9th Class 2021

Math (Science)	Group-I	Paper-II
Time: 2.10 Hours	(Subjective Type)	Max. Marks: 60

(Part-I)

2. Write short answers to any Six (6) questions: (12)

(i) If $B = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}$, then verify that $(B^t)^t = B$.

Ans

$$B = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix}$$

$$B^t = \begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}$$

$$(B^t)^t = \begin{bmatrix} 1 & 1 \\ 2 & 0 \end{bmatrix} = B$$

$$\therefore\ (B^t)^t = B$$

(ii) If $\begin{bmatrix} a+3 & 4 \\ 6 & b-1 \end{bmatrix} = \begin{bmatrix} -3 & 4 \\ 6 & 2 \end{bmatrix}$, then find a, b.

Ans $\begin{bmatrix} a+3 & 4 \\ 6 & b-1 \end{bmatrix} = \begin{bmatrix} -3 & 4 \\ 6 & 2 \end{bmatrix}$

$a + 3 = -3$	$b - 1 = 2$
$a = -3 - 3$	$b = 2 + 1$
$a = -6$	$b = 3$

(iii) Simplify: $5^{2^3} \div (5^2)^3$

Ans

$= 5^{2^3} \div (5^2)^3$

$= 5^8 \div 5^6$

$= 5^{8-6}$

$= 5^2$

$\boxed{= 25}$

(iv) Evaluate: i^{50}

Ans

$(i)^{50}$

$= i^{48} . i^2$

$= (i^4)^{12} . i^2$ we know $i^2 = -1$

$= [(i^2)^2]^{12} . i^2$ $i^4 = 1$

$= [(-1)^2]^{12} \times -1 = (1)^{12} \times -1$

$= 1 \times -1$

$= -1$

(v) **Find the value of x $\log_{625} 5 = \frac{1}{4}x$.**

Ans $\log_{625} 5 = \frac{1}{4}x$

$(625)^{1/4x} = 5$

$(5^4)^{1/4x} = 5^1$ $\qquad \therefore (a^m)^n = a^{mn}$

$5^x = 5^1$

$x = 1$

(vi) **Express the given number in scientific notation: 416.9**

Ans $416.9 = 4.169 \times 100$

$= 4.169 \times 10^2$

(vii) **Simplify the given expression:**

$$\frac{(x+y)^2 - 4xy}{(x-y)^2}$$

Ans $\frac{(x+y)^2 - 4xy}{(x-y)^2} = \frac{x^2 + y^2 + 2xy - 4xy}{x^2 + y^2 - 2xy}$

$= \frac{x^2 + y^2 - 2xy}{x^2 + y^2 - 2xy} = 1$

(viii) **Simplify:** $\sqrt{21} \times \sqrt{7} \times \sqrt{3}$

Ans $\sqrt{21} \times \sqrt{7} \times \sqrt{3} = \sqrt{21 \times 7 \times 3}$

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

$= \sqrt{3^2 \times 7^2}$

$= 3 \times 7$

$= 21$

(ix) **Factorize:** $4x^2 - 16y^2$

Ans $4x^2 - 16y^2$

$= 4(x^2 - 4y^2)$

$= 4((x)^2 - (2y)^2)$

$\therefore a^2 - b^2 = (a+b)(a-b)$

$= 4(x + 2y)(x - 2y)$

3. **Write short answers to any Six (6) questions: (12)**

(i) **Find H.C.F: $102xy^2z, 85x^2yz, 187xyz^2$**

Ans

Factorization of $102xy^2z = 2 \times 3 \times 17 \times x \times y \times y \times z$

// // // $85x^2yz = 5 \times 17 \times x \times x \times y \times z$

// // // $187xyz^2 = 11 \times 17 \times x \times y \times z \times z$

Common factors = 17, x, y, z

$$H.C.F = 17 \times x \times y \times z$$
$$= 17xyz$$

(ii) **Solve the equation: $\sqrt{\frac{x+1}{2x+5}} = 2, x \neq -\frac{5}{2}$.**

Ans

$$\sqrt{\frac{x+1}{2x+5}} = 2$$

or $$\left(\frac{x+1}{2x+5}\right)^{1/2} = 2$$

Squaring both sides,

$$\left(\left(\frac{x+1}{2x+5}\right)^{1/2}\right)^2 = (2)^2$$

$$\frac{x+1}{2x+5} = 4$$

Multiply by 2x + 5 on both sides,

$$x + 1 = 4 \times (2x + 5)$$
$$8x + 20 = x + 1$$
$$8x - x = 1 - 20$$
$$7x = -19$$
$$x = -\frac{19}{7}$$

(iii) **Solve for x $|2x + 5| = 11$**

Ans

$+(2x + 5) = 11$ or $-(2x + 5) = 11$

$2x + 5 = 11$ or $2x + 5 = -1$

$2x = 11 - 5$ or $2x = -11 - 5$

$2x = 6$ or $2x = -16$

$x = 3$ or $x = -8$

Therefore, 3, −8 are the solutions of the given equation,

or S.S = {3, −8}.

(iv) **Writing in the form of y = mx + c find the value of m and c: $x - 2y = -2$.**

Ans

$$x - 2y = -2$$
$$-2y = -x - 2$$
$$\frac{-2y}{-2} = -\frac{x}{-2} - \frac{2}{-2}$$
$$y = \frac{1}{2}x + 1$$
$$y = mx + c$$

By comparison,

$\Rightarrow \quad m = \frac{1}{2}, c = 1.$

(v) **Verify whether the point (0, 0) lies on the line $2x - y + 1 = 0$ or not.**

Ans

$$2x - y + 1 = 0$$

or $\quad y = 2x + 1$

Putting $x = 0$ and $y = 0$ in this equation

$$0 = 2(0) + 1$$
$$0 = +1$$

which is impossible.

Therefore (0, 0) does not lie on the given line.

(vi) **Find the mid-point of the line segment joining the pair of points A(0, 0), B(0, –5).**

Ans

$$A = (0, 0) = (x_1, y_1)$$
$$B = (0, -5) = (x_2, y_2)$$

Let M(x, y) is the mid-point

$$M(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$\therefore \quad M(x, y) = \left(\frac{0 + 0}{2}, \frac{0 + (-5)}{2}\right)$$

$= (0, \frac{-5}{2})$ is the required mid-point.

(vii) **Find the distance between the points:**

A(9, 2), B(7, 2).

Ans The distance formula:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

From the above points,

$$x_1 = 9, x_2 = 7, y_1 = 2, y_2 = 2$$

By putting the values in the distance formula,

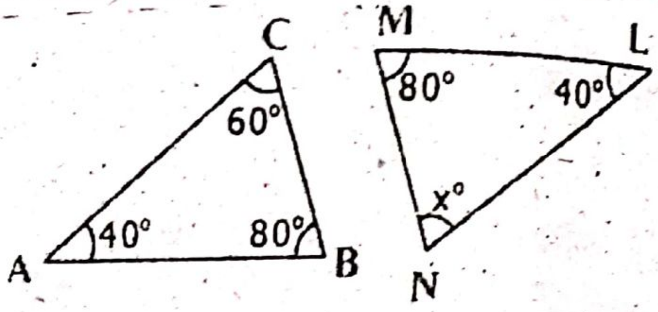
$$d = \sqrt{(7-9)^2 + (2-2)^2}$$

$$= \sqrt{(-2)^2 + (0)^2}$$

$$= \sqrt{4}$$

$$d = 2$$

(viii) If $\Delta ABC \cong \Delta LMN$, find the value of x:



Ans As $\Delta ABC \cong \Delta LMN$

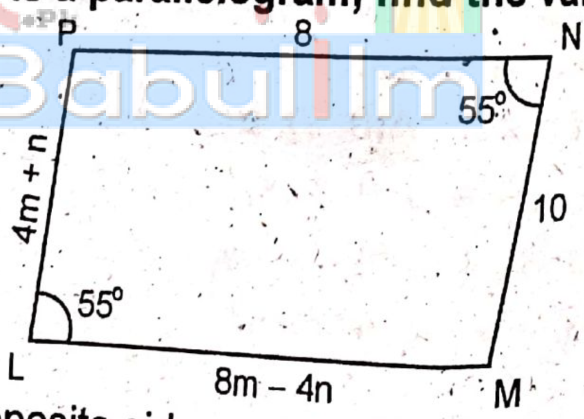
$$m\angle A = m\angle L = 40^\circ \text{ and}$$

$$m\angle B = m\angle M = 80^\circ \text{ and}$$

$$m\angle N = m\angle C$$

So, $x^\circ = 60^\circ$

(ix) If LMNP is a parallelogram, find the values of m, n:



Ans From opposite sides of || gram

$$4m + n = 10 \quad (1)$$

$$8m - 4n = 8 \quad (2)$$

Multiplying eq. (1) by '4' and adding in eq. (2),

$$16m + 4n = 40$$

$$8m - 4n = 8$$

$$24m = 48$$

$$m = \frac{48}{24}$$

$$\boxed{m = 2}$$

By putting m = 2 in eq. (1), we get

$$4(2) + n = 10$$

$$8 + n = 10$$

$$n = 10 - 8$$

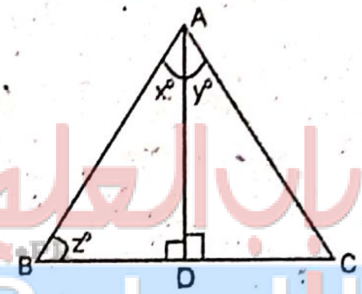
$$\boxed{n = 2}$$

4. Write short answers to any Six (6) questions: (12)

(i) Define ratio.

Ans Comparison of two similar type of quantities having same units of quantities and same units is called ratio. It is expressed as; a : b or $\frac{a}{b}$. For example, 2 : 3.

(ii) In equilateral triangle ABC, $\overline{AD}$ is bisector of angle A, then find the value of x°, y° and z°:



Ans As ABC is an equilateral triangle, so

$$\angle A = \angle B = \angle C = 60^\circ$$

$$x^\circ = y^\circ = \frac{60^\circ}{2} = 30^\circ$$

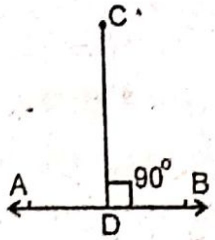
From figure $z^\circ = C^\circ$

But $C = 60^\circ$

So, $z^\circ = 60^\circ$ and $x^\circ = 30^\circ$, $y^\circ = 30^\circ$

(iii) What will be the angle for shortest distance from an outside point to the line?

Ans



As the shortest distance from a point outside to a line is the perpendicular distance. So the angle is 90°.

(iv) Verify that the Δ having the measure of sides is right angled:

a = 5 cm, b = 12 cm , c = 13 cm

Ans By Pythagoras theorem,

$(\text{Hypotenuse})^2 = (\text{Perpendicular})^2 + (\text{Base})^2$

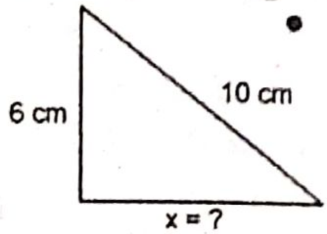
$(13)^2 = 5^2 + 12^2$

$169 = 25 + 144$

$169 = 169$

Hence verified.

(v) Find the value of x in the figure:



Ans As $(\text{Hyp})^2 = (\text{Base})^2 + (\text{Perp})^2$

$(10)^2 = (x)^2 + (6)^2$

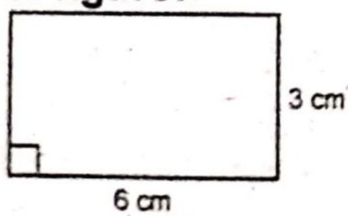
$100 = x^2 + 36$

$100 - 36 = x^2$

$\Rightarrow \quad x^2 = 64$

$x = 8 \text{ cm}$

(vi) Find the area of figure:



Ans Length of rectangle = 6 cm = l

Width of // // = 3 cm = w

Area = $l \times w$

w = Area of // // = 6×3

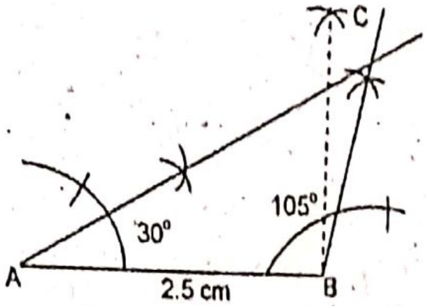
= 18 cm²

(vii) Define area of the figure.

Ans The region enclosed by the boundary of the closed figure is called area of a figure.

(viii) **Construct ΔABC in which: $m\overline{AB} = 2.5$ cm, $m\angle A = 30^\circ$, $m\angle B = 105^\circ$.**

Ans



ΔABC is the required triangle.

(ix) **Define circumcentre.**

Ans The point of concurrency of the perpendicular bisectors of the sides of a triangle is called its circumcenter.

(Part-II)

NOTE: Attempt THREE (3) questions in all. But question No. 9 is Compulsory.

Q.5.(a) Solve the system of linear equations by using Cramer's rule: **(4)**

$$2x - 2y = 4$$
$$3x + 2y = 6$$

Ans For Answer see Paper 2017 (Group-I), Q.5.(a).

(b) Simplify: $\left(\frac{a^p}{a^q}\right)^{p+q} \cdot \left(\frac{a^q}{a^r}\right)^{q+r} \div 5(a^p \cdot a^r)^{p-r}, a \neq 0.$ **(4)**

Ans

$$\left(\frac{a^p}{a^q}\right)^{p+q} \cdot \left(\frac{a^q}{a^r}\right)^{q+r} \div 5(a^p \cdot a^r)^{p-r}$$

$$= \frac{(a^{p-q})^{p+q} \cdot (a^{q-r})^{q+r}}{5(a^{p+r})^{p-r}}$$

$$= \frac{a^{(p-q)(p+q)} \cdot a^{(q-r)(q+r)}}{5 \cdot a^{(p+r)(p-r)}}$$

Using $(a - b)(a + b) = a^2 - b^2$

$$= \frac{a^{p^2-q^2} \cdot a^{q^2-r^2}}{5a^{p^2-r^2}}$$

$= \frac{1}{5} a^{p^2-q^2+q^2-r^2-p^2+r^2}$

$= \frac{1}{5} a^0$ $\qquad \therefore \quad a^0 = 1$

$= \frac{1}{5} \times 1$

$= \frac{1}{5}$

Q.6.(a) Use log table to find the value of : $\sqrt[3]{25.47}$. (4)

Ans $\sqrt[3]{25.47}$

Let $x = \sqrt[3]{25.47}$

$= (25.47)^{1/3}$

Applying log on both sides,

$\log x = \log (25.47)^{1/3}$

$= \frac{1}{3} \log (25.47)$

$= \frac{1}{3} (1.4060)$

$\log x = 0.4687$

Taking Antilog,

$x = \text{Antilog } 0.4687$

$= 2.942$

So, $\sqrt[3]{25.47} = 2.942$

(b) If $x + y + z = 12$ and $x^2 + y^2 + z^2 = 64$, then find the value of $xy + yz + zx$. (4)

Ans For Answer see Paper 2018 (Group-I), Q.6.(b).

Q.7.(a) Factorize: $x^2 - y^2 - 4xz + 4z^2$ (4)

Ans $x^2 - y^2 - 4xz + 4z^2$

Re-arranging

$x^2 - 4xz + 4z^2 - y^2$

$= [x^2 - 2(x)(2z) + (2z)^2] - y^2$

$\therefore \quad a^2 - 2ab + b^2 = (a - b)^2$

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

$\because a^2 - b^2 = (a+b)(a-b)$

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

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

(b) Find the H.C.F. by the division method: **(4)**

$x^3 + 3x^2 - 16x + 12,\ x^3 + x^2 - 10x + 8$

Ans

Quotient: 1

Divisor: $x^3 + x^2 - 10x + 8$

$$x^3 + 3x^2 - 16x + 12$$
$$\pm x^3 \pm x^2 \mp 10x \pm 8$$
$$2x^2 - 6x + 4$$
$$x^2 - 3x + 2$$

Quotient: $x + 4$

Divisor: $x^3 - 3x + 2$

$$x^3 + x^2 - 10x + 8$$
$$\pm x^3 \mp 3x^2 \pm 2x$$
$$4x^2 - 12x + 8$$
$$\pm 4x^2 \pm 12x \pm 8$$
$$\times$$

$\text{H.C.F} = x^2 - 3x + 2$

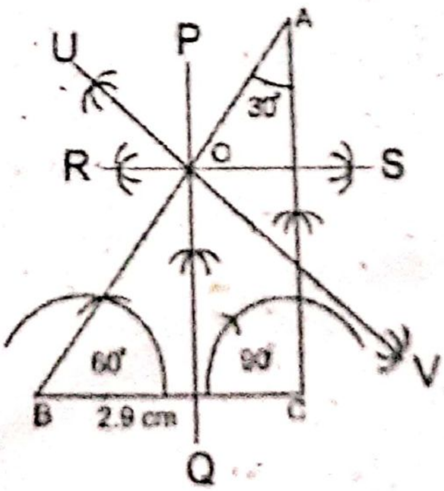
Q.8.(a) Solve the equation: $\frac{5(x-3)}{6} - x = 1 - \frac{x}{9}$. **(4)**

Ans For Answer see Paper 2017 (Group-II), Q.8.(a).

(b) Construct the ΔABC and draw the perpendicular bisectors of its sides: **(4)**

$m\overline{BC} = 2.9\text{ cm},\ m\angle A = 30^\circ,\ m\angle B = 60^\circ$

Ans



Steps of Construction:

1. Take a line segment $m\overline{BC} = 2.9$ cm.
2. Draw an angle $\angle C\widehat{B}W = 60$ at B.
3. We find $m\angle C$ first and draw

$$\begin{aligned} m\angle C &= 180 - m\angle B - m\angle A \\ &= 180 - 60 - 30 \\ &= 90^\circ \end{aligned}$$

4. Draw an angle $\angle C = 90^\circ$ at point C.
5. Which intersects $m\angle B$ at A.
6. ABC is a required Δ.
7. $\overleftrightarrow{RS}$, $\overleftrightarrow{UV}$ and $\overleftrightarrow{PQ}$ are the right bisectors of $\overline{AC}$, $\overline{AB}$ and $\overline{BC}$, respectively.
8. $\overleftrightarrow{PQ}$, $\overleftrightarrow{RS}$ and $\overleftrightarrow{UV}$ are concurrent at point O.

Q.9. Prove that any point on the right bisector of a line segment is equidistant from its end points. (8)

Ans

Given:

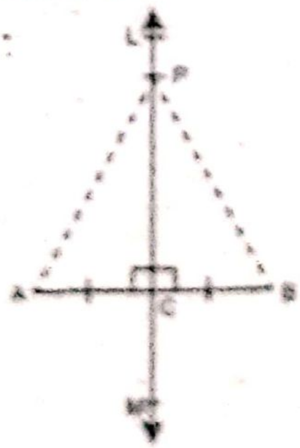
A line LM intersects the line segment AB at the point C such that $\overleftrightarrow{LM} \perp \overline{AB}$ and $\overline{AC} \cong \overline{BC}$. P is a point on $\overleftrightarrow{LM}$.

To Prove:

$$\overline{PA} \cong \overline{PB}$$

Construction:

Join P to the points A and B.



Proof:

Statements	Reasons
In $\Delta ACP \leftrightarrow \Delta BCP$	
$\overline{AC} \cong \overline{BC}$	given
$\angle ACP \cong \angle BCP$	given $\overline{PC} \perp \overline{AB}$, so that each $\angle$ at C = 90°
$\overline{PC} \cong \overline{PC}$	common
$\therefore$ $\Delta ACP \cong \Delta BCP$	S.A.S. postulate
Hence $\overline{PA} \cong \overline{PB}$	(corresponding sides of congruent triangles)

OR

Prove that any point on the bisector of an angle is equidistant from its arms.

Ans For Answer see Paper 2016 (Group-I) Q.9.