ = 216x^3 \]

But v of three cubes = v of one big cube

\[ 216x^3 = a^3 \]

(let side of big cube is ‘a’).

\[ \Rightarrow \quad a = 6x \]

Now the length of diagonal of big cube is

\[ \sqrt{(6x)^2 + (6x)^2 + (6x)^2} = \sqrt{108x^2} \]

\[ \Rightarrow \quad \sqrt{108x^2} = 12\sqrt{3} \]

\[ \Rightarrow \quad 108x^2 = 144 \times 3 \Rightarrow n = 2 \]

Therefore the sides are 6.8 and 10 cm.
OR

Let pipe can fill in ‘t’ minutes

therefore V. of water flowed in pipe in ‘t’ minutes

\[ V = V. \text{ of water in cone.} \]

\[ \Rightarrow \ \pi \times r^2 \times h \times t = \frac{1}{3} \pi r^2 \cdot h \]

\[ \Rightarrow \ \frac{\pi}{4} \times 2 \times 2 \times 2000 \times t = \frac{1}{3} \times \frac{\pi}{4} \times 40 \times 40 \times 72 \]

\[ \Rightarrow \ t = \frac{24}{5} \text{ min.} \]

or \ 4 \text{ min 48 sec.} \hspace{1cm} \text{Ans.}
## BLUE PRINT - II

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**Note**: Marks are within brackets.
SAMPLE QUESTION PAPER

MATHEMATICS (SA - II)

Time allowed : 3 to 3½ hours
Maximum Marks : 80

General Instructions

1. All question are compulsory.

2. The question paper consists of 34 questions divided into four sections A, B, C and D. Section A comprises of 10 questions of 1 mark each. Section B comprises of 8 questions of 2 marks each. Section C comprises of 10 questions of 3 marks each and Section D comprises of 6 questions of 4 marks each.

3. Question numbers 1 to 10 in Section A are multiple choice questions where you are to select one correct option out of the given four.

4. There is no overall choice. However, internal choice has been provided in 1 question of 2 marks 3 questions of three marks each and 2 questions of 4 marks each. You have to attempt only one of the alternatives in all such questions.

5. Use of calculators is not permitted.

SECTION A

Question number 1 to 10 are of 1 mark each

1. The sum of roots of the quadratic equation \(2x^2 + 13x + 11 = 0\) is

   \(a\) \(\frac{-13}{2}\) \(b\) \(\frac{-13}{2}\)

   \(c\) \(\frac{11}{2}\) \(d\) \(-11\)

2. \(n^{th}\) term of the A.P. -5, -3, -1, ........... is
3. In the given fig. P, Q and R are the points of contact. If \( AB = 6 \text{ cm}, \ BP = 3 \text{ cm} \), then the perimeter of \( \triangle ABC \) is

(a) 12 cm (b) 18 cm (c) 9 cm (d) 15 cm

4. The tops of the two poles of height 8 m and 12 m are connected with wire. If wire makes an angle 30° with the horizontal, then the length of wire is–

(a) 10 m (b) 12 m (c) 8 m (d) 4 m

5. The distance between the line \( y + 3 = 0 \) and \( 2y - 5 = 0 \) is–

(a) 8 unit (b) \( \frac{11}{2} \) unit (c) 6 unit (d) 5 unit

6. The probability of a question calculated to be right is \( \frac{x}{12} \). If the probability of the question calculoted not to be right is \( \frac{2}{3} \) then \( x = \ldots \ldots \)

(a) 2 (b) 3 (c) 4 (d) 6
7. If \(-9, -14, -19, \ldots\) is an A.P. then the value of \(a_{30} - a_{20}\) is

(a) \(-50\)  
(b) \(50\)
(c) \(10\)  
(d) None of these

8. A right circular cylinder of height 45 cm and radius 4 cm is made by melting of spheres of radius 6 cm each. Find the number of spheres.

(a) 3  
(b) 4
(c) 5  
(d) 6

9. At any instant, the shadow of a pole is equal to its height, the angle of elevation of the sun is

(a) 30°  
(b) 45°
(c) 60°  
(d) 90°

10. The perimeter of triangle formed by the points (0, 0), (3, 0) and (0, 3) is

(a) 6 unit  
(b) 9 unit
(c) 2 \((1 + \sqrt{3})\) unit  
(d) 3 \((2 + \sqrt{2})\) unit

**SECTION B**

11. If the first term of an A.P. is 3 and 6\(^{th}\) term is 23 then find its 17\(^{th}\) term.

12. For what value of ‘\(m\)’ the roots of the quadratic equation : \(4x^2 + mx + 1 = 0\) are real?

13. Two concentric circles are of radii 5 cm and 3 cm. Find the length of chord of the larger circle which touches the smaller circle.

**OR**

In given fig. find the radius of the circle.
14. In given fig. $XY$ and $X'Y'$ are two parallel tangents to a circle with centre $O$ and another tangent $AB$ with point of contact $C$ intersecting $XY$ at $A$ and $X'Y'$ at $B$. Prove that $\angle AOB = 90^\circ$.

15. Three balls are made by melting a ball of radius 3 cm out of these three the radius of two balls are 1.5 cm and 2 cm respectively. Find the radius of third ball.

16. The angle of elevation of the top of a tower from two points at a distance of 4 m and 9 m from the base and on the same straight line with it are complementary. Find the height of the tower.

17. Find a point on y-axis which is equidistant from the points $(–2, 5)$ and $(2, –3)$.

18. All kings, queens and jacks have been removed from a pack of cards and remaining cards are well shuffled. A card is drawn at random. Find the probability that it is–

(a) A face card. 

(b) A black card.
SECTION C

19. Construct an isosceles triangle whose base is 8 cm and altitude 5 cm and then construct another triangle whose sides are \( \frac{3}{4} \) times the corresponding sides of the given triangle.

20. Solve the equation

\[
\frac{x - 1}{x - 2} + \frac{x - 3}{x - 4} = \frac{10}{3}, \quad x \neq 2, \quad x \neq 4.
\]

21. In given fig. a \( \triangle ABC \) is drawn to circum scribe a circle of radius 4 cm. \( D, \quad E \) and \( F \) are points of contact. Find the sides \( AB \) and \( AC \).

22. A copper of 2.2 dm\(^3\) is melted and recast into a wire of diameter .50 cm. Find the length of wire.

**OR**

Find the area swept by a minute hand of length 14 cm in one minute.

23. Find the sum of the A.P. \( 6 + 12 + 18 + \ldots \ldots + 120 \).

24. The sum of 4\(^{th}\) and 8\(^{th}\) term of on A.P. is 24 and then sum of 5\(^{th}\) and 10\(^{th}\) term is 39, find the A.P.

**OR**

If \( n^{th} \) term of an A.P. is \( 3 - 2n \), then find hte sum of its 40 terms.
25. The slant height of right circular cone is 10 cm and its height is 8 cm. It is cut by a plane parallel to its base passing through the mid point of the height find ratio of the volume of two parts.

26. In right angled \( \Delta ABC \), \( \angle B = 90° \) and \( AB = \sqrt{34} \) unit. The coordinates of points \( B \) and \( C \) are \((4, 2)\) and \((-1, y)\) respectively. If \( ar(\Delta ABC) = 17 \) sq. unit, then find the value of \( y \).

27. A number 'x' is selected from the numbers 1, 2, 3 and the another number 'y' is selected from the numbers 1, 4, 9 what is the probability that the promet of \((x, y)\) is less than 9.

OR

A bag contains 12 balls out of which \( x \) are black. If 6 more black balls are put in the box, the probability of drawing a black ball is double of what it was before. Find \( x \).

28. If the points \((x, y), (-5, -2)\) and \((3, -5)\) are collinear prove that \(3x + 8y + 31 = 0\).

\textbf{SECTION D}

29. Two water taps together can fill a tank in \( 9 \frac{3}{8} \) hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.

OR

A motor boat, whose speed is 9 km/h in still water goes 12 km down stream and comes back in a total time 3 hours. Find the speed of the stream.

30. Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

31. From solid cylinder of height 28 cm and radius 12 cm, a conical cavity of height 16 cm, and radius 12 cm, is drilled out. Find (a) the volume (b) total surface area of remaining solid.

32. A container, shaped like a right circular cylinder, having diameter 12 cm and height 15 cm is full of ice-cream. This ice-cream is to be filled in to
cones of height 12 cm and diameter 6 cm, having a hemispherical shape on the top, find the number of such cones which can be filled with ice-cream.

33. From a point 100 m above a lake, the angle of elevation of a stationary helicopter is 30° and the angle of depression of its reflection in the lake is 60°. Find the distance of the helicopter from the point of observation.

34. A hemispherical bowl of internal diameter 36 cm is full of liquid. Thus liquid is to be filled in cylindrical bottles of radius 3 cm and height 65 cm. How many bottles are required to empty the bowl?

OR

The inner circumference of a circular track is 440 cm. The track is 14 cm wide. Find the cost of leveling it at 20 paise/sqm. Also find the cost of putting up a fencing along outer circle at Rs. 2 metre.

**Answers**

1. b  
2. a
3. b  
4. c
5. b  
6. c
7. a  
8. c
9. b  
10. d
11. 67  
12. $m \geq 4$ or $m \leq -4$
13. 8 cm or $\frac{11}{2}$ cm  
14. 5 cm
15. 6 m  
16. (0, 1)
17. (0, 1)
18. (a) 0, (b) $\frac{1}{2}$  
19. 5, $\frac{5}{2}$
20. 112 m or 10.26 cm$^2$
21. $AB = 15$ cm, $AC = 13$ cm  
22. 1260  
23. 24. $-13, -8, -3, \ldots$ OR $-1520$
25. 8 : 7  
26. $y = -1, 5$

27. $\frac{5}{9}$ OR 3.  
29. 15 hours, 25 hours OR 3 km/h

31. $10258 \frac{2}{7} \text{ cm}^3$, $3318 \frac{6}{7} \text{ cm}^2$  
32. 10

33. 200 m  
34. 72 OR Rs. 1355.20, Rs. 1056