

# NUMBER SYSTEM

## IMPORTANT CONCEPTS:

- The numbers of the form  $p/q$ , where 'p' and 'q' are integers and  $q \neq 0$ , are called rational numbers.
- A rational number  $p/q$  is said to be in simplest form, if 'p' and 'q' are integers having no common factor other than 1 and  $q \neq 0$ .
- Every rational number can be expressed as decimal. If the decimal expression of  $p/q$  terminates, then it is called a terminating decimal.
- A decimal in which a digit or a group of digits repeats periodically, is called a recurring decimal.
- The decimal expression of a rational number is either terminating or non-terminating recurring.
- The decimal expression of an irrational number is 'non-terminating and non-recurring'.
- All rational and all irrational numbers form the collection of all real numbers.
- The process of converting the irrational denominator of a number by multiplying its numerator and denominator by a suitable number, is called rationalization.

## SOME ILLUSTRATIONS/EXAMPLES:

### MCQs

1.  $3\sqrt{6} + 4\sqrt{6}$  is equal to:  
a)  $6\sqrt{6}$       b)  $7\sqrt{6}$       c)  $4\sqrt{12}$       d)  $7\sqrt{12}$

**Answer: b**

$$3\sqrt{6} + 4\sqrt{6} = (3 + 4)\sqrt{6} = 7\sqrt{6}$$

2.  $\sqrt{6} \times \sqrt{27}$  is equal to:  
a)  $9\sqrt{2}$       b)  $3\sqrt{3}$       c)  $2\sqrt{2}$       d)  $9\sqrt{3}$

**Answer: a**

$$\begin{aligned}\sqrt{6} \times \sqrt{27} &= \sqrt{2 \times 3 \times 3 \times 3 \times 3} \\ &= (3 \times 3)\sqrt{2} \\ &= 9\sqrt{2}\end{aligned}$$

3. Which of the following is equal to  $x^3$ ?  
a)  $x^6 - x^3$       b)  $x^6 \cdot x^3$       c)  $x^6/x^3$       d)  $(x^6)^3$

**Answer: c**       $x^6/x^3 = x^{6-3} = x^3$

4. Which of the following is an irrational number?  
a) 0.14      b) 0.1416      c)  $0.\overline{1416}$  d) 0.4014001400014...

**Answer: d**

0.4014001400014... is an irrational number as it is non-terminating and non-repeating.

5.  $2\sqrt{3} + \sqrt{3} =$   
a) 6      b)  $2\sqrt{6}$       c)  $3\sqrt{3}$       d)  $4\sqrt{6}$

**Answer: c**       $2\sqrt{3} + \sqrt{3} = (2+1)\sqrt{3} = 3\sqrt{3}$ .

### SHORT ANSWER TYPE QUESTIONS

1. Add  $2\sqrt{2} + 5\sqrt{3}$  and  $\sqrt{2} - 3\sqrt{3}$ .

**Solution:**

$$\begin{aligned}(2\sqrt{2} + 5\sqrt{3}) + (\sqrt{2} - 3\sqrt{3}) \\ &= 2\sqrt{2} + 5\sqrt{3} + \sqrt{2} - 3\sqrt{3} \\ &= (2 + 1)\sqrt{2} + (5 - 3)\sqrt{3} \\ &= 3\sqrt{2} + 2\sqrt{3}\end{aligned}$$

2. Simplify:  $(\sqrt{3} + \sqrt{7})(\sqrt{3} - \sqrt{7})$ .

**Solution:**

$$\begin{aligned}(\sqrt{3} + \sqrt{7})(\sqrt{3} - \sqrt{7}) \\ \text{Using the identity } (a + b)(a - b) = a^2 - b^2, \\ (\sqrt{3} + \sqrt{7})(\sqrt{3} - \sqrt{7}) = (\sqrt{3})^2 - (\sqrt{7})^2 \\ = 3 - 7\end{aligned}$$

= -4

3. Rationalize the denominator of  $1/[7+3\sqrt{3}]$ .

**Solution:**

$=1/(7 + 3\sqrt{3})$

By rationalizing the denominator,

$= [1/(7 + 3\sqrt{3})] [(7 - 3\sqrt{3})/(7 - 3\sqrt{3})]$

$= (7 - 3\sqrt{3})/[(7)^2 - (3\sqrt{3})^2]$

$= (7 - 3\sqrt{3})/(49 - 27)$

$= (7 - 3\sqrt{3})/22$

**PRACTICE QUESTIONS**

**MCQs**

- The decimal expansion of an irrational number may be:
  - Terminating
  - Recurring
  - Either terminating or non- recurring
  - non-terminating and non-recurring
- What would be the denominator after rationalizing  $7/(5\sqrt{3} - 5\sqrt{2})$ ?
  - 19
  - 20
  - 25
  - None of these
- In between two rational number there is/are:
  - Exactly one rational number
  - Infinitely many rational number
  - Many irrational numbers
  - Only irrational numbers

The value of  $\sqrt[4]{(16)^{-2}}$  is:

- $1/4$
  - $1/2$
  - 4
  - $1/16$
- $\sqrt{12} \times \sqrt{15}$  is equal to:
    - $5\sqrt{6}$
    - $6\sqrt{5}$
    - $10\sqrt{5}$
    - $\sqrt{25}$
  - Which of the following is irrational?
    - 0.14
    - 0.1416
    - $0.\overline{1416}$
    - 0.4014001400014...
  - Which of the following is irrational?
    - $\sqrt{\frac{4}{9}}$
    - $\frac{\sqrt{12}}{\sqrt{3}}$
    - $\sqrt{5}$
    - $\sqrt{81}$
  - The product of a rational and an irrational numbers is:
    - Always an integer
    - Always a rational number
    - Always an irrational number
    - Sometimes rational and sometimes irrational
  - $\sqrt{6} \times \sqrt{27}$  is equal to:
    - $9\sqrt{2}$
    - $3\sqrt{3}$
    - $2\sqrt{2}$
    - $9\sqrt{3}$

**ASSERTION- REASONING QUESTION**

- Assertion:**  $\sqrt{5}$  is an irrational number.  
**Reason:** A number is called irrational, if it cannot be written in the form  $p/q$ , where  $p$  and  $q$  are integers and  $q \neq 0$ 
  - Both Assertion and Reason are correct and Reason is the correct explanation for Assertion
  - Both Assertion and Reason are correct and Reason is not the correct explanation for Assertion.
  - assertion is true but the reason is false.
  - both assertion and reason are false.

**SHORT ANSWER TYPE QUESTIONS**

- Simplify:  $(\sqrt{5} + \sqrt{2})^2$
- Find the value of  $\sqrt{(3)^{-2}}$ .
- Identify a rational number among the following numbers :  
 $2 + \sqrt{2}$ ,  $2\sqrt{2}$ ,  $0$  and  $\pi$
- Evaluate :  $(\sqrt{5} + \sqrt{2})^2 + (\sqrt{8} - \sqrt{5})^2$
- If  $x = 15\sqrt{-2}$ , find the value of  $x^3 - 3^2 - 5x + 3$
- Find a rational number between 1 and 2.
- Write a rational number equivalent to  $5/9$  such that its numerator is 25.

8. Find two rational numbers between 0.1 and 0.3
9. Simplify:  $(4+\sqrt{3})(4-\sqrt{3})$
10. Simplify:  $(\sqrt{3}+\sqrt{2})^2$

**ANSWERS:**

**MCQs**

- |        |        |        |       |        |        |        |
|--------|--------|--------|-------|--------|--------|--------|
| Q1. d  | Q2.d,  | Q3b,   | Q4.a, | Q5. b, | Q6. a, | Q7. c, |
| Q8. C, | Q9. a, | Q10. A |       |        |        |        |

**SHORT ANSWER QUESTIONS:**

- |                      |               |                            |                         |        |
|----------------------|---------------|----------------------------|-------------------------|--------|
| Q1: $7 + 2\sqrt{10}$ | Q2: $1/3$     | Q3: 0 is a rational number | Q4: $20 - 2\sqrt{10}$ , | Q5. 4, |
| Q6. $3/2$ ,          | Q7. $25/45$ , | Q8. $5/30$ and $7/30$ ,    | Q9. 13,                 |        |
| Q10. $5+2\sqrt{6}$   |               |                            |                         |        |

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### TEST-1 (MM.20)

1. Find five rational numbers between 1 and 2.
2. Find five rational numbers between  $\frac{3}{5}$  and  $\frac{4}{5}$ .
3. Locate  $\sqrt{3}$  on the number line.
4. Find the decimal expansions of  $\frac{10}{3}$ ,  $\frac{7}{8}$  and  $\frac{1}{7}$ .
5. Find three different irrational numbers between the rational numbers  $\frac{5}{7}$  and  $\frac{9}{11}$ .
6. Visualize 3.765 on the number line, using successive magnification.
7. Represent  $\sqrt{(9.3)}$  on the number line.
8. Simplify:
  - (i)  $7^{2/3} \cdot 7^{1/5}$
- (ii)  $10^{1/2}/10^{1/4}$
9. Express  $3\frac{1}{8}$  in the form of decimal.
10. Rationalize the denominator of  $\frac{1}{\sqrt{3}-\sqrt{2}}$

### TEST-2 (MM.30)

1. Express in the form  $p/q$   
Express 0.4323232... in the form  $p/q$ , where  $p$  and  $q$  are integers and  $q \neq 0$ .
2. **Find 6 rational numbers between  $\frac{6}{5}$  and  $\frac{7}{5}$ .**
3. Rationalize the denominator:
  - a)  $\frac{1}{9+\sqrt{5}+\sqrt{6}}$
  - b)  $\frac{2}{\sqrt{3}-1}$
  - c)  $\frac{7}{\sqrt{12}-\sqrt{5}}$
4. Express as Fractions  
Express 1.363636... in the form  $p/q$ , where  $p$  and  $q$  are integers and  $q \neq 0$ .
5. Simplify the following:
  - a)  $(8+\sqrt{5})(8-\sqrt{5})$
  - b)  $(10+\sqrt{3})(6+\sqrt{2})$
  - c)  $(\sqrt{3}+\sqrt{11})^2+(\sqrt{3}-\sqrt{11})^2$
6. What can the maximum number of digits be in the recurring block of digits in the decimal expansion of  $\frac{1}{17}$ ?
7. Classify the following numbers as rational or irrational:
  - a)  $2-\sqrt{5}$
  - b)  $(3+\sqrt{23})-\sqrt{23}$
  - c)  $1/(\sqrt{2})$
8. Simply by rationalizing denominator:  $\frac{7+3\sqrt{5}}{7-3\sqrt{5}}$
9. Simplify:  
$$\left\{ \left[ 625^{\frac{-1}{2}} \right]^{\frac{1}{4}} \right\}^2$$
10. Express  $2.417\overline{8}$  in the form  $a/b$ .

# POLYNOMIALS

## (I) Main Concepts and Results:

Meaning of a Polynomial Degree of a polynomial

Coefficients

Monomials, Binomials etc.

Constant, Linear, Quadratic Polynomials etc.

Value of a polynomial for a given value of the variable Zeroes of a polynomial

Remainder theorem Factor theorem

Factorization of a quadratic polynomial by splitting the middle term Factorization of algebraic expressions by using the Factor theorem Algebraic identities –

$$(x + y)^2 = x^2 + 2xy + y^2$$

$$(x - y)^2 = x^2 - 2xy + y^2$$

$$x^2 - y^2 = (x + y)(x - y)$$

$$(x + a)(x + b) = x^2 + (a + b)x + ab$$

$$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$$

$$(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3 = x^3 + y^3 + 3xy(x + y)$$

$$(x - y)^3 = x^3 - 3x^2y + 3xy^2 - y^3 = x^3 - y^3 - 3xy(x - y)$$

$$x^3 + y^3 = (x + y)(x^2 - xy + y^2)$$

$$x^3 - y^3 = (x - y)(x^2 + xy + y^2)$$

$$x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)$$

## EXAMPLES:

### 1) MCQ'S-

(i) Which one of the following is a polynomial?

(A)  $\frac{x^2}{2} = \frac{2}{x^2}$  (B)  $\sqrt{2x} - 1$  (C)  $x^2 + \frac{3x^{\frac{3}{2}}}{\sqrt{x}}$  (D)  $\frac{x-1}{x+1}$

Answer: (C)

(ii) On factorizing  $x^2 + 8x + 15$ , we get :

(A)  $(x + 3)(x - 5)$  (B)  $(x - 3)(x + 5)$  (C)  $(x + 3)(x + 5)$  (D)  $(x - 3)(x - 5)$

Answer: (C)

(iii) On dividing  $x^2 - 2x - 15$  by  $(x - 5)$ , the quotient is  $(x + 3)$  and the following statements is true?

remainder is 0. Which of

- (A)  $x^2 - 2x - 15$  is a multiple of  $(x - 5)$
- (B)  $x^2 - 2x - 15$  is a factor of  $(x - 5)$
- (C)  $(x + 3)$  is a factor of  $(x - 5)$
- (D)  $(x + 3)$  is a multiple of  $(x - 5)$

Answer: (A)

(iv) The value of the polynomial  $2x^2 + 3x - 4$  at  $x = 0$  is:

- (A) 2    (B) 3    (C) -4    (D) 4

Answer: (C)

(v) The value of the polynomial  $5x - 4x^2 + 3$ , when  $x = -1$  is-

- (A) -6    (B) 6    (C) 2    (D) -2

Answer: (A)

## 2) SHORT ANSWER QUESTIONS:

(i) Give an example of a monomial and a binomial having degrees of 82 and 99, respectively.

Solution: An example of a monomial having a degree of 82 =  $x^{82}$ . An example of a binomial having a degree of 99 =  $x^{99} + x$ .

(ii) Find the value of the polynomial  $5x - 4x^2 + 3$  at  $x = 2$  and  $x = -1$ .

**Solution:** Let the polynomial be  $f(x) = 5x - 4x^2 + 3$

Now, for  $x = 2$ ,

$$f(2) = 5(2) - 4(2)^2 + 3$$

$$\Rightarrow f(2) = 10 - 16 + 3 = -3$$

Or, the value of the polynomial  $5x - 4x^2 + 3$  at  $x = 2$  is -3.

Similarly, for  $x = -1$ ,

$$f(-1) = 5(-1) - 4(-1)^2 + 3$$

$$\Rightarrow f(-1) = -5 - 4 + 3 = -6$$

The value of the polynomial  $5x - 4x^2 + 3$  at  $x = -1$  is -6.

(iii) Compute the value of  $9x^2 + 4y^2$  if  $xy = 6$  and  $3x + 2y = 12$ .

Solution: Consider the equation  $3x + 2y = 12$

Now, square both sides:

$$(3x + 2y)^2 = 12^2$$

$$\Rightarrow 9x^2 + 12xy + 4y^2 = 144$$

$$\Rightarrow 9x^2 + 4y^2 = 144 - 12xy$$

From the questions,  $xy = 6$  So,

$$9x^2 + 4y^2 = 144 - 72$$

Thus, the value of  $9x^2 + 4y^2 = 72$ .

### 3) PRACTICE QUESTIONS:

(A) MCQ'S QUESTIONS:

Q1.  $\sqrt{2}$  is a polynomial of degree is -

- (A) 2      (B) 0      (C) 1      (D)  $\frac{1}{2}$

Q2. Degree of the polynomial  $4x^4 + 0x^3 + 0x^5 + 5x + 7$  is -

- (A) 4      (B) 5      (C) 3      (D) 7

Q3. Degree of the zero polynomial is-

- (A) 0      (B) 1      (C) Any natural number      (D) Not defined

Q4. If  $p(x) = x^2 - 2\sqrt{2}x + 1$ , then  $p(2\sqrt{2})$  is equal to

- (A) 0      (B) 1      (C)  $4\sqrt{2}$       (D)  $8\sqrt{2} + 1$

Q5. The value of the polynomial  $5x - 4x^2 + 3$ , when  $x = -1$  is-

- (A) -6      (B) 6      (C) 2      (D) -2

Q6. If  $p(x) = x + 3$ , then  $p(x) + p(-x)$  is equal to-

- (A) 3      (B)  $2x$       (C) 0      (D) 6

Q7. Zero of the polynomial  $p(x) = 2x + 5$  is -

- (A)  $-2/5$       (B)  $-5/2$       (C)  $2/5$       (D)  $5/2$

Q8. The value of  $249^2 - 248^2$  is-

- (A) 12      (B) 477      (C) 487      (D) 497

Q9. . If  $49x^2 - b = \left\{7x + \frac{1}{2}\right\} \left\{7x - \frac{1}{2}\right\}$ , then the value of  $b$  is-

- (A) 0      (B)  $1/\sqrt{2}$       (C)  $1/4$       (D)  $\frac{1}{2}$

ASSERTION & REASON BASED QUESTION:

Q10. **Assertion:** The value of  $593 \times 607$  is 359,951.

**Reason:**  $(a + b)(a - b) = a^2 - b^2$

**Directions:** Choose the correct answer out of the following choices :

- (A) Assertion and Reason both are correct statements and Reason is the correct explanation of Assertion.  
(B) Assertion and Reason both are correct statements but Reason is not the correct explanation of Assertion.  
(C) Assertion is correct statement but Reason is wrong statement.  
(D) Assertion is wrong statement but Reason is correct statement.

(B) SHORT ANSWER QUESTIONS:

Q11. Calculate the perimeter of a rectangle whose area is  $25x^2 - 35x + 12$ .

Q12. Find the value of  $x^3 + y^3 + z^3 - 3xyz$  if  $x^2 + y^2 + z^2 = 83$  &  $x + y + z = 15$ .

Q13. If  $a + b = 15$ ,  $ab = 14$  then find  $a^2 + b^2$ .

Q14. Check whether  $(7 + 3x)$  is a factor of  $(3x^3 + 7x)$ .

Q15. Factorise  $x^2 + 1/x^2 + 2 - 2x - 2/x$ .

Q16. Factorise  $x^2 - 1 - 2a - a^2$ .

Q17. Expand  $(a - 2b + 3c)^2$

Q18. Expand  $(3a - 4b)^3$

Q19. Classify the following polynomials as polynomials Monomial, Binomial, Trinomial, Polynomial etc.

(i)  $x^2 + x + 1$  (ii)  $y^3 - 5y$  (iii)  $xy$  (iv)  $x^2 - 2xy + y^2 + 1$

Q20. Factorise:  $x^3 - 64$

(C) ANSWER OF PRACTICE QUESTIONS:

(i) MCQ QUESTIONS:-

1) (B), 2) (A), 3) (D), 4) (B), 5) (A), 6) (D), 7) (B), 8) (D) 9), (C) 10) (A)

(ii) SHORT QUESTIONS:

11)  $P = (2x - 14)$ , 12) 180, 13) 197, 14) NO, 15)  $(x + \frac{1}{x})(x + \frac{1}{x} - 2)$ ,

16)  $(x-1-a)(x+1+a)$ , 17)  $(a^2 + 4b^2 + 9c^2 - 4ab - 12bc + 6ca)$

18)  $27a^3 - 64b^3 - 108a^2c + 144ac^2$ ,

19) (i) Trinomial (ii) Binomial (iii) Monomial (iv) Polynomial

20)  $(x - 4)(x^2 + 4x + 16)$

CLASS TEST – 1 -  
TOPIC- POLYNOMIALS  
CLASS-IX

TIME- 45 MIN.

M.M. 20

SECTION – A –

( 1 mark for each correct option)

Choose the correct option from the following questions:-

Q1. . On dividing  $x^2 - 2x - 15$  by  $(x - 5)$ , the quotient is  $(x + 3)$  and remainder is 0. Which of the following statements is true?

- (a)  $x^2 - 2x - 15$  is a multiple of  $(x - 5)$       (b)  $x^2 - 2x - 15$  is a factor of  $(x - 5)$   
(c)  $(x + 3)$  is a factor of  $(x - 5)$       (d)  $(x + 3)$  is a multiple of  $(x - 5)$

Q2. The value of the polynomial  $3x + 2x^2 - 4$  at  $x = 0$  is :

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

Q3. If  $p(x) = x + 3$ , then  $p(x) + p(-x)$  is equal to :

- (a) 3    (b)  $2x$     (c) 0    (d) 6

Q4. If  $x^2 + kx + 6 = (x + 2)(x + 3)$  for all  $x$ , then the value of  $k$  is:

- (a) 1    (b) - 1    (c) 5    (d) 3

SECTION – B –

(2 marks for each correct answer)

Q5. Factorise:  $9x^2 + 4y^2 + 16z^2 + 12xy - 16yz - 24xz$

Q6. Factorise:  $4x^2 + 20x + 25$

Q7. Verify if 2 and 0 are zeroes of the polynomial  $x^2 - 2x$ .

Q8. Evaluate:  $99^3$

Q9. Expand:  $(3a+5b)^3$ .

SECTION – C –

(3 marks for each correct answer)

Q10. If  $(x - 4)$  is a factor of the polynomial  $2x^2 + Ax + 12$  and  $(x - 5)$  is a factor of the polynomial  $x^3 - 7x^2 + 11x + B$ , then what is the value of  $(A - 2B)$ ?

Q11. If  $(x+3)$  and  $(x-3)$  are factors of  $ax^2+5x+b$  then show that  $a=b$ .

CLASS TEST – 2 -  
TOPIC- POLYNOMIALS  
CLASS-IX

TIME - 90 MIN.

M.M. 30

SECTION – A –

( 1 mark for each correct option)

Choose the correct option from the following questions:-

- Q1. The value of  $(5)^3 + (7)^3 + (-12)^3$  is:  
 (a) 1260 (b) -1260 (c) 420 (d) 0
- Q2. If  $a + b = 7$ ,  $ab = 6$  then the value of  $a^3 + b^3$  will be:  
 (a) 117 (b) 217 (c) 469 (d) 61
- Q3. Product of  $(2a + 7)(2a - 7)$  is:  
 (a)  $2a^2 - 7$  (b)  $2a^2 - 49$  (c)  $2a^2 + 49$  (d)  $4a^2 - 49$
- Q4. Factors of  $\sqrt{2}x^2 - x - 10\sqrt{2}$  are:  
 (a)  $(\sqrt{2}x - 5)(x + 2\sqrt{2})$  (b)  $(\sqrt{2}x + 5)(x + 2\sqrt{2})$   
 (c)  $(\sqrt{2}x + 5)(x - 2\sqrt{2})$  (d)  $(\sqrt{2}x - 5)(x - 2\sqrt{2})$
- Q5. Factors of  $343a^3 - 125b^3$  are:  
 (a)  $(7a + 5b)(49a^2 + 35ab + 25b^2)$   
 (b)  $(7a - 5b)(49a^2 - 35ab - 25b^2)$   
 (c)  $(7a - 5b)(7a^2 + 35ab + 5b^2)$   
 (d)  $(7a - 5b)(49a^2 + 35ab + 25b^2)$

SECTION – B –

(2 marks for each correct answer)

- Q6. If  $a + b = 15$ ,  $ab = 14$  then find  $a^2 + b^2$
- Q7. Expand  $(a - 2b + 3c)^2$
- Q8. Expand  $(3a - 4c)^3$
- Q9. Find the product of  $(x^2 + 3y + 7)(x - 2)$ .
- Q10. Find the value of  $p(-2\sqrt{3})$  if  $p(y) = (\sqrt{3}y^2 - 3y + 5\sqrt{3})$ .

SECTION – C –

(3 marks for each correct answer)

- Q11. If  $a + b + c = 9$  and  $ab + bc + ca = 26$ , find  $a^2 + b^2 + c^2$ .
- Q12. If  $x + y = 12$  and  $xy = 27$ , find the value of  $x^3 + y^3$ .
- Q13. If  $(x - 2)$  is a factor of  $(x) = x^4 - 2x^3 + 3x^2 - ax + 3a - 7$   
 Then find the value of  $a$ .
- Q14. Find  $k$  if  $x^3 + 6x^2 + 11x + 6 = k(x + 1)$
- Q15. Factorise:  $x^3 - 216y^3 - 18x^2y + 108xy^2$ .

**ANSWERS FOR TEST PAPERS:**

**TEST 1 :**

**(i) MCQ QUESTIONS:-**

- 1) (a) 2) (c) 3) (c) 4) (c)

**(ii) SHORT ANSWER QUESTIONS-**

- 5)  $(3x + 2y - 4z)^2$ , 6)  $(2x + 5)^2$ , 7) YES, 2 & 0 are zeroes of given polynomial  
 8) 970299 9)  $27a^3 + 125b^3 + 135a^2b + 225ab^2$ , 10)  $A = 11, B = 5$  then  $A - 2B = 1$

**TEST 2 :**

**(i) MCQ QUESTIONS:-**

1) (b) 2) (b) 3) (d) 4) (a) 5) (d)

**(ii) SHORT ANSWER QUESTIONS-**

6) 197, 7)  $a^2 + 4b^2 + 9c^2 - 4ab - 12bc + 6ac$ , 8)  $9a^3 - 64c^3 - 108a^2c + 144ac^2$

9)  $x^3 + 3xy + 7x - 2x^2 - 6y - 14$ , 10)  $23\sqrt{3}$ , 11) 29, 12) 756, 13)  $a = -5$ ,

14)  $K = (x + 3)(x + 2)$ , 15)  $x^3 - 216y^3 - 18x^2y + 108xy^2$

JSUNIL TUTORIAL

# CO-ORDINATE GEOMETRY

## (I) Main Concepts and Results:

1. Identify the need of coordinate geometry.
2. Identify Cartesian system.
3. Understand the four quadrants and the nature of signs of points.
4. Identify the quadrant in which a given point lies.
5. Identify the terms - axes and origin.
6. Understand the meaning of coordinates.
7. Acquire skill in plotting points in the Cartesian plane.
8. Find the coordinates of a point plotted in Cartesian plane.
9. Identify the equations of the axes.
10. Understand the nature of coordinates of points on the two axes.

## EXAMPLES:

### 1) MCQ'S-

1) The name of the horizontal line in the Cartesian plane which determines the position of a point is called:

- a. Origin      b. X-axis      c. Y-axis      d. Quadrants

Answer: **b**

2) The name of the vertical line in the Cartesian plane which determines the position of a point is called:

- a. Origin      b. X-axis      c. Y-axis      d. Quadrants

Answer: **c**

3) The section formed by horizontal and vertical lines determining the position of the point in a Cartesian plane is called:

- a. Origin      b. X-axis      c. Y-axis      d. Quadrants

Answer: **d**

4) The point of intersection of horizontal and vertical lines determining the position of a point in a Cartesian plane is called:

- a. Origin      b. X-axis      c. Y-axis      d. Quadrants

Answer: a

5) If the coordinates of a point are (0, -4), then it lies in:

- a. X-axis      b. Y-axis      c. At origin      d. Between x-axis and y-axis

Answer: b

2) SHORT ANSWER QUESTIONS:

Q6. Which of the following points lie on y-axis?

A(1,1), B(1,0), C(0,1), D(0,0), E(0,-1), F(-1,0), G(0,5), H(-7,0), I(3,3).

Answer: C(0,1), D(0,0), E(0,-1), G(0,5)

Q7. Without plotting the points indicate the quadrant in which they lie, if:

- 1) Ordinate is -5 and abscissa is 3.  
2) abscissa is -5 and ordinate is -3.

Answer: IV & III quadrant.

Q8. Take a rectangle ABCD with A(-6,4), B(-5,2), C(-3,3), D(-4). Find it's mirror image with respect to x-axis.

Answer: A(-6,-4), B(-6,-2), C(-2,-2), D(-2,-4)

3) PRACTICE QUESTIONS:

(A) MCQ'S QUESTIONS:

1) If the coordinates of a point are (3, 0), then it lies in:

- a. X-axis      b. Y-axis      c. At origin      d. Between x-axis and y-axis

2) If the coordinates of a point are (-3, 4), then it lies in:

- a. First quadrant      b. Second quadrant      c. Third quadrant      d. Fourth quadrant

3) Points (1, 2), (-2, -3), (2, -3);

- a. First quadrant      b. Do not lie in the same quadrant      c. Third quadrant      d. Fourth quadrant

4) If x coordinate of a point is zero, then the point lies on:

- a. First quadrant      b. Second quadrant      c. X-axis      d. Y-axis

ASSERTION & REASON BASED QUESTION:

Q5. **Assertion:** The abscissa of a point (5, 2) is 5.

**Reason:** The  $\square$  distance of a point from y-axis is called its abscissa.

*Directions:* Choose the correct answer out of the following choices :

- (A) Assertion and Reason both are correct statements and Reason is the correct explanation of Assertion.  
(B) Assertion and Reason both are correct statements but Reason is not the correct explanation of Assertion.

- (C) Assertion is correct statement but Reason is wrong statement.  
 (D) Assertion is wrong statement but Reason is correct statement.

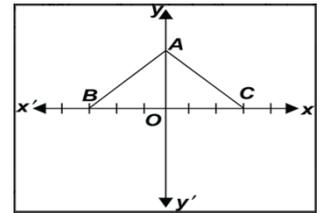
**(B) SHORT ANSWER QUESTIONS:**

- Q6. Find the coordinates of the point  
 a) Whose ordinate is -4 and lies on y-axis.  
 b) Whose abscissa is 5 and lies on x-axis.

Q7. A point lies on x-axis at a distance of 9 units from y-axis. What are its coordinates? What will be the coordinates of a point, if it lies on y-axis at a distance of -9 units from x-axis?

Q8. What will be reflections of D(-2, -3) in x-axis and y-axis?

Q9. In the given figure, ABC is an equilateral triangle. The coordinates of vertices B and C are (3,0) & (-3,0) respectively. Find the coordinates of its vertex A. Also, find its area.



Q10. Plot the points (-1, -1), (2, 3) and (8, 11) and show that they are collinear.

**(C) ANSWER OF PRACTICE QUESTIONS:**

**(A) MCQ QUESTIONS:-**

- 1) (a), 2) (b), 3) (b) 4) (d), 5) (A),

**(B) SHORT QUESTIONS:**

- 6) a) (0,-4), b) (5,0)

7) When the point lies on x axis at a distance of 9 units from y axis then the coordinate of this point is (9,0).  
 When the point lies on y axis at a distance of -9 units from x axis then the coordinate of this point is (0,-9).

8) On x-axis (-2,3), On y-axis (2,-3)

9)  $BC = 3+3 = 6$  units

Length of altitude  $OA = \frac{\sqrt{3}}{2} \times BC = \frac{\sqrt{3}}{2} \times 6 = 3\sqrt{3}$  Therefore, coordinate of A are (0,  $3\sqrt{3}$ ).

**CLASS TEST – 1 -  
 TOPIC- CO-ORDINATE GEOMETRY  
 CLASS-IX**

TIME- 45 MIN.

M.M. 20

**SECTION – A – ( 1 mark for each correct option)**

Choose the correct option from the following questions:-

Q1. The point (-10, 0) lies in



Q12. **Assertion:** Point (4, -2) lies in IV quadrant.

**Reason:** The distance of a point from y-axis is called its abscissa.

**ANSWERS OF TEST 1:-**

(A) MCQ QUESTIONS:-

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

(B) SHORT QUESTIONS:

5) I and IV quadrants , Explanation: In a coordinate plane, x can take positive values in the first and fourth quadrants. For example, (2, 2) and (2, -4) lie on the first and fourth quadrants, respectively.

6) I,IV,III,II, on Y-Axis & X-Axis ,

7) 0 , Explanation: The abscissa of all the points on the y-axis is 0. We know that the coordinates of any point on the y-axis is (0, y). Here, the ordinate can take any value and the abscissa is zero.

8) Y-Axis , 9) (0, -5) , 10)  $x=1, y=1$

Q11. (a) Assertion and Reason both are correct statements and Reason is the correct explanation of Assertion.

Q12. (b) Assertion and Reason both are correct statements but Reason is not the correct explanation of Assertion.

# LINEAR EQUATION IN TWO VARIABLE

## Main Concepts and Results:

- Any equation which can be written in the form  $ax + by + c = 0$ , where  $a, b$  and  $c$  are real numbers  $a \neq 0, b \neq 0$  is called a **linear equation in two variables**.
- An **ordered pair**  $(x, y)$  is the solution of linear equation in two variables if this point satisfies the linear equation  $ax + by + c = 0$ .
- **Examples** of line are equation in two variables  $-2x + 4y = 1, x + 10y = 5$ , etc.
- A **linear equation** has a **unique solution** when there exists only one point which satisfies the linear equation.

- For example: Solution of  $2x + 6 = 2$  is

- $2x + 6 = 2$   
 $2x = 2 - 6$

$$2x = -4$$

$$x = -4 \div 2$$

$$x = -2$$

In  $2x + 6 = 2$  has only one variable  $x$  therefore  $x$  has unique solution. Also, geometrically it will be a point on rectangular axes whose ordinate will be 0.

- A system of linear equation has unique solution when the system of lines intersects each other at only one point.
- A **linear equation in two variables** have **infinitely many solutions** means there are more than one ordered pair which satisfy the equation.
- **Equation of x-axis** is  $y = 0$  because in x-axis,  $y$  coordinates are always zero and the coordinate form of any point on x-axis will be  $(x, 0)$ .
- **Equation of y-axis** is  $x = 0$  because at y-axis  $x$ -coordinates are always zero and the coordinate form of any point on y-axis will be  $(0, y)$

## ILLUSTRATIONS:

### MCQ TYPES OF QUESTIONS:

1. Which points given below satisfy the equation  $2x + 3y = 12$ ?

- A. (-6, 8)    B. (6, -8)    C. (3, 2)    D. (-4, 5)

Ans. A

2. Which of the following is a linear equation in one variable?

- A.  $2x + 3y = 0$     B.  $x^2 = 5x + 3$     C.  $5x = y^2 + 3$     D.  $2x + 5 = 11$

Ans. D

3. The cost of book (x) exceeds twice the cost of pen (y) by 10 rupees. This statement can be expressed as linear equation as:

- A.  $x - 2y - 10 = 0$     B.  $2x - y - 10 = 0$     C.  $2x + y - 10 = 0$     D.  $x - 2y + 10 = 0$

Ans. A

4. The linear equation  $2x - 5y = 7$  has

- (A) unique solution (B) Two solutions (C) Infinitely many solutions (D) No solution

Ans. C

5. Assertion: (2,1) is a solution of  $2x + 3y = 7$

Reason: If Ordered pair (p, q) lies on the line then it is one of the solutions of line  $ax + by + c = 0$ .

A) Both Assertion and Reason are correct and reason is correct explanation for the assertion.

B) Both Assertion and Reason are false but reason is not correct explanation for assertion.

C) Assertion is correct but reason is false.

D) Both Assertion and reason are false.

Ans. A

### SHORT ANSWER TYPE QUESTIONS:

1. Find the points where the graph of the equation  $3x + 4y = 12$  cuts the x-axis and the y-axis.

Ans. The graph of the linear equation  $3x + 4y = 12$  cuts the x-axis at the point where  $y = 0$ . On putting  $y = 0$  in the linear equation, we have  $3x = 12$ , which gives  $x = 4$ . Thus, the required point is (4, 0).

2. Determine the point on the graph of the equation  $2x + 5y = 20$  whose x-coordinate is  $\frac{5}{2}$  times its ordinate.

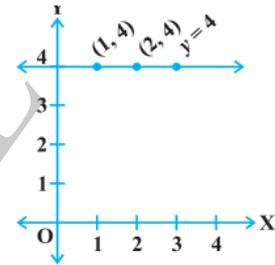
Ans. As the x-coordinate of the point is  $\frac{5}{2}$  times its ordinate, therefore,  $x = \frac{5}{2}y$ . Now putting value of x in  $2x + 5y = 20$ , we get,  $y = 2$ . Therefore,  $x = 5$ . Thus, the required point is (5, 2).

3. At what point does the graph of the linear equation  $x + y = 5$  meet a line which is parallel to the y-axis, at a distance 2 units from the origin and in the positive direction of x-axis.

Ans. The coordinates of the points lying on the line parallel to the y-axis, at a distance 2 units from the origin and in the positive direction of the x-axis are of the form (2, a). Putting  $x = 2$ ,  $y = a$  in the equation  $x + y = 5$ , we get  $a = 3$ . Thus, the required point is (2, 3).

4. Draw the graph of the equation represented by the straight line which is parallel to the x-axis and is 4 units above it.

Ans.



5. Let y varies directly as x. If  $y = 12$  when  $x = 4$ , then write a linear equation. What is the value of y when  $x = 5$ .

Ans. This shows that  $y = 3x$

Hence, at  $x = 5$  we get  $y = 15$ .

### QUESTIONS FOR PRACTICE:

#### MCQ TYPES OF QUESTIONS:

- The positive solutions of the equation  $ax + by + c = 0$  always lie in the quadrant (A) 1st (B) 2nd quadrant (C) 3rd quadrant (D) 4th quadrant
- $x = 5, y = 2$  is a solution of the linear equation (A)  $x + 2y = 7$  (B)  $5x + 2y = 7$  (C)  $x + y = 7$  (D)  $5x + y = 7$
- How many linear equations in x and y can be satisfied by  $x = 1$  and  $y = 2$ ? (A) Only one (B) Two (C) Infinitely many (D) Three
- Any point on the line  $y = x$  is of the form (A) (a, a) (B) (0, a) (C) (a, 0) (D) (a, -a)
- Assertion: The graph of  $y = b$  is always parallel to x-axis.  
Reason: The graph of  $y = 6$  is a line that passes through the origin.  
A) Both Assertion and Reason are correct and reason is correct explanation for the assertion.  
B) Both Assertion and Reason are false but reason is not correct explanation for assertion.  
C) Assertion is correct but reason is false.  
D) Both Assertion and reason are false.

#### SHORT ANSWER TYPE QUESTIONS:

1. How many solution(s) of the equation  $2x + 1 = x - 3$  are there on the:

- (i) Number line (ii) Cartesian plane

2. Show that the points A (1, 2), B (-1, -16) and C (0, -7) lie on the graph of the linear equation  $y = 9x - 7$ .

3. For what value of c, the linear equation  $2x + cy = 8$  has equal values of x and y for its solution.

4. The following observed values of x and y are thought to satisfy a linear equation. Write the linear equation:

|   |    |    |
|---|----|----|
| x | 6  | -6 |
| y | -2 | 6  |

Draw the graph using the values of x, y as given in the above table. At what points the graph of the linear equation

- (i) cuts the x-axis      (ii) cuts the y-axis

5. If the point (3, 4) lies on the graph of  $3y = ax + 7$ , then find the value of a.

**ANSWERS:**

**MCQ QUESTIONS**

1. A      2.C      3. C      4. A      5. C

**SHORT ANSWER TYPE QUESTIONS**

1. One, infinite      2. yes, all points are solutions.      3.  $c = \frac{8-x}{x}$
4. The graph cuts the x-axis at (3, 0) and the y-axis at (0, 2).
5.  $\frac{5}{3}$

**PRACTICE TEST-1**

**MARKS: 20**

Q NO.

**QUESTIONS**

**SECTION - A**

1. The equation of x-axis is 1
- (a)a = 0    (b)y = 0    (c)x = 0    (d)y = k
2. The ordered pair (m, n) satisfies the equation  $ax + by + c = 0$  if 1
- (a)  $am + bn = 0$     (b)  $c = 0$     (c)  $am + bn + c = 0$     (d)  $am + bn - c = 0$
3. Which of the following is not a linear equation in two variables? 1
- (a)  $ax + by = c$     (b)  $ax^2 + by = c$     (c)  $2x + 3y = 5$     (d)  $3x + 2y = 6$

4. A linear equation in two variables has \_\_\_ solutions. 1  
 (a)no (b)only one (c)only two (d)infinitely many
5.  $x=5$  ,  $y=2$  is a solution of the linear equation 1  
 (a) $x+2y=7$  (b) $5x+2y=7$  (c) $x+y=7$  (d) $5x+y=7$
6. The graph of the linear equation  $2x+3y=6$  is a line which meets the x-axis at the point 1  
 (a)(2,0) (b)(0,3) (c)(3,0) (d)(0,2)
7. The point of the form (a , a) always lies on: 1  
 (a) x-axis (b) y-axis (c) on the line  $y = x$  (d) on the line  $x + y = 0$
8. The solution of the equation  $x - 2y = 4$  is: 1  
 (a)(0,2) (b)(4,0) (c)(1,1) (d)(2,0)
9. If (2 , 0) is a solution of the linear equation  $2x + 3y = k$ , then the value of k is 1  
 (a)4 (b)6 (c)5 (d)2
10. The equation  $x = 7$ , in two variables, can be written as 1  
 (a) $x+0y=7$  (b)  $0x+ y=7$  (c)  $0x + 0y=7$  (d) $x +y=7$

#### SECTION-B

11. Find the solution of the linear equation  $x+2y = 8$  which represents a point on (i)x-axis (ii)y-axis 2
12. Solve the equation  $2x+1 = x-3$ , and represent the solution(s) on 2  
 (i) The number line,  
 (ii) The Cartesian plane.
13. Let y varies directly as x. If  $y = 12$  when  $x=4$ , then write a linear equation. What is the value of y when  $x= 5$ ? 2
14. Determine the point on the graph of the equation  $2x + 5y = 20$  whose x-coordinate is  $\frac{5}{2}$  times its ordinate. 2
15. What is the distance of (2 , 4) from x-axis and y-axis. 2

ANSWERS:

1.b 2. C 3.b 4.d 5. C 6.c 7.c 8.b 9.a 10. a

11. (i) (8,0) (ii) (0,4)

12.  $x = -4$

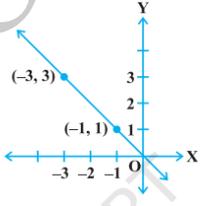
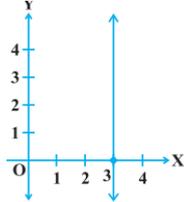
13.  $y = 3x$ ,  $y = 15$

14. (5,2)

## PRACTICE TEST-2

MARKS: 30

| Q<br>N<br>O<br>. | QUESTION   |   |
|------------------|--|---|
|                  | SECTION - A  |   |
| 1                | Which of the following represent a line parallel to x-axis?<br>(A) $x + y = 3$ (B) $2X + 3 = 7$<br>(C) $2Y - 3 = Y - 7$ (D) $x + 3 = 0$  | 1 |
| 2                | The point of the form $(a, -a)$ always lies on the line<br>(A) $x = a$ (B) $y = -a$ (C) $y = x$ (D) $x + y = 0$  | 1 |
| 3                | If we multiply or divide both sides of a linear equation with a non-zero number, then the solution of the linear equation:<br>(A) Changes (B) Remains the same<br>(C) Changes in case of multiplication only<br>(D) Changes in case of division only   | 1 |
| 4                | The equation $2x + 5y = 7$ has a unique solution, if $x, y$ is:<br>(A) Natural numbers (B) Positive real numbers<br>(C) Real numbers (D) Rational numbers  | 1 |
| 5                | The linear equation $3x - y = x - 1$ has:<br>(A) A unique solution (B) Two solutions<br>(C) Infinitely many solutions (D) No solution  | 1 |
| 6                | A linear equation in two variables is of the form $ax + by + c = 0$ , where<br>(A) $a \neq 0, b \neq 0$ (B) $a = 0, b \neq 0$ (C) $a \neq 0, b = 0$<br>(D) $a = 0, c = 0$  | 1 |
| 7                | Any point on the y-axis is of the form<br>(A) $(x, 0)$ (B) $(x, y)$ (C) $(0, y)$ (D) $(y, y)$  | 1 |
| 8                | The solution of a linear equation in two variables is<br>(A) a number which satisfies the given equation<br>(B) an ordered pair which satisfies the given equation<br>(C) an ordered pair, whose respective values when substituted for $x$ and $y$ in the given equation, satisfies it<br>(D) none of these | 1 |
| 9                | The graph of $ax + by + c = 0$ is<br>(A) a straight line parallel to x-axis<br>(B) a straight line parallel to y-axis<br>(C) a general straight line<br>(D) a line in the 2 <sup>nd</sup> and 3 <sup>rd</sup> quadrant   | 1 |
| 10               | The ordered pair $(m, n)$ satisfies the equation $ax + by + c = 0$ if<br>(A) $am + bn = 0$ (B) $c = 0$<br>(C) $am + bn + c = 0$ (D) $am + bn - c = 0$  | 1 |

- 1 The linear graph  $2x + 3y = 12$  cuts y axis at 1  
1  
· (A) (3, 0) (B) (4, y) (C) (2, 2) (D) (3,2)
- 1 The graph of the linear equation in two variables  $y = mx$  is 1  
2  
· (A) a line parallel to x-axis  
(B) a line parallel to y-axis  
(C) a line passing through the origin  
(D) not a straight line
- 1 How many linear equations in x and y can be satisfied by 1  
3  
·  $x = -1$  and  $y = 3$ ?  
(A) Only one (B) two  
(B) (C) three (D) infinitely many
- 1 Point (3,1) lies on the line: 1  
4  
· (A)  $x + 2y = 5$  (B)  $x + 2y = -6$  (C)  $x + 2y = 6$  (D)  $x + 2y = 16$
- 1 The graph of the linear equation  $x + 2y = 7$  passes through 1  
5  
· the point  
(a) (0, 7) (b) (4, 3) (c) (6,1) (d) (7,0)
- 1 The graph below is of which linear equation: 1  
6  
· (A)  $x + y = 0$   
(B)  $x - y = 0$   
(C)  $2x + y = 3$   
(D)  $2x - 3y = 4$
- 
- 1 The following is the graph of which 1  
7  
· linear equation:  
(A)  $x - 3 = 0$   
(B)  $x = y$   
(C)  $2x + y = 0$   
(D)  $x + 2y = 0$
- 
- 1 The graphs of linear equations  $y = x$  and  $y = -x$  on the same 1  
8  
· cartesian plane. What do you observe?  
(A) Both lines intersect at origin.  
(B) Both lines are parallel to x-axis.  
(C) Both lines are parallel to y-axis.  
(D) None of these.
- 1 Assertion: (2,4) is a solution of  $2x + 3y = 16$  1  
9  
· Reason: If Ordered pair (p, q) lies on the line then it is one of the solutions of line  $ax + by + c = 0$ .
- A) Both Assertion and Reason are correct and reason is correct explanation for the assertion.  
B) Both Assertion and Reason are false but reason is not correct explanation for assertion.  
C) Assertion is correct but reason is false.

- D) Both Assertion and reason are false.
- 2 The value of k if (3,1) lies on  $4x - ky = -2$  1
- 0
- . a)10 (b)14 (c)15 (d)12

SECTION - B

- 2 Form a linear equation whose solutions are represented by 2
- 1 the points having the sum of the coordinates as 10 units.
- .
- 2 Determine the point on the equation  $2x + 5y = 20$  whose 2
- 2 x-coordinate is  $\frac{5}{2}$  times its ordinate.
- .
- 2 How many solution(s) of the equation 2
- 3  $3x + 1 = 2x - 3$  are there on the:
- . (i) Number line (ii) Cartesian plane
- 2 Find four different solutions of the equation  $x + 2y = 6$ . 2
- 4
- .
- 2 The cost of a notebook is twice the cost of a pen. Write a linear 2
- 5 equation in two variables to represent this statement.
- .

ANSWERS:

- 1.C 2. B 3.C 4.A 5.C 6.A 7.C 8.C 9.C 10.C 11.D 12.C 13.C 14.A 15.D
- 16.A 17.A 18.A 19.A 20.B 21.  $x + y = 10$  22.  $\frac{5}{2}$  23. (i) one (ii) infinite 24. (2,2),
- (0,3), (6,0), (4,1)

25. let cost of one pen be x and one notebook be y

$$y = 2x$$

$$y - 2x = 0$$

# EUCLID GEOMETRY

## CONCEPTS

Points, Line, Plane or surface, Axiom, Postulate and Theorem, The Elements, Shapes of altars or vedis in ancient India, Equivalent versions of Euclid's fifth Postulate, Postulates

1. A straight line may be drawn from any point to any other point.
2. A terminated line (line segment) can be produced indefinitely.
3. A circle may be described with any centre and any radius.
4. All right angles are equal to one another.
5. If a straight line falling on two straight lines makes the interior angles on the same side of it, taken together less than two right angles, then the the two straight lines if produced indefinitely, meet on that side on which the sum of angles is taken together less than two right angles

## Euclid's axioms

- (1) Things which are equal to the same thing are equal to one another.
- (2) If equals are added to equals, the wholes are equal.
- (3) If equals are subtracted from equals, the remainders are equal.
- (4) Things which coincide with one another are equal to one another.
- (5) The whole is greater than the part.
- (6) Things which are double of the same things are equal to one another.
- (7) Things which are halves of the same things are equal to one another.

## ILLUSTRATIONS

### MCQ

1. Euclid's fifth postulate is
  - (A) The whole is greater than the part.
  - (B) A circle may be described with any centre and any radius.

(C) All right angles are equal to one another.

(D) If a straight line falling on two straight lines makes the interior angles on the same side of it taken together less than two right angles, then the two straight lines if produced indefinitely, meet on that side on which the sum of angles is less than two right angles.

Solution : Answer (D)

2: John is of the same age as Mohan. Ram is also of the same age

as Mohan. State the Euclid's axiom that illustrates the relative ages of John and Ram

(A) First Axiom (B) Second Axiom

(C) Third Axiom (D) Fourth Axiom

Solution : Answer (A)

3. Euclid divided his famous treatise "The Elements" into :

(A) 13 chapters (B) 12 chapters (C) 11 chapters (D) 9 chapters

ANS A) 13 CHAPTERS

4. The number of dimensions, a solid has :

(A) 1 (B) 2 (C) 3 (D) 0

Short answer type questions

1 .Write whether the following statements are True or False?

Justify your answer

1Euclid's fourth axiom says that everything equals itself.

Ans True. Things equal to the same thing are equal.

### QUESTION FOR PRACTICE

1.The number of dimensions, a solid has :

(A) 1 (B) 2 (C) 3 (D) 0

2.. It is known that if  $x + y = 10$  then  $x + y + z = 10 + z$ . The Euclid's axiom that illustrates this statement is :

(A) First Axiom (B) Second Axiom

(C) Third Axiom (D) Fourth Axiom

3. Which of the following needs a proof ?

(A) Theorem (B) Axiom (C) Definition (D) Postulate

4. Euclid belongs to the country :

(A) Babylonia (B) Egypt (C) Greece (D) India

5. Assertion and reason

**2) Assertion: Through two distinct points there can be only one line that can be drawn.**

**Reason: . . From this two point we can draw only one line**

- a) both Assertion and reason are correct and reason is correct explanation for Assertion
- b) both Assertion and reason are correct but reason is not correct explanation for Assertion
- c) Assertion is correct but reason is false
- d) both Assertion and reason are false

Short answer type

6. Ram and Ravi have the same weight. If they each gain weight by 2 kg, how will their new weights be compared ?

7 If a point C lies between two points A and B such that  $AC = BC$ , then prove that  $AC = \frac{1}{2} AB$ . Explain by drawing the figure.

8. Write postulate 1 in your own words.

9. If A, B and C are three points on a line, and B lies between A and C then prove that  $AB + BC = AC$ .

10. : Solve the equation  $a - 15 = 25$  and state which axiom do you use here.

Answers 1) C 2) (B) 3) (A) 4) (C) 5) (A) 6) Ram and Ravi are equal in weight.

10. Euclid's second axiom). or  $a = 40$

### Chapter test MM 20

MCQ (1 Mark each)

1. The number of dimensions, a solid has :

(A) 1 (B) 2 (C) 3 (D) 0

2. The number of dimensions, a surface has :

(A) 1 (B) 2 (C) 3 (D) 0

3. The number of dimension, a point has :

(A) 0 (B) 1 (C) 2 (D) 3

4. The side faces of a pyramid are :

(A) Triangles (B) Squares (C) Polygons (D) Trapeziums

5. Which of the following needs a proof ?

(A) Theorem (B) Axiom (C) Definition (D) Postulate

6. It is known that if  $x + y = 10$  then  $x + y + z = 10 + z$ . The Euclid's axiom that illustrates this statement is :

7. In Indus Valley Civilisation (about 3000 B.C.), the bricks used for construction work were having dimensions in the ratio

(A) 1 : 3 : 4 (B) 4 : 2 : 1 (C) 4 : 4 : 1 (D) 4 : 3 : 2 (A) First Axiom (B) Second Axiom

### Chapter test

8 'Lines are parallel if they do not intersect' is stated in the form of

(A) an axiom (B) a definition (C) a postulate (D) a proof

9. The things which are equal to the same thing are equal to one another in the form of

(A) An axiom (B) definition (C) a postulate (D) a proof

10. Boundaries of surfaces are :

(A) surfaces (B) curves (C) lines (D) points

Short answer type (2 marks each)

11. : Solve the equation  $a - 15 = 25$  and state which axiom do you use here.

12. If a point C lies between two points A and B such that  $AC = BC$ , then prove that  $AC = \frac{1}{2} AB$ . Explain by drawing the figure.

13. Write the Euclid's second postulate in your own words.

14 Ram and Ravi have the same weight. If they each gain weight by 2 kg, how will their new weights be compared ?

15. Give a definition for each of the following terms.

i) parallel lines ii) line segment

### Chapter test MM 30

MCQ(1 MARK)

1. The number of dimensions, a solid has :

(A) 1 (B) 2 (C) 3 (D) 0

2. The number of dimensions, a surface has :

(A) 1 (B) 2 (C) 3 (D) 0

3. The number of dimension, a point has :

(A) 0 (B) 1 (C) 2 (D) 3

4. The side faces of a pyramid are :

(A) Triangles (B) Squares (C) Polygons (D) Trapeziums

5. Which of the following needs a proof ?

(A) Theorem (B) Axiom (C) Definition (D) Postulate

6. It is known that if  $x + y = 10$  then  $x + y + z = 10 + z$ . The Euclid's axiom that illustrates this statement is :

9. The things which are equal to the same thing are equal to one another in the form of (A) An axiom (B) definition (C) a postulate (D) a proof

10. Boundaries of surfaces are :

(A) surfaces (B) curves (C) lines (D) points

SHORT ANS TYPE(2 MARKS EACH)

- 11 .State any two Euclids postulates .
- 12 .Solve the equation  $x - 5 = 15$  and state the axiom that you use here.
- 13 How many dimensions do boundaries of surfaces have ?
14. What is the difference between axiom and postulates?
- 15 Which of the following statements are true and which are false? Give reasons for your
- 16.: Solve the equation  $a - 15 = 25$  and state which axiom do you use here.
17. If a point C lies between two points A and B such that  $AC = BC$ , then prove that  $AC = \frac{1}{2} AB$ . Explain by drawing the figure.
18. Write the Euclid s second postulate in your own words.
19. Ram and Ravi have the same weight. If they each gain weight by 2 kg, how will their new weights be compared ?
- 20.. Give a definition for each of the following terms.  
i)parallel lines ii)line segment

# LINES AND ANGLES

## Basic Terms and Definitions on Lines and Angles

**Line Segment:** A line that has two endpoints is called a line segment.



**Ray:** A line with one endpoint and the other end of the line extending up to infinity is called a ray.



**collinear points:** When three or more points lie on the same line, they are said to be collinear.

**Non-collinear points:** When three or more points do not lie on the same line, they are non-collinear.

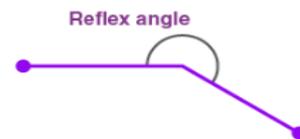
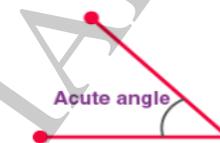
**Angle:** An angle is formed by two rays meeting at a common point (called a vertex), and the rays forming the angle are called arms of the angle.

**Acute Angle:** An angle that measures between  $0^\circ$  and  $90^\circ$  is called an acute angle.

**Obtuse angle:** An angle that measures between  $90^\circ$  and  $180^\circ$  is called an obtuse angle.

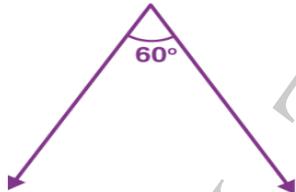
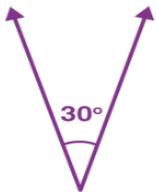
**Right angle:** An angle that is equal to  $90^\circ$  is called a right angle.

**Reflex angle:** An angle greater than  $180^\circ$  but less than  $360^\circ$  is called a reflex angle.

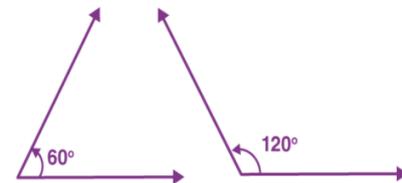


### : [Types Of Angles](#)

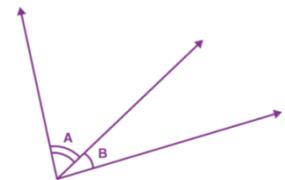
**Complementary angles:** When sum of two angles is equal to  $90^\circ$



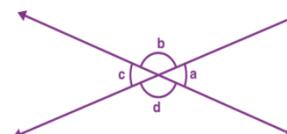
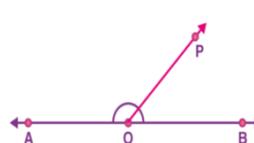
**Supplementary angles:** When sum of two angles is equal to  $180^\circ$ .



**Adjacent angles:** Two angles with a common vertex, a common arm and their non-common arms on different sides of the common arm.



**Linear pairs of angles:** When 2 adjacent angles are supplementary, i.e. they form a straight line (add up to  $180^\circ$ ), they are called a linear pair.



**Vertically opposite angles:** When two lines intersect at a point, they form equal angles that are vertically opposite to each other.

## Intersecting and Non-Intersecting Lines

When two lines intersect each other at a common point, they are said to be intersecting lines.



Non-intersecting lines are parallel lines that do not intersect each other at a common point.



## Pairs of Angles

### Axiom – Linear Pair of Angles

If a ray stands on a line, the sum of two adjacent angles so formed is  $180^\circ$ .

### Axiom – Converse of Linear Pair of Angles

If the sum of two adjacent angles is  $180^\circ$ , the non-common arms of the angles form a line.

### Theorem – Vertically Opposite Angles

If two lines intersect each other, the vertically opposite angles are equal.

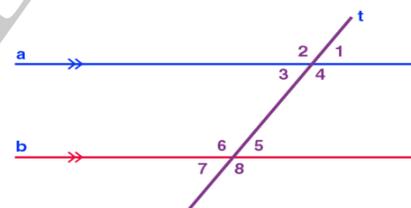
### Parallel lines with a transversal

A line that intersects two or more lines is called a transversal.

$\angle 1 = \angle 5, \angle 2 = \angle 6, \angle 4 = \angle 8$  and  $\angle 3 = \angle 7$  (Corresponding angles)

$\angle 3 = \angle 5, \angle 4 = \angle 6$  (Alternate interior angles)

$\angle 1 = \angle 7, \angle 2 = \angle 8$  (Alternate exterior angles)



Interior angles on the same side of the transversal are referred to as consecutive interior angles, allied angles, or co-interior angles.

### Corresponding angles axiom

If a transversal intersects two parallel lines, then each pair of corresponding angles are equal.

### Converse of corresponding angles axiom

If a transversal intersects two lines such that a pair of corresponding angles are equal, then the two lines are parallel to each other.

### Theorem – Alternate interior angles

If a transversal intersects two parallel lines, then each pair of alternate interior angles are equal.

### Theorem – Converse of alternate interior angles

If a transversal intersects two lines such that a pair of alternate interior angles are equal, then the two lines are parallel.

### Theorem – Sum of co-interior angles is supplementary

If a transversal intersects two parallel lines, then each pair of interior angles on the same side of the transversal is supplementary.

### Theorem – Converse of the sum of co-interior angles is supplementary

If a transversal intersects two lines such that a pair of interior angles on the same side of the transversal are supplementary, then the two lines are parallel.

## Lines parallel to the same line

Lines that are parallel to the same line are also parallel to each other.

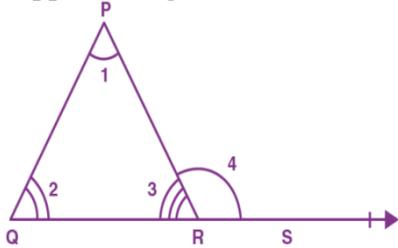
### Theorem – Lines Parallel to the Same Line

Lines which are parallel to the same line are parallel to each other.

### Angle Sum Property of a Triangle

Theorem 1: The sum of the angles of a triangle is  $180^\circ$ .

Theorem 2: If a side of a triangle is produced, then the exterior angle so formed is equal to the sum of the two interior opposite angles.



$$\angle 4 = \angle 1 + \angle 2$$

### M.C.Q. QUESTIONS

Question 1. In a triangle, if the measure of an exterior angle is  $105^\circ$  and its opposite interior angles are equal. Find the value of these equal angles

- a.  $72\frac{1}{2}^\circ$
- b.  $52\frac{1}{2}^\circ$
- c.  $75^\circ$
- d.  $37^\circ$

Answer: b.  $52\frac{1}{2}$

Explanation: Given, exterior angle =  $105^\circ$

Let us consider the interior angles as x

Using the exterior angle theorem,

[Sum of the interior opposite angles = exterior angle]

$$2x = 105^\circ$$

$x = 52\frac{1}{2}^\circ$ . Hence, each of the interior opposite angles measure  $52\frac{1}{2}^\circ$ .

Question 2: If the ratio of the angles 2:4:3. The value of the smallest angle will be:

- a.  $40^\circ$
- b.  $80^\circ$
- c.  $60^\circ$
- d.  $20^\circ$

Answer: a.  $40^\circ$

Explanation: let us consider 2:4:3 as 2x, 4x and 3x

So,  $2x + 4x + 3x = 180^\circ$  [the sum of the interior angles of a triangle is  $180^\circ$ ]

$$9x = 180^\circ$$

$$x = 20^\circ$$

Hence, the value of:

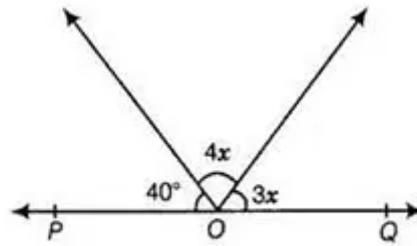
$$2x = 2(20^\circ) = 40^\circ$$

$$4x = 4(20^\circ) = 80^\circ$$

$$3x = 3(20^\circ) = 60^\circ$$

So, the smallest angle is  $40^\circ$ .

Question3: Find the value of  $x$  from the given figure, where  $POQ$  is a line.



- a.  $20^\circ$
- b.  $30^\circ$
- c.  $25^\circ$
- d.  $35^\circ$

Answer: a.  $20^\circ$

Explanation: Given  $POQ$  is a line, which means  $POQ = 180^\circ$ .

$$40^\circ + 4x + 3x = 180^\circ$$

$$40^\circ + 7x = 180^\circ$$

$$7x = 180^\circ - 40^\circ$$

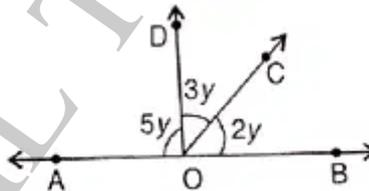
$$7x = 140^\circ$$

$$x = 140^\circ / 7$$

$$x = 20^\circ$$

So,  $x = 20^\circ$

Question4: If  $AOB$  is a line then the measure of  $\angle BOC$ ,  $\angle COD$  and  $\angle DOA$  respectively in the given figure, are:



- a.  $36^\circ, 54^\circ, 90^\circ$
- b.  $90^\circ, 54^\circ, 36^\circ$
- c.  $90^\circ, 36^\circ, 54^\circ$
- d.  $36^\circ, 90^\circ, 54^\circ$

Answer: a.  $36^\circ, 54^\circ, 90^\circ$

Explanation:  $\angle AOD + \angle DOC + \angle COB = 180^\circ$  [sum of the interior angles of a triangle is  $180^\circ$ ]

$$5y + 3y + 2y = 180^\circ$$

$$10y = 180^\circ$$

$$y = 180^\circ / 10$$

$$y = 18^\circ$$

So, the values of  $5y$ ,  $3y$  and  $2y$  are:

$$5y = 5 (18^\circ) = 90^\circ$$

$$3y = 3 (18^\circ) = 54^\circ$$

$$2y = 2 (18^\circ) = 36^\circ$$

## CASE STUDY BASED QUESTIONS

Q1. Read the following and answer the questions given below :

Ramesh singh bought an electric bicycle for his son. He saw the bicycle and felt very happy. After seeing the bicycle he thought of some geometrical figure:

- (i) From the geometrical figure, what is  $\angle CBF$ , if  $\angle BCD = 45^\circ$  and  $AB \parallel CD$ ?  
(a)  $90^\circ$  (b)  $45^\circ$  (c)  $75^\circ$  (d)  $30^\circ$
- (ii) In the given figure,  $\angle AFC = 75^\circ$ , then  $\angle CFB =$   
(a)  $75^\circ$  (b)  $45^\circ$  (c)  $105^\circ$  (d) None of these
- (iii) In the given figure,  $\angle FCB =$   
(a)  $45^\circ$  (b)  $30^\circ$  (c)  $75^\circ$  (d) None of these
- (iv) In the given figure, what is the value of  $\angle EFB$ ?  
(a)  $75^\circ$  (b)  $45^\circ$  (c)  $30^\circ$  (d)  $105^\circ$

Answer : (i) We have,  $AB \parallel CD$

$\angle BCD = \angle CBF$  (Alternate angles)

$$45^\circ = \angle CBF$$

Option (b) is correct

(ii)  $\angle AFC + \angle CFB = 180^\circ$  (Linear pair)

$$75^\circ + \angle CFB = 180^\circ$$

$$\angle CFB = 180^\circ - 75^\circ = 105^\circ$$

Option (c) is correct

(iii) Since  $AB \parallel CD$ ,

$\angle AFC = \angle FCD$  (Alternate angles)

$$75^\circ = \angle FCB + \angle BCD$$

$$75^\circ = \angle FCB + 45^\circ$$

$$\angle FCB = 30^\circ$$

Option (b) is correct

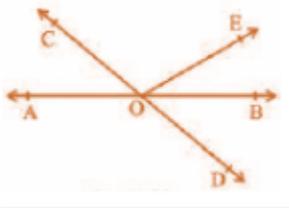
(iv) We have,  $\angle EFB = \angle AFC$  (Vertically opp. Angles)

$$\angle EFB = 75^\circ$$

Option (a) is correct.

## SHORT ANSWER TYPE QUESTIONS

Q.1: In the figure, lines  $AB$  and  $CD$  intersect at  $O$ . If  $\angle AOC + \angle BOE = 70^\circ$  and  $\angle BOD = 40^\circ$ , find  $\angle BOE$  and reflex  $\angle COE$ .



Solution:

From the given figure, we can see;

$\angle AOC$ ,  $\angle BOE$ ,  $\angle COE$  and  $\angle COE$ ,  $\angle BOD$ ,  $\angle BOE$  form a straight line each.

So,  $\angle AOC + \angle BOE + \angle COE = \angle COE + \angle BOD + \angle BOE = 180^\circ$

Now, by substituting the values of  $\angle AOC + \angle BOE = 70^\circ$  and  $\angle BOD = 40^\circ$  we get:

$$70^\circ + \angle COE = 180^\circ$$

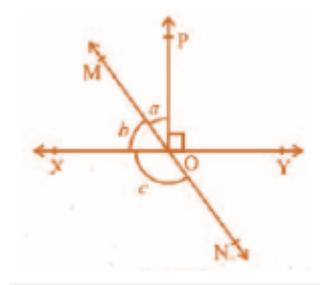
$$\angle COE = 110^\circ$$

Similarly,

$$110^\circ + 40^\circ + \angle BOE = 180^\circ$$

$$\angle BOE = 30^\circ$$

Q.2: In the Figure, lines XY and MN intersect at O. If  $\angle POY = 90^\circ$  and  $a : b = 2 : 3$ , find c.



Solution:

As we know, the sum of the linear pair is always equal to  $180^\circ$

So,

$$\angle POY + a + b = 180^\circ$$

Substituting the value of  $\angle POY = 90^\circ$  (as given in the question) we get,

$$a + b = 90^\circ$$

Now, it is given that  $a : b = 2 : 3$  so,

Let a be  $2x$  and b be  $3x$ .

$$\therefore 2x + 3x = 90^\circ$$

Solving this we get

$$5x = 90^\circ$$

$$\text{So, } x = 18^\circ$$

$$\therefore a = 2 \times 18^\circ = 36^\circ$$

Similarly, b can be calculated and the value will be

$$b = 3 \times 18^\circ = 54^\circ$$

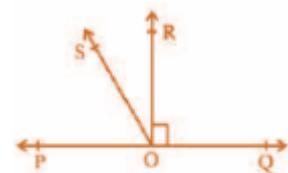
From the diagram,  $b + c$  also forms a straight angle so,

$$b + c = 180^\circ$$

$$\Rightarrow c + 54^\circ = 180^\circ$$

$$\therefore c = 126^\circ$$

Q.3: In the Figure, POQ is a line. Ray OR is perpendicular to line PQ. OS is another ray lying between rays OP and OR. Prove that  $\angle ROS = \frac{1}{2}(\angle QOS - \angle POS)$ .



Solution:

In the question, it is given that  $(OR \perp PQ)$  and  $\angle POQ = 180^\circ$

So,  $\angle POS + \angle ROS + \angle ROQ = 180^\circ$  (Linear pair of angles)

Now,  $\angle POS + \angle ROS = 180^\circ - 90^\circ$  (Since  $\angle POR = \angle ROQ = 90^\circ$ )

$$\therefore \angle POS + \angle ROS = 90^\circ$$

Now,  $\angle QOS = \angle ROQ + \angle ROS$

It is given that  $\angle ROQ = 90^\circ$ ,

$$\therefore \angle QOS = 90^\circ + \angle ROS$$

$$\text{Or, } \angle QOS - \angle ROS = 90^\circ$$

As  $\angle POS + \angle ROS = 90^\circ$  and  $\angle QOS - \angle ROS = 90^\circ$ , we get

$$\angle POS + \angle ROS = \angle QOS - \angle ROS$$

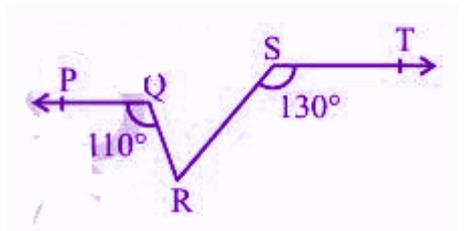
$$\Rightarrow 2 \angle ROS + \angle POS = \angle QOS$$

Or,  $\angle ROS = \frac{1}{2} (\angle QOS - \angle POS)$  (Hence proved).

### LONG QUESTIONS

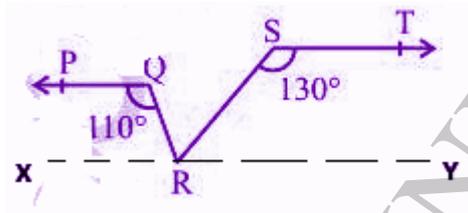
1. In the Figure, if  $PQ \parallel ST$ ,  $\angle PQR = 110^\circ$  and  $\angle RST = 130^\circ$ , find  $\angle QRS$ .

[Hint: Draw a line parallel to  $ST$  through point  $R$ .]



Solution:

First, construct a line  $XY$  parallel to  $PQ$ .



The angles on the same side of the transversal are equal to  $180^\circ$ .

$$\text{So, } \angle PQR + \angle QRX = 180^\circ$$

$$\text{Or, } \angle QRX = 180^\circ - 110^\circ$$

$$\therefore \angle QRX = 70^\circ$$

Similarly,

$$\angle RST + \angle SRY = 180^\circ$$

$$\text{Or, } \angle SRY = 180^\circ - 130^\circ$$

$$\therefore \angle SRY = 50^\circ$$

Now, for the linear pairs on the line  $XY$ -

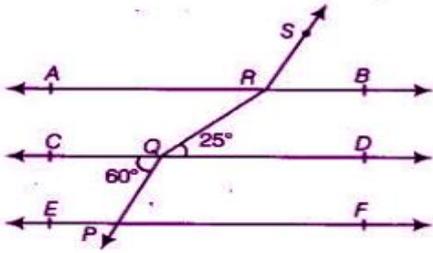
$$\angle QRX + \angle QRS + \angle SRY = 180^\circ$$

Substituting their respective values we get,

$$\angle QRS = 180^\circ - 70^\circ - 50^\circ$$

$$\text{Or, } \angle QRS = 60^\circ$$

2. In the figure, if  $AB \parallel CD \parallel EF$ ,  $PQ \parallel RS$ ,  $\angle RQD = 25^\circ$  and  $\angle CQP = 60^\circ$ , then find  $\angle Q$



Solution:

According to the given figure, we have

$AB \parallel CD \parallel EF$

$PQ \parallel RS$

$\angle RQD = 25^\circ$

$\angle CQP = 60^\circ$

$PQ \parallel RS$ .

As we know,

If a transversal intersects two parallel lines, then each pair of alternate exterior angles is equal.

Now, since,  $PQ \parallel RS$

$\Rightarrow \angle PQC = \angle BRS$

We have  $\angle PQC = 60^\circ \Rightarrow \angle BRS = 60^\circ \dots \text{eq.(i)}$

We also know that,

If a transversal intersects two parallel lines, then each pair of alternate interior angles is equal.

Now again, since,  $AB \parallel CD$

$\Rightarrow \angle DQR = \angle QRA$

We have  $\angle DQR = 25^\circ$

$\Rightarrow \angle QRA = 25^\circ \dots \text{eq.(ii)}$

Using linear pair axiom,

We get,

$\angle ARS + \angle BRS = 180^\circ$

$\Rightarrow \angle ARS = 180^\circ - \angle BRS$

$\Rightarrow \angle ARS = 180^\circ - 60^\circ$  (From (i),  $\angle BRS = 60^\circ$ )

$\Rightarrow \angle ARS = 120^\circ \dots \text{eq.(iii)}$

Now,  $\angle QRS = \angle QRA + \angle ARS$

From equations (ii) and (iii), we have,

$\angle QRA = 25^\circ$  and  $\angle ARS = 120^\circ$

Hence, the above equation can be written as:

$\angle QRS = 25^\circ + 120^\circ$

$\Rightarrow \angle QRS = 145^\circ$

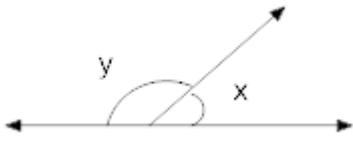
**Class 9 Maths Chapter 6 LINES AND ANGLES**

**PRACTICE QUESTIONS**

1. The sum of angle of a triangle is

- (i)  $0^\circ$  (ii)  $90^\circ$  (iii)  $180^\circ$  (iv) none of these

2. In fig if  $x = 30^\circ$  then  $y =$



- (i)  $90^\circ$   
(ii)  $180^\circ$   
(iii)  $150^\circ$   
(iv)  $210^\circ$

3. If two lines intersect each other then

- (i) vertically opposite angles are equal  
(ii) corresponding angles are equal  
(iii) alternate interior angles are equal  
(iv) none of these

4. The measure of Complementary angle of  $63^\circ$  is

- (a)  $30^\circ$   
(b)  $36^\circ$   
(c)  $27^\circ$   
(d) none of these

5. Question 1 is an ASSERTION REASON type question. This question contains STATEMENT -

1 (Assertion) and STATEMENT -2 (Reason) and has following four choices (a), (b), (c) and (d), only one of which is the correct answer. Mark the correct answer.

- (a) Statement -1 and Statement -2 are true ; Statement -2 is a correct explanation for Statement -1.  
(b) Statement -1 and Statement -2 are true ; Statement -2 is not a correct explanation for Statement -1.  
(c) Statement -1 is True, Statement -2 is False.  
(d) Statement -1 is False, Statement -2 is True.

Q1. STATEMENT - 1 If one angle of a triangle is equal to the sum of the other two angles, then the triangle is a right triangle.

STATEMENT - 2 The exterior angle of a triangle is the sum of two interior opposite angles

### CASE STUDY BASED QUESTIONS

Q1. Read the following and answer any four questions from (i) to (v)

Ishita loves triangular objects. She wants to decorate the wall of her room with some triangular hangings.

When she searched for it she found a number of beautiful options for her room.

- (i) The angles of triangle ABC are in the ratio 3 : 4 : 5. The measure of the smallest angle A is  
(a)  $15^\circ$  (b)  $45^\circ$  (c)  $60^\circ$  (d)  $75^\circ$
- (ii) If the measure of  $\angle ACE$  is  $105^\circ$ , then  $\angle ABC =$   
(a)  $45^\circ$  (b)  $75^\circ$  (c)  $60^\circ$  (d)  $105^\circ$
- (iii) If  $AB \parallel DE$ , then measure of  $\angle CED$  is  
(a)  $60^\circ$  (b)  $45^\circ$  (c)  $105^\circ$  (d)  $80^\circ$
- (iv) If one angle of a triangle is equal to the sum of the other two angles, then the triangle is

- (a) An isosceles triangle (b) a right triangle  
 (c) an obtuse triangle (d) an equilateral triangle  
 (v) If  $\angle ABC = 60^\circ$  and  $\angle DCE = 40^\circ$  the measure of  $\angle BAC$  is

- (a)  $60^\circ$  (b)  $70^\circ$  (c)  $80^\circ$  (d)  $30^\circ$

Answers (i) (b) (ii) (c) (iii) (a) (iv) (b) (v) (c)

Q2. In the given figure  $p \parallel q$  and  $t$  is a transversal.

Based on the above information, answer the following questions

- (i) If  $\angle 1 = 100^\circ$ , then  $\angle 6 =$   
 (a)  $100^\circ$ , corresponding angles (b)  $100^\circ$  exterior alternate angles  
 (c)  $80^\circ$ , co-interior angles (d)  $80^\circ$ , corresponding angles
- (ii) If  $\angle 2 = 80^\circ$  then  $\angle 7 =$   
 (a)  $80^\circ$ , corresponding angles (b)  $80^\circ$  exterior alternate angles  
 (c)  $80^\circ$ , interior alternate angles (d)  $100^\circ$ , exterior alternate angles
- (iii) If  $\angle 3 = 128^\circ$ , then  $\angle 5 =$   
 (a)  $56^\circ$ , corresponding angles (b)  $128^\circ$  co-interior angles  
 (c)  $52^\circ$ , co-interior angles (d)  $64^\circ$ , interior alternate angles
- (iv) If  $\angle 1 : \angle 2 = 9 : 4$ , then  $\angle 7 : \angle 8 =$   
 (a)  $3 : 2$  (b)  $9 : 4$   
 (c)  $4 : 9$  (d)  $2 : 3$
- (v) If  $\angle 3 + \angle 6 = 200^\circ$ , then  $\angle 7 =$   
 (a)  $50^\circ$  (b)  $100^\circ$  (c)  $120^\circ$  (d)  $80^\circ$

Answer (i) (a) (ii) (b) (iii) (c) (iv) (c) (v) (d)

Q3. PQ and RS are two mirrors placed parallel to each other. An incident ray AB strikes the mirror PQ at B, the reflected ray moves along the path BC and strikes the mirror RS at C and again reflects back along CD.

- (i) Draw the figure from above statement.  
 (ii) Which is the incident ray and which one is the reflected ray.  
 (iii) Prove that  $AB \parallel CD$ .

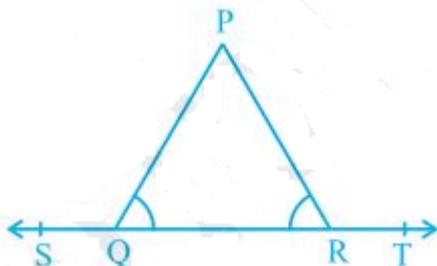
**[iv] Short Answer Type Question (10 questions)**

Q1. If two lines intersect, prove that the vertically opposite angles are equal.

Q2. Bisectors of interior  $\angle B$  and exterior  $\angle ACD$  of a  $\Delta ABC$  intersect at the point T. Prove that  $\angle BTC = \frac{1}{2} \angle BAC$ .

Q3. A transversal intersects two parallel lines. Prove that the bisectors of any pair of corresponding angles so formed are parallel.

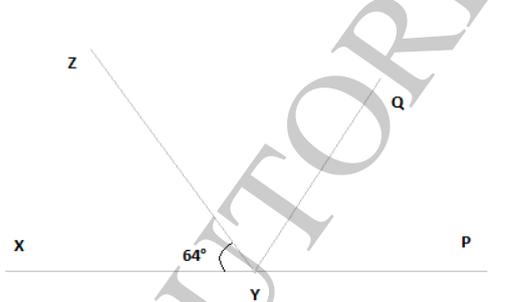
Q4. In Fig. ,  $\angle PQR = \angle PRQ$ , then prove that  $\angle PQS = \angle PRT$ .



- Q5. Can a triangle have all angles less than  $60^\circ$ ? Give a reason for your answer.
- Q6. If the measures of two supplementary angles are  $(3x + 15)^\circ$  and  $(2x + 5)^\circ$ , then find the value of  $x$ .
- Q7. Can a triangle have two obtuse angles? Give the reason for your answer.
- Q8. How many triangles can be drawn having its angles as  $45^\circ$ ,  $64^\circ$  and  $72^\circ$ ? Give the reason for your answer.
- Q9. How many triangles can be drawn having its angles as  $53^\circ$ ,  $64^\circ$  and  $63^\circ$ ? Give the reason for your answer.
- Q10. If the difference between two supplementary angles is  $80^\circ$ , then find the angles.

**[v] Long Answer Type Question (5 questions)**

- Q1. If two parallel lines are intersected by a transversal, prove that the bisectors of the two pairs of interior angles enclose a rectangle.
- Q2. The angles of a triangle are arranged in ascending order of magnitude. If the difference between two consecutive angles is  $10^\circ$ , find all the three angles.
- Q3. It is given that  $\angle XYZ = 64^\circ$  and  $XY$  is produced to point  $P$ . Draw a figure from the given information. If ray  $YQ$  bisects  $\angle ZYP$ , find  $\angle XYQ$  and reflex  $\angle QYP$ .



**Test Paper 1**  
**SUBJECT – MATHEMATICS**

**CLASS – IX MAX. MARKS: 20**

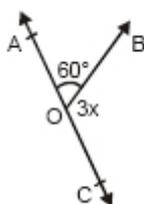
**TIME : 30 min.**

**General Instruction**

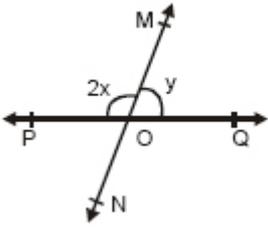
- (1) This question paper contains 3 Sections.
- (2) Section A contains 3 questions of 2 marks each.
- (3) Section B contains 2 questions of 3 marks each.
- (4) Section C contains 2 questions of 4 marks each.

**Section A**

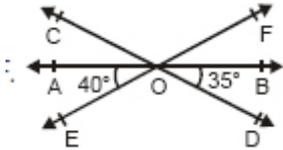
- Q1. In the given figure,  $AOC$  is a line, find  $x$ .



- Q2. In the given figure, line  $PQ$  and line  $MN$  intersect at  $O$ .
- (a) Determine  $y$ , when  $x = 60^\circ$ .
  - (b) Determine  $x$ , when  $y = 40^\circ$ .



- Q3. In the given figure, lines AB, CD and EF intersect at O.  
Find the measure of  $\angle AOC$ ,  $\angle COF$ .

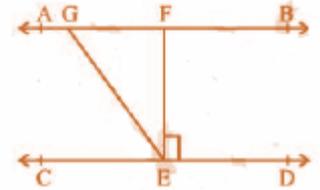


#### Section B

- Q4. The exterior angles obtained on producing the base of a triangle both ways are  $100^\circ$  and  $120^\circ$ .  
Find all the angles.
- Q5.  $\triangle ABC$  is right angled at A and  $AL \perp BC$ . Prove that  $\angle BAL = \angle ACD$ .

#### Section C

- Q.6: It is given that  $\angle XYZ = 64^\circ$  and XY is produced to point P. Draw a figure from the given information. If ray YQ bisects  $\angle ZYP$ , find  $\angle XYQ$  and reflex  $\angle QYP$ .
- Q7. In the Figure, if  $AB \parallel CD$ ,  $EF \perp CD$  and  $\angle GED = 126^\circ$ , find  $\angle AGE$ ,  $\angle GEF$  and  $\angle FGE$ .



### Test Paper 2 SUBJECT – MATHEMATICS

**TIME : 45 min.**

**CLASS –IX MAX. MARKS: 30**

#### General Instruction

- (1) This question paper contains 3 Sections.
- (2) Section A contains 5 questions of 2 marks each.
- (3) Section B contains 4 questions of 3 marks each.
- (4) Section C contains 2 questions of 4 marks each.

#### Section A

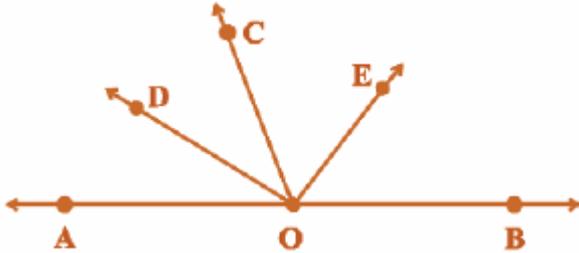
- Q1. How many triangles can be drawn having its angles as  $45^\circ$ ,  $64^\circ$  and  $72^\circ$ ? Give reason for your answer.
- Q2. The exterior angles obtained on producing the base of a triangle both ways are  $100^\circ$  and  $120^\circ$ .  
Find all the angles.
- Q3.  $\triangle ABC$  is right angled at A and  $AL \perp BC$ . Prove that  $\angle BAL = \angle ACD$ .

Q4. The exterior angles obtained on producing the base of a triangle both ways are  $100^\circ$  and  $120^\circ$ . Find all the angles.

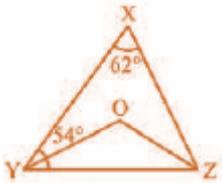
Q5.  $\triangle ABC$  is right angled at A and  $AL \perp BC$ . Prove that  $\angle BAL = \angle ACD$

### Section B

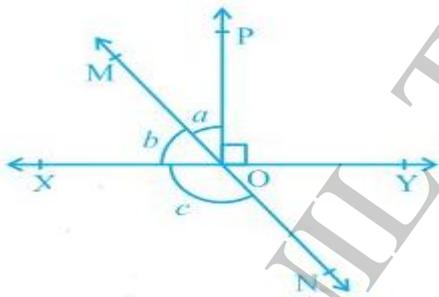
Q 6. In the figure, OD is the bisector of  $\angle AOC$ , OE is the bisector of  $\angle BOC$  and  $OD \perp OE$ . Show that the points A, O and B are collinear.



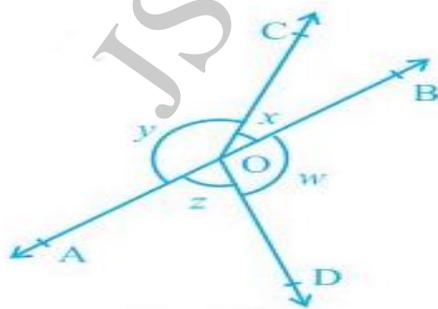
Q7. In Fig. ,  $\angle X = 62^\circ$ ,  $\angle XYZ = 54^\circ$ . If YO and ZO are the bisectors of  $\angle XYZ$  and  $\angle XZY$  respectively of  $\triangle XYZ$ , find  $\angle OZY$  and  $\angle YOZ$ .



Q8. In Fig. , lines XY and MN intersect at O. If  $\angle POY = 90^\circ$  and  $a : b = 2 : 3$ , find c.



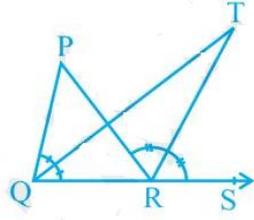
Q9. In Fig. 6.16, if  $x+y = w+z$ , then prove that AOB is a line.



### Section C

Q10. If two parallel lines are intersected by a transversal, prove that the bisectors of the two pairs of interior angles enclose a rectangle.

Q11. In Fig. , the side QR of  $\Delta PQR$  is produced to a point S. If the bisectors of  $\angle PQR$  and  $\angle PRS$  meet at point T, then prove that  $\angle QTR = \frac{1}{2} \angle QPR$ .



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# TRIANGLES

## Important Concepts

- Two figures are congruent if they are of the same shape and of the same size.
- Two circles of the same radii are congruent.
- Two squares of the same sides are congruent.
- Two triangles are congruent if their corresponding parts are congruent.
- If two triangles ABC and PQR are congruent under the correspondence  $A \leftrightarrow P$ ,  $B \leftrightarrow Q$  and  $C \leftrightarrow R$ , then symbolically, it is expressed as  $\Delta ABC \cong \Delta PQR$ .

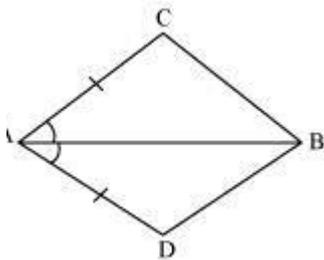
Some congruence rules are SAS(Side-Angle-Side)

Congruence Rule: Two triangles are congruent if two sides and the included angle of one triangle are equal to the sides and the included angle of the other triangle. ASA(Angle-Side-Side) Congruence Rule: Two triangles are congruent if two angles and the included side of one triangle are equal to two angles and the included side of the other triangle. AAS Congruence Rule: Two triangles are congruent if any two pairs of angles and one pair of corresponding sides are equal.

## NCERT SOLUTIONS

### Question 1

In quadrilateral ACBD,  $AC = AD$  and AB bisects  $\angle A$  (See the given figure). Show that  $\Delta ABC \cong \Delta ABD$ . What can you say about BC and BD?



ANSWER:

In  $\Delta ABC$  and  $\Delta ABD$ ,

$AC = AD$  (Given)

$\angle CAB = \angle DAB$  (AB bisects  $\angle A$ )

$AB = AB$  (Common)

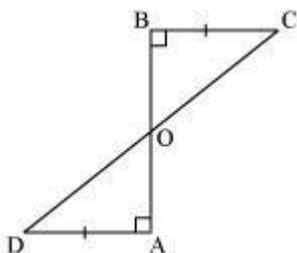
$\therefore \Delta ABC \cong \Delta ABD$  (By SAS congruence rule)

$\therefore BC = BD$  (By CPCT)

Therefore, BC and BD are of equal lengths.

### Question 2:

AD and BC are equal perpendiculars to a line segment AB (See the given figure). Show that CD bisects AB



ANSWER:

In  $\triangle BOC$  and  $\triangle AOD$ ,

$\angle BOC = \angle AOD$  (Vertically opposite angles)

$\angle CBO = \angle DAO$  (Each  $90^\circ$ )

$BC = AD$  (Given)

$\therefore \triangle BOC \cong \triangle AOD$  (AAS congruence rule)

$\therefore BO = AO$  (By CPCT)

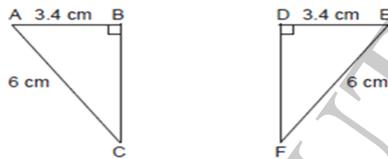
$\Rightarrow CD$  bisects  $AB$ .

MCQ

Q1. The exterior angle of a triangle is equal to the

- (a) sum of the two interior opposite angles.
- (b) sum of the three interior angles.
- (c) difference of two interior angles.
- (d) opposite of the interior angle.

Q2. In two right-angled triangle  $ABC$  and triangle  $DEF$ , the measurement of hypotenuse and one side is given. Check if they are congruent or not? If yes, by which rule.



- a) SAS
- b) ASA
- c) SSS
- d) RHS

Q3. The angles of a triangle are in the ratio 3 : 4 : 2. Find all the angles of the triangle.

- (a)  $110^\circ, 40^\circ, 30^\circ$
- (b)  $60^\circ, 80^\circ, 40^\circ$
- (c)  $60^\circ, 50^\circ, 70^\circ$
- (d)  $110^\circ, 50^\circ, 20^\circ$

Q4. In SAS congruence rule

- a) The angle should be included
- b) The angle should not be included
- c) Any two sides and one angle
- d) None of the above

Q5. Assertion: In  $\triangle ABC$ ,  $BC = AB$  and  $B = 80^\circ$ , Then,  $A = 50^\circ$

Reason: In a triangle, angles opposite to two equal sides are equal

- a) Both Assertion and Reason are correct and Reason is correct explanation for Assertion.
- b) Both Assertion and Reason are correct and Reason is not correct explanation for Assertion.
- c) Both Assertion is true but and Reason is false.
- d) Both Assertion and Reason are false.

#### SECTION B SHORT ANSWERS TYPE

Q1. The angle of triangle are  $(x + 10^\circ)$ ,  $(2x - 30^\circ)$  and  $x^\circ$ . Find the value of  $x$ .

Q2.  $\triangle ABC$  is a right triangle such that  $AB = AC$  and bisector of angle  $C$  intersects the side  $AB$  at  $D$ . Prove that  $AC + AD = CD$ .

Q3. D, E, F are the midpoints of the sides BC, CA and AB respectively of  $\triangle ABC$ , then  $\triangle DEF$  is congruent to triangle  $\triangle AEF$

Q4. In an isosceles triangle ABC, with  $AB = AC$ , the bisectors of  $\angle B$  and  $\angle C$  intersect each other at O. Join A to O. Show that:

- i)  $OB = OC$  (ii) AO bisects  $\angle A$

Q5. ABC is a right angled triangle in which  $\angle A = 90^\circ$  and  $AB = AC$ . Find  $\angle B$  and  $\angle C$ .

Q6. ABC is an isosceles triangle with  $AB = AC$ . Drawn  $AP \perp BC$  to show that  $\angle B = \angle C$ .

Q7. BE and CF are two equal altitude of a triangle ABC. Using RHS congruence rule, Prove that the triangle ABC is isosceles

Q8. Prove that the Perimeter of a triangle is greater than the sum of three median

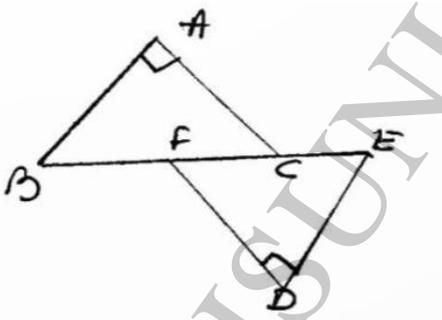
Q9. BE and CF are two equal altitudes of a triangle ABC. Using RHS congruence rule, prove that the triangle ABC is isosceles.

Q10. In the given figure  $\angle CPD = \angle BPD$  and AD is the bisector of  $\angle BAC$ .

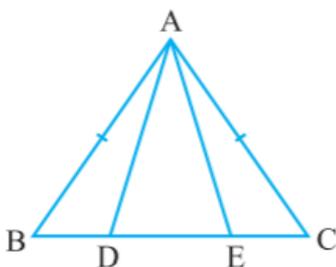
Prove that  $\triangle BAP \cong \triangle CAP$  and hence  $BP = CP$ .

### LONG ANSWER TYPE

Q1. In the given figure BA is perpendicular to AC, DE is perpendicular to DF such that  $BA = DE$  and  $BF = EC$ . Show that  $\triangle ABC \cong \triangle DEF$ .

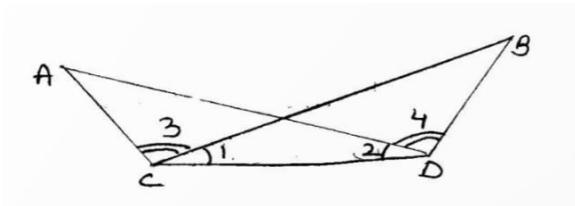


Q2. In an isosceles triangle ABC with  $AB = AC$ , D and E are points on BC such that  $BE = CD$ . Show that  $AD = AE$



Q3. In the given figure  $\angle BCD = \angle ACD$  and  $\angle ACB = \angle BDA$ .

Prove that  $AD = DB$  and  $\angle A = \angle B$ .



Q4. Prove that if two angles of a triangle are equal then sides opposite to them are also equal.

Q5. PQR is a triangle in which  $PQ = PR$  and S is any point on the side PQ. Through S, a line is drawn parallel to QR and intersecting PR at T. Prove that  $PS = PT$ .

ANSWERS (MCQ) Q1 (a) , Q2(d), Q3(b), Q4(a) ,Q5(a)

### TEST 1

(20Marks : Q1– 2Marks, Q2 TO Q7 are of 3 Marks each)

Q1. ABC is an isosceles triangle with  $AB = AC$ . Draw  $AP \perp BC$  to show that  $\angle B = \angle C$ .

Q2. ABCD is a quadrilateral such that  $AB = AD$  and  $CB = CD$ . Prove that AC is the perpendicular bisector of BD.

Q3. ABC is an isosceles triangle with  $AB = AC$  and BD and CE are two medians.

Show that  $BD = CE$ .

Q4. BE and CF are two equal altitudes of a triangle ABC. Using RHS congruence rule,

Prove that the triangle ABC is isosceles.

Q5. If two isosceles triangles have a common base, prove that the line joining the vertex bisects the base at right angle.

Q6. ABC is a right-angled triangle in which  $\angle A = 90^\circ$  and  $AB = AC$ . Find  $\angle B$  and  $\angle C$ .

Q7. Prove that the perimeter of a triangle is greater than the sum of the three medians.

### TEST 2

(30 Marks: Each Question is of 5 Marks each)

Q1. Prove that the medians of an equilateral triangle are equal.

Q2. Prove that "angle opposite to equal sides of a triangle are equal."

Q3. Prove that, "A triangle is isosceles if and only if any two altitudes are equal."

Q4. AD is an altitude of an isosceles triangle ABC in which  $AC = AB$ .

Show that (i)AD bisects BC (ii)AD bisects  $\angle A$ .

Q5.  $\triangle ABC$  is an isosceles triangle in which  $AB = AC$ . Side BA is produced to D such that  $AD = AB$ . Show that  $\angle BCD$  is right angle.

Q5. ABC and DBC are triangles on the same base BC such that A and D lie on the opposite side of BC,  $AB = AC$  and  $DB = DC$ . Show that AD is the perpendicular bisector of BC.

OR

.Line segment joining the mid-points. M and N of parallel sides. AB and DC, respectively of a trapezium ABCD is perpendicular to both the sides AD and BC. Prove that MN = DC

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# QUADRILATERALS

## MULTIPLE CHOICE QUESTIONS:

- In a  $\triangle ABC$ , P, Q, R, are the midpoints of the sides BC, CA and AB respectively. If  $AC = 21\text{cm}$ ,  $BC = 29\text{cm}$ ,  $AB = 30\text{cm}$ . Find the perimeter of quadrilateral ARPQ.  
(A) 20 cm. (B) 52cm (C) 51cm (D) 80cm
- The quadrilateral formed by joining the midpoints of the sides of the quadrilateral PQRS taken in order, is a rectangle if diagonals of  
(A) PQRS are at right angles (B) PQRS is rectangle  
(C) PQRS is a parallelogram (D) none of these
- The diagonal of a rectangle is inclined to one side of the rectangle at  $25^\circ$ . The acute angle between the diagonals is  
(A)  $55^\circ$  (B)  $50^\circ$  (C)  $40^\circ$  (D) none of these
- ABCD is rhombus such that  $\angle ACB = 40^\circ$  then  $\angle ADB$  is  
(A)  $40^\circ$  (B)  $45^\circ$  (C)  $50^\circ$  (D)  $60^\circ$

## ASSERTION AND REASON:

**Direction:** Each of these questions contains an assertion followed by reason. Read them carefully and answer the questions on the basis of following options, select the one that best describes the two statements.

- If both assertion and reason are correct and reason is the correct explanation of assertion.
- If both assertion and reason are correct but reason is not the correct explanation of assertion.
- If assertion is correct but reason is incorrect.
- If assertion is incorrect but reason is correct

- ASSERTION:** The line segment joining the mid points of any two sides of a triangle is parallel to the third side and equal to half of it.

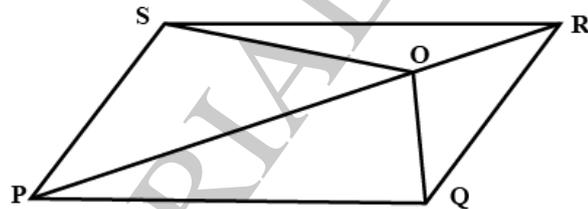
**REASON:** Diagonal of a parallelogram divides it into two congruent triangles.

## SHORT ANSWER QUESTIONS:

- ABCD is a rectangle in which diagonals BD bisects  $\angle B$ . show that ABCD is a square.
- If in a parallelogram ABCD,  $AB = x + 5$  and  $BC = x + 11$  and perimeter is 40cm. Find x.
- If in a parallelogram ABCD, AC is a diagonal. If the area of ABCD is  $180\text{cm}^2$ . Find the area of  $\triangle ABC$ .
- Show that each angle of rectangle is a right angle.
- The perimeter of parallelogram is 32cm. If the longer side is 9.5cm, then find the measure of shorter side.
- In a trapezium ABCD,  $AB \parallel CD$ , if  $\angle A = 55^\circ$ ,  $\angle B = 70^\circ$ , find  $\angle C$  and  $\angle D$ .
- The diagonals of rectangle ABCD intersect at a point O. If  $\angle COD$  is  $78^\circ$ , then find  $\angle OAB$ .
- The angles of a quadrilateral are in the ratio 2:3:4:6. Find the angles of quadrilateral.
- In a parallelogram PQRS, If angle P =  $(3x - 5)$  and angle Q =  $(2x + 15)$ . Find the value of x
- The adjacent angles of a parallelogram are  $(3x + 10)$  and  $(5x - 30)$ . Find the value of x

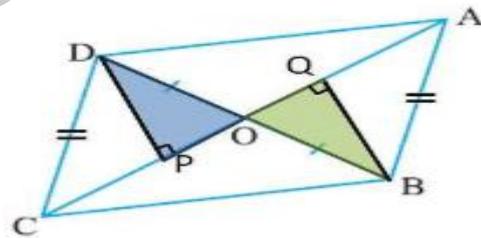
**LONG ANSWER QUESTIONS:**

16. ABCD is a quadrilateral in which P, Q, R and S are mid-points of sides AB, BC, CD and DA respectively. AC is the diagonal. Show that:
- $SR \parallel AC$  and  $SR = (1/2) AC$
  - $PQ = SR$
  - PQRS is a parallelogram
17. In ABCD is parallelogram, AE is perpendicular to DC and CF is perpendicular to AD. If AB =12 cm, AE =5 cm, CF =8 cm find AD.
18. Prove that the quadrilateral formed by the bisectors of the angles of a parallelogram is rectangle.
19. E and F are respectively the mid points of the non-parallel sides AD and BC of a trapezium ABCD. Prove that  $EF \parallel AB$  and  $EF = \frac{1}{2}(AB + CD)$
20. O is any point on the diagonal PR of parallelogram PQRS. Prove that  $ar(PSO) = ar(PQO)$ .



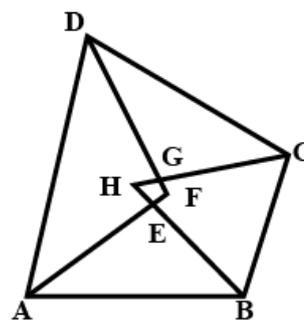
21. In Figure given, diagonals AC and BD of quadrilateral ABCD intersect at O such that  $OB = OD$ . If  $AB = CD$ , then show that:

- $ar(DOC) = ar(AOB)$
- $ar(DCB) = ar(ACB)$
- $DA \parallel CB$



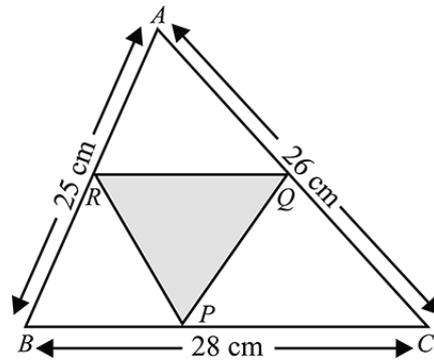
22. In figure given, prove that the quadrilateral EFGH internal angle bisectors of the quadrilateral ABCD is

formed by the cyclic.



**CASE STUDY BASED QUESTIONS**

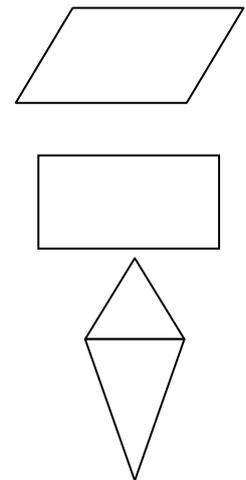
23. There is a Holi celebration in the KV school Rishikesh. Girls are asked to prepare Rangoli in a triangular shape. They made a rangoli in the shape of triangle ABC. Dimensions of  $\Delta ABC$  are 26 cm, 28 cm, 25 cm.



- In fig, R is mid-point of AB and  $RQ \parallel BC$  then AQ is equal to
  - QC
  - RB
  - BC
  - AD
- In fig R and Q are mid-points of AB and AC respectively. The length of RQ is:
  - 13
  - 14
  - 12.5
  - 13.5
- If Garland is to be placed along the side of  $\triangle QPR$  which is formed by joining midpoint, what is the length of garland?
  - 39.5 cm
  - 49.5 cm
  - 35 cm
  - 79.5 cm

24. During Math Lab Activity each student was given four broomsticks of lengths 10cm, 10cm, 6cm, 6cm to make different types of quadrilaterals.

- How many quadrilaterals can be formed using these sticks?
  - Only one type of quadrilateral can be formed
  - Two types of quadrilaterals can be formed.
  - Three types of quadrilaterals can be formed.
  - Four types of quadrilaterals can be formed.
- Name the types of quadrilaterals formed?
  - Rectangle, Square, Parallelogram
  - Kite, Trapezium, parallelogram
  - Rectangle, Square, Kite
  - Rectangle, Kite, Parallelogram
- Which of the following is not true for a parallelogram?
  - opposite sides are equal
  - opposite angles are equal
  - opposite angles are bisected by the diagonals
  - diagonals do not bisect each other.



25. There was four plants in Rama's field. rama named their bases as P, Q, R, S. He joined PQ, QR, RS and SP. His teacher told him that the quadrilateral PQRS was a parallelogram. He asked him to find the measure of all the angles of the parallelogram, provided that the measure of anyone interior angle of PQRS.



- (i) Obtain all the angles of the parallelogram PQRS if  $\angle R=80^\circ$ .  
 (ii) Which mathematical concept is used in the above problem?  
 (ii) If PQ is 8cm then SR is\_\_\_\_\_.

**ANSWERS:**

1. (C) 51cm
2. (A) PQRS are at right angles
3. (B)  $50^\circ$
4. (C)  $50^\circ$
5. (A)
6. Solve
7. 2cm
8.  $90\text{cm}^2$
9. Solve
10. 6.5cm
11.  $\angle C = 110^\circ$  and  $\angle D = 125^\circ$
12.  $78^\circ$
13.  $48^\circ, 72^\circ, 96^\circ, 144^\circ$
14.  $34^\circ$
15.  $20^\circ$
16. Solve
17. AD = 7.5CM
18. Solve
19. Solve
20. Solve
21. Solve
22. Solve
23. 1) a. QC 2) b. 14 3) a. 39.5 cm
24. 1) c 2) d 3) d
25. 1)  $80^\circ, 100^\circ, 100^\circ$  2) Opposite angles of a parallelogram are equal  
 3) 8cm (Opposite sides are equal in a parallelogram)

# CIRCLE

## EXPECTED LEARNING OUTCOMES

1. Recall and review the definition and basic terms related to Circle.
2. Revise statements of basic theorems on Circles.
3. To appreciate the theorems
  - a. Equal chords of a circle subtend equal angles at the centre.
  - b. If the angles subtended by the chords of a circle at the centre are equal, then the chords are equal.
  - c. The perpendicular from the centre of a circle to a chord bisects the chord.
  - d. The line drawn through the centre of a circle to bisect a chord is perpendicular to the chord
  - e. There is one and only one circle passing through three given non-collinear points
  - f. Equal chords of a circle (or of congruent circles) are equidistant from the centre (or centres).
  - g. Chords equidistant from the centre of a circle are equal in length.
  - h. The angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.
  - i. Angles in the same segment of a circle are equal.
  - j. If a line segment joining two points subtends equal angles at two other points lying on the same side of the line containing the line segment, the four points lie on a circle (i.e. they are concyclic).
  - k. The sum of either pair of opposite angles of a cyclic quadrilateral is  $180^\circ$ .
3. If the sum of a pair of opposite angles of a quadrilateral is  $180^\circ$ , the quadrilateral is cyclic.
4. Apply Knowledge gained on the topic 'Circles' to solve problems.

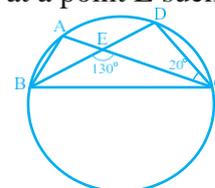
### MCQ:-

**Q1.** In Fig. ,A, B, C and D are four points on a circle. AC and BD intersect at a point E such that  $\angle BEC=130^\circ$

And  $\angle ECD = 20^\circ$ . Value of  $\angle BAC$  is.

- (a)  $50^\circ$       (b)  $40^\circ$       (c)  $90^\circ$       (d)  $110^\circ$

**Answer:-** (d)

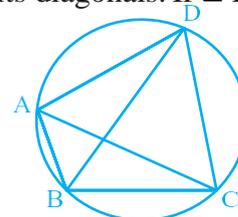


### Short answer type question:-

**Q1.** In Fig, ABCD is a cyclic quadrilateral in which AC and BD are its diagonals. If  $\angle DBC = 55^\circ$  and  $\angle BAC = 45^\circ$ , find  $\angle BCD$ .

**Solution :**  $\angle CAD = \angle DBC = 55^\circ$

(Angles in the same segment)Therefore,



$$\angle DAB = \angle CAD + \angle BAC$$

$$= 55^\circ + 45^\circ = 100^\circ \text{ But } \angle DAB + \angle BCD = 180^\circ$$

(Opposite angles of a cyclic quadrilateral) So,

$$\angle BCD = 180^\circ - 100^\circ = 80^\circ$$

**Long answer type question:-**

**Q.1** The line drawn through the centre of a circle to bisect a chord is perpendicular to the chord.

Let AB be a chord of a circle with centre O and O is joined to the mid-point M of AB. You have to prove that  $OM \perp AB$ . Join OA and OB . In triangles OAM and OBM,

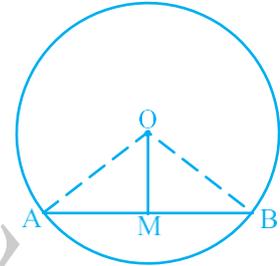
$$OA = OB \text{ (Radii)}$$

$$AM = BM \text{ (given)}$$

$$OM = OM \text{ (Common)}$$

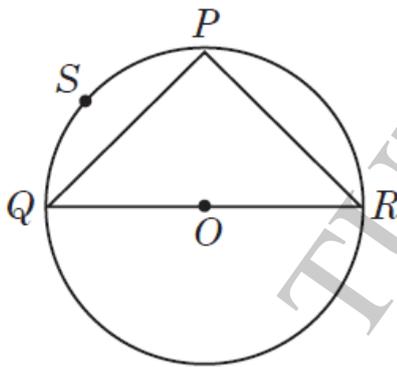
Therefore,  $\triangle OAM \cong \triangle OBM$  (By SSS rule)

This gives  $\angle OMA = \angle OMB = 90^\circ$  (CPCT)



**Case Study question :- Q 1.**

Ankit visited in a mall with his father. He sees that three shops are situated at P, Q, R as shown in the figure from where they have to purchase things according to their need. Distance between shop P and Q is 8 m, that of between shop Q and R is 10 m and between shop P and R is 6 m.



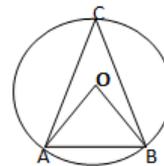
- (i) Find the radius of the circle.
  - (a) 5 m                      (b) 7 m                      (c) 14 m                      (d) 8 m
- (ii) Measure of  $\angle QPR$  is
  - (a)  $60^\circ$                       (b)  $90^\circ$                       (c)  $120^\circ$                       (d)  $180^\circ$
- (iii) Length of the longest chord of the circle is
  - (a) 6 m                      (b) 8 m                      (c) 10 m                      (d) 24 m
- (iv) In figure, PSQP is known as
  - (a) Major segment                      (b) Minor segment                      (c) Major sector                      (d) Minor sector

**Answer:-** (i) (a) (ii) (a) (iii) (c) (iv) (b)

**MCQ:-**

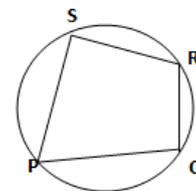
1. In the figure, if  $\angle ACB = 50^\circ$ , then  $\angle OAB$  what is

- (a)  $50^\circ$       (b)  $40^\circ$       (c)  $90^\circ$       (d)  $100^\circ$



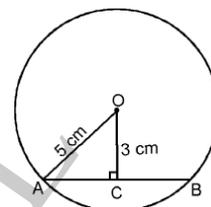
2. In the figure, quadrilateral PQRS is cyclic. If  $\angle P = 80^\circ$ , then what is the value of  $\angle R$  ?

- (a)  $30^\circ$       (b)  $40^\circ$       (c)  $100^\circ$       (d)  $60^\circ$



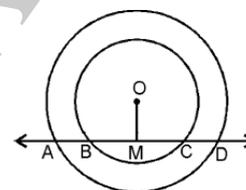
3. In the given figure, O is the centre of the circle. If  $OA = 5$  cm and  $OC = 3$  cm, then find the length of AB .

- (a) 7 cm      (b) 9 cm      (c) 8 cm      (d) 10 cm



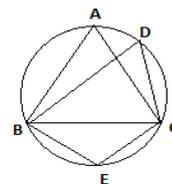
4. Two concentric circles with centre O have A, B, C and D as points of intersection with a line l as shown in the figure. If  $AD = 12$  cm and  $BC = 8$  cm, find the length of AB and CD.

- (a) 4 cm      (b) 6 cm      (c) 10 cm      (d) 2 cm



5. In the figure,  $\Delta ABC$  is equilateral. Find  $\angle BDC$  and  $\angle BEC$

- (a)  $60^\circ, 110^\circ$       (b)  $50^\circ, 120^\circ$       (c)  $60^\circ, 120^\circ$       (d)  $70^\circ, 130^\circ$



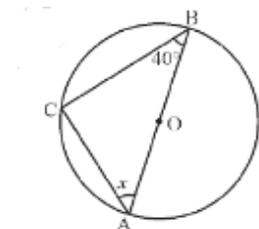
6. **Assertion:** A chord of a circle, which is twice as long as its radius, is a diameter of the circle.

**Reason:** As we know that any chord whose length is twice as long as the radius of the circle always passes through the centre of the circle

- a) both Assertion and reason are correct and reason is correct explanation for Assertion  
 b) both Assertion and reason are correct but reason is not correct explanation for Assertion  
 c) Assertion is correct but reason is false  
 d) both Assertion and reason are false

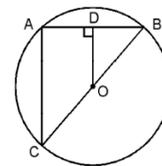
**Short answer type question:-**

- In the figure, if AB is the diameter of the circle, then find the value of x.
- A chord of a circle is equal to the radius of the circle. Find the angle subtended by the chord at a point on the minor arc and also at a point on the major arc.
- If two non-parallel sides of a trapezium are equal, prove that it is cyclic.
- Prove that a cyclic parallelogram is a rectangle.
- Show that two circles cannot intersect at more than two points.



**Long answer type question:-**

- In the given figure, OD is perpendicular to the chord AB of a circle whose centre is O. If BC is a diameter, show that  $CA = 2OD$ .
- A circular park of radius 20 m is situated in a village. Three girls Rita, Sita and Gita are sitting at equal distance on its boundary each having a toy telephone in their hands to talk to each other. Find the length of the string of each phone
- If two circles intersect at two points, prove that their centers lies on the perpendicular bisector of the common chord.
- Find the length of a chord of a circle which is at a distance of 4 cm from the centre of the circle with radius 5 cm.
- Prove that if chords of congruent circles subtend equal angles at their centres, then they are equal.



**MCQ**

**ANSWER:-** 1. (b) 2. (c) 3. (c) 4. (d) 5. (c) 6. (a)

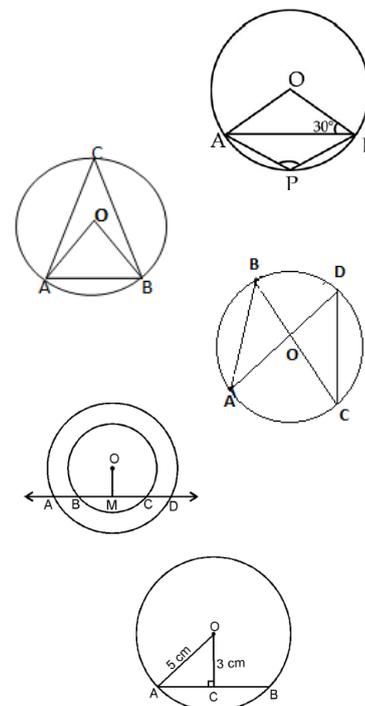
**Short answer type question:-**

**ANSWER:-** 1.  $50^\circ$  2.  $30^\circ, 150^\circ$

**CHAPTER-TEST (20 Marks)**

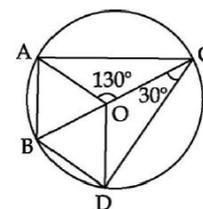
**SECTION – A (2 marks for each question)**

- In the given figure, if O is the centre of circle and  $\angle OBA = 30^\circ$ , determine  $\angle APB$ .
- In the figure, if  $\angle ACB = 50^\circ$ , then what is the measure of  $\angle OAB$  ?
- Can we have a cyclic quadrilateral ABCD such that  $\angle A = 90^\circ$ ,  $\angle B = 70^\circ$ ,  $\angle C = 95^\circ$  and  $\angle D = 105^\circ$  ?
- In the figure, O is the centre of the circle and  $\angle ABC = 55^\circ$ , then what is  $\angle ADC$  ?
- Two concentric circles with centre O have A, B, C and D as points of intersection with a line l as shown in the figure. If  $AD = 12$  cm and  $BC = 8$  cm, find the length of AB and CD.
- In the given figure, O is the centre of the circle. If  $OA = 5$  cm and  $OC = 3$  cm, then find the length of AB .



**SECTION – B (4 marks for each question)**

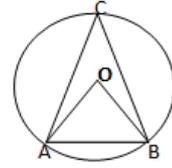
- Prove that , The angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.
- In the given figure, O is the centre of the circle. Find  $\angle BAO$ ,  $\angle AOB$ ,  $\angle BOD$ ,  $\angle ODB$ , if  $\angle AOC = 130^\circ$  and  $\angle OCD = 30^\circ$ .



## CHAPTER-TEST (30 Marks)

### SECTION – A (2 marks for each question)

1. AD is a diameter of a circle and AB is a chord. If  $AD = 34$  cm,  $AB = 30$  cm, then find the distance of AB from the centre of the circle.
2. If  $AB = 12$  cm,  $BC = 16$  cm and AB is perpendicular to BC, then the radius of the circle passing through the points A, B and C is
3. In Fig. 10.6, if  $\angle OAB = 40^\circ$ , then find the  $\angle ACB$ .
4. ABCD is a cyclic quadrilateral such that AB is a diameter of the circumscribing it and  $\angle ADC = 140^\circ$ , then find the  $\angle BAC$ .
5. AB and AC are two equal chords of a circle. Prove that the bisector of the angle BAC passes through the centre of the circle.
6. If a line segment joining mid-points of two chords of a circle passes through the centre of the circle, prove that the two chords are parallel.



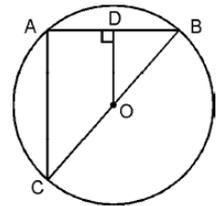
circle

### SECTION – B (3 marks for each question)

7. On a common hypotenuse AB, two right triangles ACB and ADB are situated on opposite sides. Prove that  $\angle BAC = \angle BDC$ .
8. If non-parallel sides of a trapezium are equal, prove that it is cyclic.

### SECTION – C (4 marks for each question)

9. In the given figure, OD is perpendicular to the chord AB of a circle whose centre is O. If BC is a diameter, show that  $CA = 2OD$ .
10. A circular park of radius 20 m is situated in a village. Three girls Rita, Sita and Gita are sitting at equal distance on its boundary each having a toy telephone in their hands to talk to each other. Find the length of the string of each phone
11. If two circles intersect at two points, prove that their centers lie on the perpendicular bisector of the common chord.



# HERONS FORMULA

## Multiple choice Questions

- 1 If the perimeter of an equilateral triangle is 180cm. Then its area will be:  
a.  $900\text{cm}^2$       b.  $900\sqrt{3}\text{cm}^2$       c.  $300\sqrt{3}\text{cm}^2$       d.  $600\sqrt{3}\text{cm}^2$
- 2 Heron's formula to find the area of an equilateral triangle of side 'a' is given by:  
a.  $\sqrt{a^2s^2}$       b.  $\sqrt{[s(s-a)(s-b)]}$       c.  $[s(s-a)]^2$       d.  $\sqrt{s(s-a)^3}$
- 3 Find the area of a regular hexagon of side a.  
a.  $3\sqrt{3}a^2/2\text{cm}^2$       b.  $\sqrt{3}a^2\text{cm}^2$       c.  $3\sqrt{3}a^2\text{cm}^2$       d.  $4\text{cm}^2$
- 4 The area of triangle with given two sides 18cm and 10cm respectively and perimeter equal to 42cm is:  
a.  $20\sqrt{11}\text{cm}^2$       b.  $19\sqrt{11}\text{cm}^2$       c.  $22\sqrt{11}\text{cm}^2$       d.  $21\sqrt{11}\text{cm}^2$
- 5 **Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:**

**Assertion:** Area of a triangle with sides 3cm, 4cm and 5cm is  $6\text{cm}^2$ .

**Reason:** Heron's formula for area of a triangle is  $\frac{1}{2} \text{ base} \times \text{height}$ .

- (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
- (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
- (c) Assertion (A) is true but reason (R) is false.
- (d) Assertion (A) is false but reason (R) is true.

Answers:

- 1 (b)  $900\sqrt{3}\text{cm}^2$   
2 (d)  $\sqrt{s(s-a)^3}$   
3 (a)  $3\sqrt{3}a^2/2\text{cm}^2$   
4 (d)  $21\sqrt{11}\text{cm}^2$   
5 (c) Assertion(A) is true and Reason(R) is false.

## Multiple choice Questions (For Practise)

- 1 **Directions: In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:**  
**Assertion:** Area of a scalene triangle is calculated by Heron's formula

**Reason:** Area of a quadrilateral whose sides and one diagonal are given, can be calculated by dividing the quadrilateral into two triangles using Heron's formula.

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

(c) Assertion (A) is true but reason (R) is false.

(d) Assertion (A) is false but reason (R) is true.

2 The area of an equilateral triangle with side 2cm is

- a.  $\sqrt{6}\text{cm}^2$    b.  $\sqrt{3}\text{cm}^2$    c.  $\sqrt{8}\text{cm}^2$    d.  $4\text{cm}^2$

3 The sides of a triangular plot are in the ratio of 3:5:7 and its perimeter is 300m. Find its area

- a.  $4\sqrt{30}$    b.  $1500\sqrt{3}$    c.  $12\sqrt{30}$    d.  $16\sqrt{30}$

4 The equal sides of isosceles triangle are 12cm and perimeter is 300cm. The area of this triangle is:

- a.  $9\sqrt{15}$  sq.cm   b.  $6\sqrt{15}$ sq.cm   c.  $3\sqrt{15}$  sq.cm   d.  $\sqrt{15}$  sq.cm

5 The area of an equilateral triangle having side length equal to  $\sqrt{3}/4$ cm is:

- a.  $2/27$ sq.cm   b.  $2/15$ sq.cm   c.  $3\sqrt{3}/64$ sq.cm   d.  $3/14$ sq.cm

Answer 2

**Multiple choice Questions (For Practise)**

1 (b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not a correct explanation of Assertion (A).

2 (b)  $\sqrt{3}\text{cm}^2$

3 (b)  $1500\sqrt{3}$ sq.cm

4 (a)  $9\sqrt{15}$ sq.cm

5 ©  $3\sqrt{3}/64$ sq.cm

CASE STUDY (solved) Question 1:

A farmer has a triangular plot of land, and he intends to divide it equally among his three children. The sides of the plot are 50m, 60m, and 70m. Each child will receive a triangular piece of land with a common point. Find the dimensions of the triangular pieces resulting from the division and calculate their areas.

Answer: Step 1: Find the area of the triangular plot using Heron's formula.

$$s = (a + b + c) / 2$$

$$s = (50 + 60 + 70) / 2$$

$$s = 180 / 2$$

$$s = 90$$

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$\text{Area} = \sqrt{90(90-50)(90-60)(90-70)}$$

$$\text{Area} = \sqrt{90 * 40 * 30 * 20}$$

$$\text{Area} = 3600 \text{ sq.m}$$

Step 2: Since the farmer wants to divide the land equally, each child will get a triangular piece with one-third of the area.

$$\text{Each child's area} = 3600 / 3$$

$$\text{Each child's area} = 1200 \text{ sq.m}$$

Step 3: Apply the formula to find the lengths of the triangle's sides:

$$\text{Side1} = 2 \times (\text{Area} / \text{Base1}) = 2400 / 50 = 48\text{m}$$

$$\text{Side2} = 2 \times (\text{Area} / \text{Base2}) = 2400 / 60 = 40\text{m}$$

$$\text{Side3} = 2 \times (\text{Area} / \text{Base3}) = 2400 / 70 = 34.29\text{m}$$

Step 4: Calculate dimensions of triangular pieces:

Child 1 gets a triangular piece with sides 50m, 48m, and an adjacent side to the common point.

Child 2 gets a triangular piece with sides 60m, 40m, and an adjacent side to the common point.

Child 3 gets a triangular piece with sides 70m, 34.29m, and an adjacent side to the common point.

**(Case study for practice)**

Question 1:

A triangular park has sides measuring 45m, 60m, and 75m. Due to increased pollution in the city, the local government decides to double the size of the park while maintaining the shape of the triangle. Calculate the new dimensions of the park and find the increase in area.

Question 2: The students in XYZ School decided to set up a triangular garden with a tiled pathway around it. They chose the dimensions of the triangle to be 15 meters, 30 meters, and 35 meters for the sides. The width of the pathway is 1.5 meters.

- Calculate the area of the triangular garden.
- What will be the new dimensions of the triangle if we include the pathway?
- Calculate the area of the triangular garden including the pathway.
- Determine the area covered by tiles for the pathway.

Question 3:

In a triangular park, the lengths of the sides are 15 m, 22 m, and 25 m. A smaller triangular flower bed is to be made inside the park with midpoints of each side of the park as vertices. Find the area of the smaller triangular flower bed and the remaining area of the park outside the flower bed.

### Solutions case study 1

Step 1: Calculate the current area of the triangular park = 1350 sq.m

New dimensions:  $(45\sqrt{2})\text{m}$ ,  $(60\sqrt{2})\text{m}$ ,  $(75\sqrt{2})\text{m}$

New Area = 2700 sq.m

Increase in area = 1350 sq.m

### Solution case study 2:

$$s = 40,$$

$$A = 500 \text{ square meters}$$

b) To determine the new dimensions of the triangle including the pathway, add the width of the pathway (1.5m) to each side.

$$A' = 16.5\text{m}$$

$$B' = 31.5\text{m}$$

$$C' = 36.5\text{m}$$

c) Calculate the area of the new triangular garden including the pathway:

$$\text{Let } a' = 16.5, b' = 31.5, \text{ and } c' = 36.5.$$

$$A' \approx 609.83 \text{ square meters}$$

d) To find the area covered by tiles for the pathway, subtract the area of the original triangle from the new area ( $A' - A$ ).

$$\text{Area of tiled pathway} = A' - A$$

$$\text{Area of tiled pathway} = 609.83 - 500$$

$$\text{Area of tiled pathway} \approx 109.83 \text{ square meters}$$

### Solution case study 3:

$$\text{Area of park} = 528 \text{ m}^2.$$

Sides of smaller triangle are half the sides of larger triangle,

$$a_1 = 15/2 = 7.5 \text{ m}, b_1 = 22/2 = 11 \text{ m}, \text{ and } c_1 = 25/2 = 12.5 \text{ m}.$$

$$\text{Area of flower bed} = 132 \text{ m}^2.$$

$$\text{Remaining area} = 396 \text{ m}^2.$$

### Short Answer Type Questions (Solved)

1 The perimeter of an isosceles triangle is 32cm. The ratio of the equal side to base is 3:2. Find the area of the triangle.

Answer: The ratio of the equal side to the base is 3: 2.

Let the sides be  $3x$ ,  $2x$ . Let the third =  $3x$

Given, perimeter = 32

We know that the perimeter is equal to the sum of the sides. Thus,

$$\Rightarrow 3x + 2x + 3x = 32$$

$$\Rightarrow 8x = 32$$

$$\Rightarrow x = 4$$

$$\Rightarrow \text{semi perimeter } s, 32/2 = 16$$

Thus, the sides are 12 cm, 8 cm, 12 cm

$$\begin{aligned}\text{Thus, Area of the triangle} &= \sqrt{32/2(16 - 12)(16 - 8)(16 - 12)} \\ &= \sqrt{16 \times 4 \times 8 \times 4} \\ &= 32\sqrt{2}\text{cm}^2\end{aligned}$$

2 Find the cost of laying grass in a triangular field of sides 50 m, 65 m and 65 m at the rate of Rs 7 per  $\text{m}^2$ . Also find the cost of fencing the field at the rate of Rs 9 per  $\text{m}^2$

Answer: Sides of the triangle are  $a=50\text{m}, b=65\text{m}, c=65\text{m}$

Area of triangle, by Heron's formula =  $s(s-a)(s-b)(s-c)$

where,

$$s = \frac{a+b+c}{2}$$

$$s = \frac{50+65+65}{2}$$

$$s = 90$$

$$\text{Area of triangle} = 90(40)(25)(25)$$

$$\text{Area of triangle} = 1500\text{m}^2$$

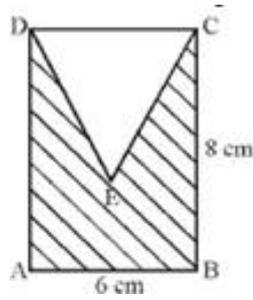
$$\text{Cost of laying grass} = \text{Area} \times 7$$

$$\text{Cost of laying grass} = 1500 \times 7$$

$$\text{Cost of laying grass} = \text{Rs } 10500$$

### Short Answer Type Questions (For practice)

- 1 The perimeter of a triangular field is 240 m with two sides 78m and 50m. Now, calculate the length of the altitude on the side of 50m length from its opposite vertex.
- 2 The sides of a triangle are in the ratio of 25:14:12 and its perimeter is 510m. Find the greatest side of the triangle and area of given triangle.
- 3 In the figure given below, ABCD is a rectangle and DEC is an equilateral triangle. Find the area of  $\triangle DEC$ .



- 4 Each side of an equilateral triangle is  $2x$ cm. If  $x\sqrt{3} = \sqrt{48}$ , then find its area.
- 5 The sides of a triangle are in the ratio of 3:5:7 and its perimeter is 300cm. Find its area.

Solution:

1. 67.5m
2.  $4800\text{m}^2$
3.  $48-9\sqrt{3}\text{cm}^2$
4.  $16\sqrt{3}\text{cm}^2$
5.  $4500\text{cm}^2$

### TEST (20)

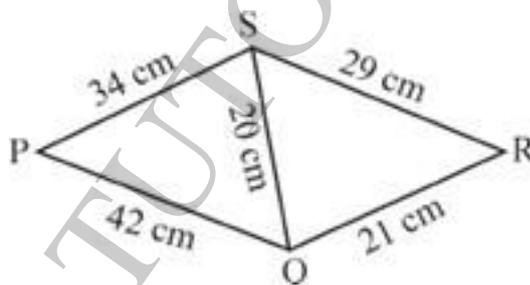
1. Sides of a triangle are in the ratio of 3: 5 :7 and its perimeter is 300cm. Its area will be: (1)  
 a.  $1000\sqrt{3}$  sq.cm    b.  $1500\sqrt{3}$ sq.cm    c.  $1700\sqrt{3}$  sq.cm    d.  $1900\sqrt{3}$ sq.cm
2. The length of altitude of an equilateral triangle of side a unit is (2)  
 a.  $\sqrt{3}/2a^2$     b.  $\sqrt{3}/4a^2$     c.  $\sqrt{3}/2a$     d. none of these
3. Find the area of a triangle having the length of sides as 3,4 and 5 units respectively. (2)
4. The length of the sides of a triangle is  $5x$ ,  $5x$  and  $8x$ . Find the area of the triangle. (3)
5. Find the area of the triangle having sides 1 m, 2m and 2 m. (3)
6. The sides of a triangular flower bed are 5m,8 m and 11m. Find the area of the flower bed. (4)
7. An isosceles right triangle has area  $8\text{cm}^2$ . Find the length of its hypotenuse. (5)

Ans: (TEST 1)

1. (b)  $1500\sqrt{3}$ sq.cm
2. c.  $\sqrt{3}/2a$
3.  $6\text{cm}^2$
4.  $12x^2\text{cm}^2$
5.  $0.25\sqrt{15}\text{m}^2$
6.  $4\sqrt{21}\text{m}^2$
7.  $4\sqrt{2}\text{cm}$

Test (30)

1. If the area of an equilateral triangle is  $36\sqrt{3}\text{cm}^2$ , then its perimeter is (1)  
a. 64 cm                  b. 60cm                  c. 36 cm                  d. None of these
2. What is the length of each side of an equilateral triangle having an area of  $4\sqrt{3}$ ? (1)  
a. 4cm                  b. 5cm                  c. 5cm                  d. 6cm
3. The area of a triangle is  $150\text{cm}^2$  and its sides are in the ratio 3:4:5. What is its perimeter? (2)  
a. 10 cm                  b. 30cm                  c. 45cm                  d. 60 cm
4. The sides of a parallelogram are 100 m each and length of the longest diagonal is 160m. Find the area of the parallelogram. (2)
5. The sides of a quadrilateral ABCD are 6cm, 8cm, 12cm and 14cm respectively. The angle between the first two sides is a right angle. Find its area. (3)
6. A rhombus-shaped sheet with perimeter 40cm and one diagonal 112cm, is painted on both sides at the rate of Rs.5 per  $\text{m}^2$ . Find the cost of painting. (3)
7. Find the area of the quadrilateral shown in the figure. (3)



8. The hypotenuse of a right-angled triangle is 41cm and the area of the triangle is 180 sq.cm, then find the difference between the lengths of the legs of the triangles. (5)
9. Find the area of a trapezium, the length of whose parallel sides is given as 22cm and 12cm and the length of other sides is 14 cm each. (5)
10. A rhombus-shaped field has green grass for 18 cows to graze. If each side of the rhombus is 30 m and its longer diagonal is 48 m, how much area of grass field will each cow be getting? (5)

Answers (TEST 2)

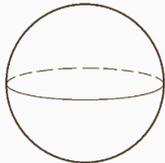
- 1 c. 36 cm
- 2 (a) 4
- 3 d. 60 cm
- 4  $9600\text{m}^2$
- 5  $546\text{cm}^2$
- 6  $82.8\text{ or }24(\sqrt{6}+1)\text{cm}^2$
- 7 Rs 960
- 8 31 cm
- 9  $51\sqrt{19}\text{cm}^2$
- 10  $48\text{m}^2$

## SURFACE AREAS AND VOLUMES

### Gist of the lesson

1. Spheres (including hemispheres)
2. Right circular cones.

Volume and Surface Area  
of Sphere



$$V = \frac{4}{3} \pi r^3$$

$$A = 4\pi r^2$$

### Surface Area and Volume Hemisphere



Surface area of hemisphere =  $3 \pi r^2$

Volume of Hemisphere =  $\frac{2}{3} \pi r^3$

| Cone   | Lateral surface area | Total surface area | Volume           |
|--|----------------------|--------------------|------------------|
|  <p style="font-size: small; margin-top: 5px;">h-height, l-slant height, r - radius</p> | $\pi r l$            | $\pi r(l + r)$     | $(1/3)\pi r^2 h$ |

### ILLUSTRATIVE EXAMPLES

### MULTIPLE CHOICE QUESTIONS

1. Total surface area of a hemisphere is  $4158 \text{ cm}^2$ , the diameter of the hemisphere is equal to \_\_\_\_\_ cm. (Take  $\pi = 22/7$ )

- a) 40 cm    b) 20 cm    c) 21 cm    d) 42 cm

Ans: d) 42 cm

2. If the surface area of a sphere of radius "R" is equal to the curved surface area of a hemisphere of radius "r", what is the ratio of R/r?

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

Ans:  $\frac{1}{\sqrt{2}}$

3. If a right circular cone has radius 4 cm and slant height 5 cm then what is its volume?

- (a)  $16 \pi \text{ cm}^3$                       (b)  $14 \pi \text{ cm}^3$                       (c)  $12 \pi \text{ cm}^3$                       (d)  $18 \pi \text{ cm}^3$

Ans:  $16 \pi \text{ cm}^3$

4. Two right circular cones of equal curved surface areas have slant heights in the ratio of 3 : 5. Find the ratio of their radii.

- (a) 4 : 1                      (b) 3 : 5                      (c) 5 : 3                      (d) 4 : 5

Ans: 5 : 3

5. Assertion: If the diameter of a sphere is decreased by 25%, then its curved surface area is decreased by 43.75%.

Reason : Curved surface area is increased when diameter decreases

- a) both Assertion and reason are correct and reason is correct explanation for Assertion  
b) both Assertion and reason are correct but reason is not correct explanation for Assertion  
c) Assertion is correct but reason is false  
d) both Assertions and reason are false

Ans: c) Assertion is correct but reason is false

CASE BASED QUESTION:-

6. Sangita had a hemispherical bowl of radius r. She made a conical vessel of radius r with a tin sheet.

(i) find the height of the conical vessel so that it can hold the water same as that of the hemispherical bowl.

(ii) if the radius of the cone formed in the above part is 14 cm, then find how much sheet is used?

(iii) if the height of the conical vessel is doubled, how much more water can it hold than the hemispherical bowl?



Ans: (i) since, volume of conical vessel = volume of hemispherical bowl

$$\Rightarrow \frac{1}{3} \pi r^2 h = \frac{2}{3} \pi r^3$$

$$\Rightarrow \frac{1}{3} \pi r^2 h - \frac{2}{3} \pi r^3 = 0$$

$$\Rightarrow h = 2r$$

The height is  $2r$

(ii) since, radius =  $r = 14$  cm

Height = 28 cm

$$l^2 = h^2 + r^2$$

$$\Rightarrow l^2 = 28^2 + 14^2$$

$$\Rightarrow l = 14\sqrt{5} \text{ cm}$$

$$\Rightarrow \text{area of sheet required} = \pi r l$$

$$= 1377.41 \text{ cm}^2$$

(iii) 
$$\frac{\frac{1}{3} \pi r^2 h}{\frac{2}{3} \pi r^3} = 2:1$$

it can hold twice the volume of the hemisphere.

### 11 SHORT ANSWER TYPE QUESTIONS

7. How many square metres of canvas is required for a conical tent whose height is 3.5 m and the radius of the base is 12 m?

Ans:  $l^2 = h^2 + r^2$

$$l^2 = 3.5^2 + 12^2$$

$$\Rightarrow l = 12.25 \text{ m}$$

total canvas required =  $\pi r l$

$$\pi \times 12 \times 12.5 = 471 \text{ m}^2$$

8. A shopkeeper has one spherical laddoo of radius 5 cm. With the same amount of material, how many laddoos of radius 2.5 cm can be made?

Ans: Given, radius of the spherical laddu,  $r = 5$  cm

$$\therefore \text{Volume of a spherical laddu} = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi 5^3 = \frac{500}{3} \pi \text{ cm}^3$$

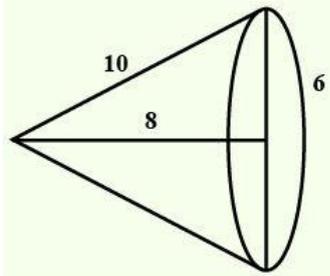
Now, radius of small laddu = 2.5 cm

$$\text{Volume of a small laddu} = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi 2.5^3 = \frac{62.5}{3} \pi \text{ cm}^3$$

$$\begin{aligned} \therefore \text{Number of laddoos} &= \frac{\text{Volume of a spherical laddu}}{\text{Volume of a small laddu}} \\ &= \frac{\frac{500}{3} \pi \text{ cm}^3}{\frac{62.5}{3} \pi \text{ cm}^3} = 8 \end{aligned}$$

So, he can make 8 laddoos.

9. A right triangle with sides 6 cm, 8 cm and 10 cm is revolved about the side 8 cm. Find the volume and the curved surface of the solid so formed.



Ans: When a right triangle with sides 6 cm, 8 cm and 10 cm is revolved about the side 8 cm, then solid formed is a cone whose height,  $h = 8$  cm.

The radius of the cone,  $r = 6$  cm.

Slant height of the cone,  $l = 10$  cm

$$\begin{aligned} \therefore \text{Volume of the cone} &= \frac{1}{3} \pi r^2 h = \frac{1}{3} * \frac{22}{7} * 6^2 * 8 \\ &= 301.7 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Curved surface area of the cone} &= \pi r l \\ &= \frac{22}{7} * 6 * 10 = 188.5 \text{ cm}^2 \end{aligned}$$

Hence, the volume and surface area of the cone are  $301.7 \text{ cm}^3$  and  $188.5 \text{ cm}^2$  respectively.

#### LONG ANSWER TYPE QUESTIONS

10. A semi-circular sheet of metal of diameter 28 cm is bent to form an open conical cup. Find the capacity of the cup.

Ans: Circumference of a semicircle =  $\pi r$  Whereas,  $r$  is the radius of circle

Diameter of circular sheet = 28 cm

$\therefore$  Radius of circular sheet = 14 cm

Therefore,

Circumference of circular sheet =  $14\pi$

When a semi-circular sheet is bent to form an open conical cup, the radius of the sheet becomes the slant height of the cup and the circumference of the sheet becomes the circumference of the base of the cone.

Slant height of cup ( $l$ ) = Radius of circular sheet = 14 cm

Circumference of the base of cone = circumference of circular sheet =  $14\pi$

Let  $r$  be the radius of the base of cone

$$\therefore 2\pi r = 14 \Rightarrow r = 7 \text{ cm}$$

Let  $h$  be the height of the cup.

$$\text{Therefore, } l^2 = h^2 + r^2$$

$$14^2 = 7^2 + h^2$$

$$\Rightarrow h = 7\sqrt{2} \text{ cm}$$

Now, Capacity of cup = Volume of cone

As we know that, volume of cone is given as-

$$V = \frac{1}{3} \pi r^2 h$$

$$\begin{aligned} \text{Therefore, Capacity of cup} &= \frac{1}{3} \pi 7^2 * 7\sqrt{2} \\ &= 622.4 \text{ cm}^3 \end{aligned}$$

Thus the capacity of the cup is  $622.4 \text{ cm}^3$

11. Two solid spheres made of the same metal have weights 5920 g and 740 g, respectively. Determine the radius of the larger sphere, if the diameter of the smaller one is 5 cm.

Ans: Mass is directly proportional to volume for same metal (Density)

Let Mass of Solid 1 be  $M_1$ , Volume be  $V_1$ , Mass of Solid 2 be  $M_2$  and Volume be  $V_2$

$$\frac{M_1}{M_2} = \frac{V_1}{V_2}$$

Volume of sphere is directly proportional to  $R^3$

$$\frac{M_1}{M_2} = \frac{V_1}{V_2} = \frac{(R_1)^3}{(R_2)^3}$$

$$\frac{5920}{740} = \frac{(R_1)^3}{(R_2)^3}$$

$$\frac{(R1)^3}{(R2)^3} = 8$$

$$\frac{R1}{R2} = 2$$

$$R1 = 2 * 2.5 = 5 \text{ cm}$$

12. A corn cob shaped somewhat like a cone, has the radius of its broadest end as 2.1 cm and length (height) as 20 cm. If each 1 cm<sup>2</sup> of the surface of the cob carries an average of four grains, find how many grains you would find on the entire cob.

Ans: We know the curved surface area of cone cob =  $\pi rl$ .

Given, r = 2.1cm , h = 20 cm.

$$l^2 = h^2 + r^2$$

$$l^2 = 2.1^2 + 20^2$$

$$l = 20.11 \text{ cm}$$

$$\therefore \text{Curved surface area of corn cob} = \frac{22}{7} * 2.1 * 20.11 = 132.73 \text{ cm}^2$$

Since, the number of grains on 1 cm<sup>2</sup> of the surface corn cob =4,

$$\therefore \text{Number of grain on } 132.73 \text{ cm}^2 \text{ of the surface of corn cob} = 132.73 \times 4 = 530.92 \approx 531.$$

### **QUESTIONS FOR PRACTICE:-**

#### **MULTIPLE CHOICE QUESTIONS**

1. The diameter of the moon is approximately one-fourth of the diameter of the earth. What fraction of the volume of the earth is the volume of the moon?

- a.  $\frac{1}{64}$                       b.  $\frac{1}{32}$                       c.  $\frac{1}{48}$                       d.  $\frac{1}{16}$

2. A hemispheric dome of radius 3.5m is to be painted at a rate of ₹600/m<sup>2</sup>. What is the cost of painting it? (Take  $\pi = 22/7$ )

- a) ₹46200                      b) ₹45000                      c) ₹47260                      d) ₹48375

3. The radius of a hemispherical balloon increases from 6 cm to 12 cm as air is being pumped into it. The ratios of the surface areas of the balloon in the two cases is

- (A) 1 : 4                      (B) 1 : 3                      (C) 2 : 3                      (D) 2 : 1

4. What is the total surface area of a cone of radius 7cm and height 24cm? (Take  $\pi = 22/7$ )

- a) 710 cm<sup>2</sup>    b) 704 cm<sup>2</sup>    c) 700 cm<sup>2</sup>    d) 725 cm<sup>2</sup>

5. Assertion: if a ball is in the shape of a sphere has a surface area of 221.76cm<sup>2</sup> then its diameter is 8.4 cm

Reason: if the radius of the sphere be  $r$  then the surface area,  $S=4\pi r^2$

- a) both Assertion and reason are correct and reason is correct explanation for Assertion
- b) both Assertion and reason are correct but reason is not correct explanation for Assertion
- c) Assertion is correct but reason is false
- d) both Assertions and reason are false

CASE BASED QUESTION:-

6. In a grinding mill, 5 types of mills were installed. These mills used spherical shaped steel balls of radius 5 mm, 7 mm, 10 mm, 14 mm, 16 mm respectively. For repairing purposes the mill needs 10 balls of radius 7 mm and 20 balls of radius 3.5mm. The workshop had  $20000\text{mm}^3$  steel which was melted and 10 balls of radius 7mm and 20 balls of radius 3.5 m were made and the remaining steel was stored for future use.

- i) What was the volume of 10 balls of radius 7mm?
- ii) How much steel was kept for future use?
- iii) What was the surface area of one ball of radius 7mm?

7. A class teacher brings some clay in the classroom to teach the topic mensuration. First she forms a cone of radius 10 cm and height 5 cm and then she moulds that cone into a sphere.

- (i) Find the volume of the conical shape.
- (ii) Find the radius of the sphere.
- (iii) Find the volume of the sphere the teacher made.



8. Monica has a piece of canvas whose area is  $551\text{ m}^2$ . She uses it to have a conical tent made, with a base radius of 7 m. Assuming that all the stitching margins and the wastage incurred while cutting, amounts to approximately  $1\text{ m}^2$

- (i) find the slant height of the conical tent so formed.
- (ii) Find the height of the conical tent so formed.
- (iii) find the volume of the conical tent?



SHORT ANSWER TYPE QUESTIONS

9. The surface area of a sphere of radius 5 cm is five times the area of the curved surface of a cone of radius 4 cm. Find the height and the volume of the cone (taking  $\pi=22/7$ )

10. A dome of a building is in the form of a hemisphere. From inside, it was whitewashed at the cost of ₹498.96. If the rate of whitewashing is ₹4 per

square metre, find the :

- (i) Inside surface area of the dome

(ii) Volume of the air inside the dome.

11. A metallic sphere is of radius 4.9 cm. If the density of the metal is  $7.8 \text{ g/cm}^3$ , find the mass of the sphere ( $\pi = 22/7$ ).

12. The height of a cone is 16 cm and its base radius is 12 cm. Find the curved surface area and the total surface area of the cone (Use  $\pi = 3.14$ ).

13. A cone is 8.4 cm high and the radius of its base is 2.1 cm. It is melted and recast into a sphere. Find the radius of the sphere so formed.

14. A joker's cap is in the form of a right circular cone with a base radius of 7 cm and a height of 24 cm. Find the area of the sheet required to make 10 such caps.

15. A hemispherical bowl is made of steel, 0.25 cm thick. The inner radius of the bowl is 5 cm. Find the outer curved surface area of the bowl.

16. If the radius of a sphere is doubled then what is the ratio of their volumes?

17. Find the capacity in litres of a conical vessel whose diameter is 14 cm and slant height is 25 cm.

18. The area of the circular base of a right circular cone is  $78.5 \text{ cm}^2$ . If its height is 12 cm then find its volume.

#### LONG ANSWER TYPE QUESTIONS

19. A bus stop is barricaded from the remaining part of the road, by using 50 hollow cones made of recycled cardboard. Each cone has a base diameter of 40 cm and height 1m. If the outer side of the cone is to be painted and the cost of painting is Rs  $12/\text{m}^2$ . What will be the cost? ( Take  $\pi = 3.14$  and take  $\sqrt{1.04} = 1.02$ )

20. To maintain the beauty of the monument, the students of the school cleaned and painted the dome of the monument. The monument is in the form of a hemisphere. From inside, it was white washed by the students whose area is  $249.48 \text{ m}^2$ . Find the volume of the air inside the dome.

21. A right triangle of hypotenuse 13 cm and one of its sides 12 cm is made to revolve taking side 12 cm as its axis. Find the volume and curved surface area of the solid so formed.

22. A right triangle ABC with sides 5 cm, 12 cm and 13 cm is revolved about the side 5 cm. Find the volume of the solid so obtained. If it is now revolved about the side 12 cm, then what would be the ratio of the volumes of the two solids obtained in two cases ?

23. A gulab jamun contains sugar syrup up to about 30% of its volume. Find approximately how much syrup would be found in 45 gulab jamuns each shaped like a sphere of diameter 2.8 cm .

#### ANSWERS OF PRACTICE QUESTIONS

1.  $\frac{1}{64}$

2. ₹46200

3. 1 : 4

4.  $704 \text{ cm}^2$

5. Ans: a) both Assertion and reason are correct and reason is correct explanation for Assertion

6. (i)  $14373.3 \text{ mm}^3$

(ii)  $2033.4 \text{ mm}^3$

(iii)  $616 \text{ mm}^2$

7. (i)  $\frac{500\pi}{3} \text{ cm}^3$

(ii)  $5 \text{ cm}$

(iii)  $\frac{500\pi}{3} \text{ cm}^3$

8. (i)  $25 \text{ m}$

(ii)  $24 \text{ m}$

(iii)  $1232 \text{ m}^3$

9.  $h = 3 \text{ cm}$

$V = 50.29 \text{ cm}^3$

10. the inner surface area of the dome is  $249.48 \text{ m}^2$  and the volume of the air inside the dome is  $523.9 \text{ m}^3$

11.  $3845.44 \text{ g} = 3.85 \text{ kg}$  (nearly)

12.  $\text{CSA} = 753.6 \text{ cm}^2$

$\text{TSA} = 1205.76 \text{ cm}^2$

13.  $2.1 \text{ cm}$

14. Curved surface area of 10 jokers cap =  $5500 \text{ cm}^2$

15.  $173.25 \text{ cm}^2$

16.  $1:8$

17.  $1.232 \text{ litres}$

18.  $V = 314 \text{ cm}^3$

19.  $\text{₹}384.34$

20.  $V = 523.908 \text{ m}^3$

21.  $\text{CSA} = 65\pi \text{ cm}^2$      $\text{VOL} = 100\pi \text{ cm}^3$

22.  $\text{VOLUME} = 240\pi \text{ cm}^3$

RATIO IS  $5:12$

23.  $1552.32 \text{ cm}^3$

## STATISTICS

1 The marks obtained by 17 students in a mathematics test (out of 100) are given below :

98, 82, 100, 100, 96, 65, 82, 76, 79, 90, 41, 64, 72, 68, 66, 48, 49.

The range of the data is :

(A) 59 (B) 54 (C) 90 (D) 100

2 The class-mark of the class 120-160 is :

(A) 130 (B) 135 (C) 140 (D) 145

3 In a frequency distribution, the mid value of a class is 10 and the width of the class is 6. The lower limit of the class is :

(A) 6 (B) 7 (C) 8 (D) 12

4 In the class intervals 10-20, 20-30, 30-40, the number 30 is included in :

(A) 30-40 (B) 20-30 (C) both the intervals (D) none of these

### ASSERTION- REASONING

5 DIRECTION : In each of the following questions, a statement of Assertion is given followed by a corresponding statement of Reason just below it. Of the statements, mark the correct answer as

- (a) Both assertion and reason are true and reason is the correct explanation of assertion.
- (b) Both assertion and reason are true but reason is not the correct explanation of Assertion.
- (c) Assertion is true but reason is false.
- (d) Assertion is false but reason is true.

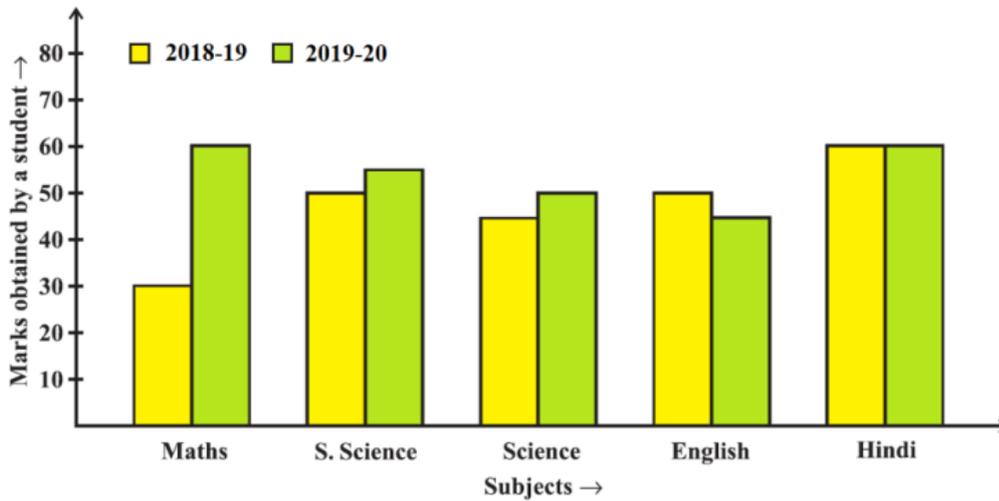
1. Assertion : If the class mark of a class interval (10- X) is 20 then upper limit X = 30

Reason :  $(\text{Upper limit} + \text{Lower limit}) = \text{Class mark} / 2$

### CASE STUDY PROBLEMS

6 The Class teacher of Class X preparing result analysis of a student. She compares the marks of a student obtained in Class IX (2018-19) and Class X (2019-20) using the

double bar graph as shown below



(I) In which subject has the performance improved the most?

- (a) Maths (b) Social Science  
(c) Science (d) English

(II) In which subject has the performance deteriorated?

- (a) Maths (b) Social Science  
(c) Science (d) English

(III) In which subject is the performance at par?

- (a) Hindi (b) Maths  
(c) Science (d) English

(IV) What is the difference in Maths Subject?

- (a) 5 (b) 30  
(c) 0 (d) 10

(V) What is the percentage of marks obtained by a student in Class X (2019-20)?

- (a) 60% (b) 55%  
(c) 54% (d) 65%

7 A Mathematics teacher asks students to collect the marks of Mathematics in Half yearly exam. She instructed to all the students to prepare frequency distribution table using the data collected. Ram collected the following marks (out of 50) obtained in Mathematics by students of Class IX

21, 10, 30, 22, 33, 5, 37, 12, 25, 42, 15, 39, 26, 32, 18, 27, 28, 19, 29, 35, 31, 24, 36, 18, 38, 22, 44, 16, 24, 10, 27, 39, 28, 49, 29, 32, 23, 31, 21, 34, 22, 23, 36, 24, 36, 33, 47, 48, 50, 39, 20, 7, 16, 36, 45, 47, 30, 22, 20, 60, 17.



|            |    |
|------------|----|
| 5 -<br>15  | 6  |
| 15 -<br>25 | 11 |
| 25 -<br>35 | 21 |
| 35 -<br>45 | 23 |
| 45 -<br>55 | 14 |
| 55 -<br>65 | 5  |

(A) The class interval with highest frequency is:

- |           |           |           |           |
|-----------|-----------|-----------|-----------|
| (i)       | (ii)      | (iii)     | (iv)      |
| 45-<br>55 | 35-<br>45 | 25-<br>35 | 15-<br>25 |

(B) Which age group was affected the least?

- |             |            |
|-------------|------------|
| (i) 35-45   | (ii) 25-35 |
| (iii) 55-65 | (iv) 45-55 |

(C) Which are group was affected the most?

- |             |            |
|-------------|------------|
| (i) 35-45   | (ii) 25-35 |
| (iii) 15-25 | (iv) 45-55 |

(D) How many patients of the age 45 years and above were admitted?

- |     |      |       |      |
|-----|------|-------|------|
| (i) | (ii) | (iii) | (iv) |
| 61  | 19   | 14    | 23   |

(E) How many patients of the age 35 years and less were admitted?

- |     |      |       |      |
|-----|------|-------|------|
| (i) | (ii) | (iii) | (iv) |
| 17  | 38   | 61    | 41   |

**SHORT ANSWER TYPE**

9 A grouped frequency table with class intervals of equal sizes using 250-270 (270 not included in this interval) as one of the class interval is constructed for the following data : 268, 220, 368, 258, 242, 310, 272, 342, 310, 290, 300, 320, 319, 304, 402, 318, 406, 292, 354, 278, 210, 240, 330, 316, 406, 215, 258, 236. Write the frequency of the class 310-330 .

10 From the given frequency table ,

Write the total number of cats that are above the age of 3 years

|                     |     |     |     |     |     |
|---------------------|-----|-----|-----|-----|-----|
| Age of cats (years) | 1-2 | 2-3 | 3-4 | 4-5 | 5-6 |
| No. of cats         | 6   | 4   | 7   | 6   | 17  |

From the given frequency table ,

|        |     |     |     |     |     |
|--------|-----|-----|-----|-----|-----|
| Age of | 25- | 30- | 40- | 50- | 60- |
|--------|-----|-----|-----|-----|-----|

Write the total number of Labours that are BELOW the age of 50 years

|                |    |    |    |    |    |
|----------------|----|----|----|----|----|
| labour (years) | 30 | 40 | 50 | 60 | 70 |
| No. of labour  | 6  | 4  | 7  | 6  | 17 |

- 12 In a histogram, the areas of the rectangles are proportional to the frequencies. Can we say that the lengths of the rectangles are also proportional to the frequencies ?
- 13 The Histogram is drawn between which of the two things of the data ?
- 14 The frequency polygon is drawn between which of the two things of the data ?
- 15 To draw a frequency polygon , a point for a class interval ( 40-60) with corresponding frequency 8. What is coordinate of that point of the frequency polygon?
- 16 The class marks of a continuous distribution are : 1.04, 1.14, 1.24, 1.34, 1.44, 1.54 and 1.64 Is it correct to say that the last interval will be 1.55 - 1.73? Justify your answer.
- 17 Write the difference between Bar graph and Histogram .
- 18 The class intervals which are 5-7 , 8-10 & 11-13 are not continuous (Inclusive way). Write these class interval with true limits.

**LONG ANSWER TYPE PROBLEMS**

19 Prepare a frequency polygon for the given frequency table .

20 In the given Fig. , there is a histogram depicting

|                |     |      |       |       |       |
|----------------|-----|------|-------|-------|-------|
| Class interval | 0-5 | 5-10 | 10-15 | 15-20 | 20-25 |
| frequency      | 3   | 6    | 11    | 5     | 3     |

daily wages of workers in a factory. Construct the frequency distribution table. ( Along x- axis members age( years) and y- axis number of villages



21 The expenditure of two families on different heads in a month is given below:

|                         |      |           |       |          |            |
|-------------------------|------|-----------|-------|----------|------------|
| Head                    | Food | Education | cloth | Medicine | House rent |
| Expenditure of family A | 6000 | 1500      | 2000  | 700      | 900        |

|                         |      |      |      |      |     |
|-------------------------|------|------|------|------|-----|
| Expenditure of family B | 8000 | 2000 | 1500 | 1200 | 950 |
|-------------------------|------|------|------|------|-----|

Draw the double Bar graph

22 Draw the Histogram for the given data

|                |     |     |     |      |       |
|----------------|-----|-----|-----|------|-------|
| Class interval | 1-4 | 4-6 | 6-8 | 8-12 | 12-20 |
| Frequency      | 6   | 30  | 44  | 16   | 4     |

23 Draw the frequenc for the given data

|                |     |     |     |      |       |
|----------------|-----|-----|-----|------|-------|
| Class interval | 1-4 | 4-6 | 6-8 | 8-12 | 12-20 |
| Frequency      | 6   | 30  | 44  | 16   | 4     |

24 The following are the marks (out of 100) of 60 students in mathematics. 16, 13, 5, 80, 86, 7, 51, 48, 24, 56, 70, 19, 61, 17, 16, 36, 34, 42, 34, 35, 72, 55, 75, 31, 52, 28, 72, 97, 74, 45, 62, 68, 86, 35, 85, 36, 81, 75, 55, 26, 95, 31, 7, 78, 92, 62, 52, 56, 15, 63, 25, 36, 54, 44, 47, 27, 72, 17, 4, 30. Construct a grouped frequency distribution table with width 10 of each class starting from 0 – 10 and Draw the Histogram and frequency polygon.