

Version No.			

ROLL NUMBER						

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

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2	2	2	2	2	2	2
3	3	3	3	3	3	3
4	4	4	4	4	4	4
5	5	5	5	5	5	5
6	6	6	6	6	6	6
7	7	7	7	7	7	7
8	8	8	8	8	8	8
9	9	9	9	9	9	9

Answer Sheet  
No. \_\_\_\_\_

Sign. of  
Candidate \_\_\_\_\_

Sign. of  
Invigilator \_\_\_\_\_

## MATHEMATICS SSC-I

(Science Group) (Curriculum 2006)

**SECTION – A (Marks 15)**

**Time allowed: 20 Minutes**

Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. **Do not use lead pencil.**

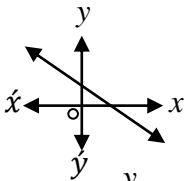
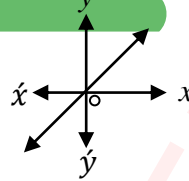
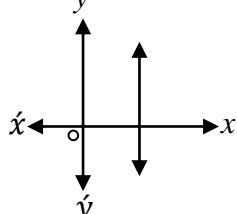
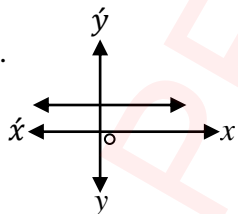
**Q.1 Fill the relevant bubble for each part. All parts carry one mark.**

- (1) Which one of the following represents an identity matrix?
- A.  $\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$   B.  $\begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix}$
- C.  $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$   D.  $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
- (2) Which one of the following options is the real part of  $5i(3 - 2i)$ ?
- A. -10  B. 10
- C. 15  D. -5
- (3) The scientific notation of 537.1 is:
- A.  $5.371 \times 10^2$   B.  $5.371 \times 10^3$
- C.  $5.371 \times 10^{-2}$   D.  $5.371 \times 10^{-3}$
- (4) Which one of the following is a polynomial?
- A.  $x^3 + 3x^2 - 5$   B.  $x^3 + 3x^{-2} - 5$
- C.  $x^{3/2} + 3x^2 - 5$   D.  $x^2 + 3x^{-1/2} - 5$
- (5) The expansion of  $(x - 1)^3$  is:
- A.  $x^3 + 3x^2 - 3x + 1$   B.  $x^3 - 3x^2 + 3x - 1$
- C.  $x^3 - 3x^2 - 3x + 1$   D.  $x^3 - 3x^2 - 3x - 1$
- (6) The multiplicative factors of  $(2x^2 - 18)$  are:
- A.  $2(x - 3)(x - 3)$   B.  $2(x - 3)(x + 3)$
- C.  $(\sqrt{2}x - 9)(\sqrt{2}x - 9)$   D.  $(\sqrt{2}x - 9)(\sqrt{2}x + 9)$

(7) Let  $a, b$  be real numbers, then  $a$  is greater than  $b$  if the difference  $a - b$  is positive and we denote this order relation by the inequality:

- A.  $a > b$   B.  $a < b$    
 C.  $b \geq a$   D.  $b \leq a$

(8) Which one of the following is a graph of  $y = mx$ ?

- A.   B.    
 C.   D. 

(9) The distance between the points  $A(5,3)$  and  $B(-5,7)$  is:

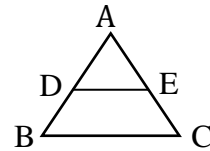
- A.  $10\sqrt{29}$   B.  $4\sqrt{29}$    
 C.  $8\sqrt{29}$   D.  $2\sqrt{29}$

(10) Which one of the following points lies on the line  $x - 2y + 1 = 0$ ?

- A.  $(0, -1)$   B.  $(-1, 0)$    
 C.  $(1, 0)$   D.  $(0, 1)$

(11) In a given figure, If  $D$  and  $E$  are the mid points of the sides and  $m\overline{DE} = 5\text{ cm}$  then  $m\overline{BC} = ?$

- A.  $5\text{ cm}$   B.  $10\text{ cm}$    
 C.  $15\text{ cm}$   D.  $2.5\text{ cm}$



(12) What is the value of  $|-a|$ , where  $a > 0$ ?

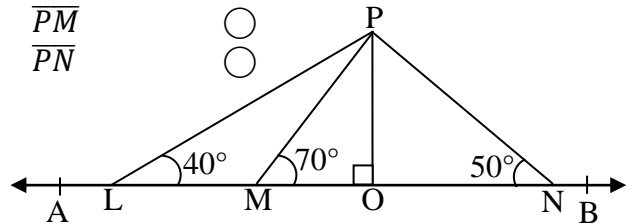
- A.  $-a$   B.  $+a$    
 C.  $-|a|$   D.  $\sqrt{a}$

(13) Which one of the following side measures represents a right angled triangle?

- A. 1, 2, 3  B. 2, 3, 5   
 C. 2, 4, 7  D. 3, 4, 5

(14) In the figure given below,  $P$  is any point and  $AB$  is a line. Which one of the following is the shortest distance between the point  $P$  and the line  $AB$ ?

- A.  $\overline{PO}$   B.  $\overline{PM}$    
 C.  $\overline{PL}$   D.  $\overline{PN}$



(15) If  $P, Q$  and  $R$  are the collinear points then, which one of the following options is correct?

- A.  $|\overline{PQ}| + |\overline{QR}| = |\overline{PR}|$   B.  $|\overline{PQ}|^2 + |\overline{QR}|^2 = |\overline{PR}|^2$    
 C.  $|\overline{PQ}|^2 + |\overline{QR}|^2 \neq |\overline{PR}|^2$   D.  $|\overline{PQ}| + |\overline{QR}| \neq |\overline{PR}|$

**Federal Board SSC-I Examination  
Mathematics Model Question Paper  
(Science Group) (Curriculum 2006)**

**Section A(Marks 15)**

Q1.

Part No.	1	2	3	4	5	6	7
Correct Option	D	B	A	A	B	B	A

8	9	10	11	12	13	14	15
B	D	B	B	B	D	A	A

**Section B(Marks 4x9=36)**

Q. 2 Attempt any nine parts from the following. All parts carry equal marks ((9\*4=36)

i. if  $A = \begin{bmatrix} 1 & 7 \\ 4 & 2 \\ 2 & 2 \end{bmatrix}$

- a. find  $|A|$
- b. is matrix A nonsingular?
- c. Find  $A^{-1}$  (multiplicative inverse)

Sol.

$$\begin{aligned}
 \text{a) } |A| &= \begin{vmatrix} 1 & 7 \\ 4 & 2 \\ 2 & 2 \end{vmatrix} \\
 &= \frac{1}{4} \times 2 - \frac{7}{2} \times 2 \\
 &= \frac{1}{2} - 7 \\
 &= \frac{1-14}{2} \\
 &= -\frac{13}{2}
 \end{aligned}$$

1 mark

b)  $|A| = \frac{13}{2} \neq 0$  so matrix A is nonsingular.

1 mark

c)  $A^{-1} = ?$

$$A^{-1} = \frac{1}{|A|} \text{Adj} [A] \text{ -----}$$

0.5 mark

$$\begin{aligned} \text{Adj} [A] &= \text{Adj} \begin{bmatrix} 1 & 7 \\ 4 & 2 \\ 2 & 2 \end{bmatrix} \\ &= \begin{bmatrix} 2 & -\frac{7}{2} \\ -2 & \frac{1}{4} \end{bmatrix} \end{aligned}$$

1 mark

put values in eq. i

$$\begin{aligned} A^{-1} &= \frac{1}{-\frac{13}{2}} \begin{bmatrix} 2 & -\frac{7}{2} \\ -2 & \frac{1}{4} \end{bmatrix} \\ &= -\frac{2}{13} \begin{bmatrix} 2 & -\frac{7}{2} \\ -2 & \frac{1}{4} \end{bmatrix} \end{aligned}$$

0.5 mark

$$\begin{aligned} &= \begin{bmatrix} -\frac{2}{13} \times 2 & -\frac{2}{13} \times -\frac{7}{2} \\ -\frac{2}{13} \times -2 & -\frac{2}{13} \times \frac{1}{4} \end{bmatrix} \\ &= \begin{bmatrix} -\frac{4}{13} & \frac{7}{13} \\ \frac{4}{13} & -\frac{1}{26} \end{bmatrix} \end{aligned}$$

1 mark

ii. Simplify using laws of exponents  $\frac{(x^{m+n})^2 \times (x^{n+p})^2 \times (x^{p+m})^2}{(x^{m+n+p})^3}$

Sol.

$$= \frac{(x)^{2(m+n)} \times (x)^{2(n+p)} \times (x)^{2(p+m)}}{x^{3(m+n+p)}} \quad \because (a^m)^n = a^{mn}$$

$$= \frac{(x)^{2m+2n} \times (x)^{2n+2p} \times (x)^{2p+2m}}{(x)^{3m+3n+3p}}$$

1 mark

$$= \frac{(x)^{2m+2n+2n+2p+2p+2m}}{(x)^{3m+3n+3p}}$$

$$= \frac{x^{4m+4n+4p}}{x^{3m+3n+3p}}$$

1 mark

$$= x^{4m+4n+4p} \times x^{-(3m+3n+3p)}$$

$$= x^{4m+4n+4p} \times x^{-3m-3n-3p}$$

1 mark

$$= x^{4m+4n+4p-3m-3n-3p} \quad \because a^m \times a^n = a^{m+n}$$

$$= x^{m+n+p}$$

1 mark

iii. Simplify  $\frac{2+6i}{3-i} - \frac{4-i}{3-i}$

Sol.

$$\frac{2+6i}{3-i} - \frac{4-i}{3-i}$$

$$= \frac{(2+6i)-(4-i)}{3-i}$$

taking lcm

$$= \frac{2+6i-4+i}{3-i}$$

$$= \frac{-2+7i}{3-i}$$

1 mark

$$= \frac{-2+7i}{3-i} \times \frac{3+i}{3+i}$$

by rationalizing

$$= \frac{-6-2i+21i+7(i^2)}{3^2-i^2}$$

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

$$= \frac{-6+19i+7(-1)}{9-(-1)}$$

$$\because i^2 = -1$$

1 mark

$$= \frac{-6+19i-7}{10}$$

$$= \frac{-13+19i}{10}$$

1 mark

$$= \frac{-13}{10} + \frac{19}{10}i \text{ where } a = \frac{-13}{10} \text{ and } b = \frac{19}{10}$$

1 mark

iv. If  $x = \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$  find

a)  $\frac{1}{x}$

b)  $x + \frac{1}{x}$

c)  $x^3 + \frac{1}{x^3}$

Sol.

$$x = \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}} \times \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}+\sqrt{3}}$$

rationalizing

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

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

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

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

$$x = \frac{5 + 3 + 2\sqrt{15}}{5 - 3}$$

$$x = \frac{8 + 2\sqrt{15}}{2}$$

$$x = \frac{2(4 + \sqrt{15})}{2}$$

$$x = 4 + \sqrt{15}$$

1 mark

$$\frac{1}{x} = \frac{1}{4 + \sqrt{15}}$$

$$= \frac{1}{4 + \sqrt{15}} \times \frac{4 - \sqrt{15}}{4 - \sqrt{15}}$$

$$\begin{aligned}
&= \frac{1}{4 + \sqrt{15}} \times \frac{4 - \sqrt{15}}{4 - \sqrt{15}} \\
&= \frac{4 - \sqrt{15}}{4^2 - \sqrt{15}^2} \\
&= \frac{4 - \sqrt{15}}{16 - 15} \\
&= \frac{4 - \sqrt{15}}{1} \\
&= 4 - \sqrt{15}
\end{aligned}$$

1 mark

$$\begin{aligned}
x + \frac{1}{x} &= (4 + \sqrt{15}) + (4 - \sqrt{15}) \\
&= 4 + \sqrt{15} + 4 - \sqrt{15} \\
&= 8
\end{aligned}$$

1 mark

$$\begin{aligned}
\left(x + \frac{1}{x}\right)^3 &= x^3 + \left(\frac{1}{x}\right)^3 + 3\left(x\right)\left(\frac{1}{x}\right)\left(x + \frac{1}{x}\right) \\
(8)^3 &= x^3 + \frac{1}{x^3} + 3(8) \\
512 &= x^3 + \frac{1}{x^3} + 24 \\
512 - 24 &= x^3 + \frac{1}{x^3} \\
x^3 + \frac{1}{x^3} &= 488
\end{aligned}$$

1 mark

v. Factorize  $(x+1)(x+3)(x+6)(x+8)-119$

Sol.

$$\begin{aligned}
&(x+1)(x+3)(x+6)(x+8)-119 \\
&=(x+1)(x+8)(x+3)(x+6)-119 && 0.5 \text{ mark} \\
&=(x^2+8x+x+8)(x^2+6x+3x+18)-119 \\
&=(x^2+9x+8)(x^2+9x+18)-119 && 0.5 \text{ mark} \\
\text{Let } x^2+9x &= y && 0.5 \text{ mark} \\
&=(y+8)(y+18)-119 \\
&=y^2+8y+18y+144-119 \\
&=y^2+26y+25 && 1 \text{ mark} \\
&=y^2+y+25y+25 \\
&=y(y+1)+25(y+1) \\
&=(y+1)(y+25) && 1 \text{ mark} \\
&=(x^2+9x+1)(x^2+9x+25) && 0.5 \text{ marks}
\end{aligned}$$

vi.  $f(x) = x^4 + 5x^3 - 8x^2 - 45x - 9$

- Find Remainder when  $f(x)$  is divided by  $(x-3)$
- Use factor theorem to show that  $(x+3)$  is a factor of  $f(x)$

Sol.

a)  $f(x) = x^4 + 5x^3 - 8x^2 - 45x - 9$

According to remainder theorem if a polynomial  $p(x)$  is divided by  $(x-a)$  then  $p(a)$  is called remainder. 1 mark

So put  $x=3$  in  $f(x)$

$$f(3) = 3^4 + 5(3^3) - 8(3^2) - 45(3) - 9$$

$$= 81 + 5(27) - 8(9) - 135 - 9$$

$$= 81 + 135 - 72 - 135 - 9$$

$$= 0$$

1 mark

Hence remainder is zero

a)  $f(x) = x^4 + 5x^3 - 8x^2 - 45x - 9$

According to Factor theorem if a polynomial  $p(x)$  is divided by  $(x-a)$  and  $p(a) = 0$  then  $(x-a)$  is called factor of

$p(x)$  1 mark

So put  $x=-3$  in  $f(x)$

$$f(-3) = (-3)^4 + 5(-3)^3 - 8(-3)^2 - 45(-3) - 9$$

$$= 81 + 5(-27) - 8(9) + 135 - 9$$

$$= 81 - 135 - 72 + 135 - 9$$

$$= 0$$

Since remainder is zero so  $(x+3)$  is factor of  $f(x)$

1 mark

vii. Find HCF of given polynomials by division method  $3x^3 + 5x^2 - 6x - 2$  ;  $3x^3 - 5x^2 + 6x - 4$

$$3x^3 - 5x^2 + 6x - 4 \overline{) 3x^3 + 5x^2 - 6x - 2}$$

$$\underline{- \quad + \quad - \quad +}$$

$$10x^2 - 12x + 2$$

$$2(5x^2 - 6x + 1)$$

$$5x^2 - 6x + 1$$

$\times 5$

$$15x^3 - 25x^2 + 30x - 20$$

$$15x^3 - 18x^2 + 3x$$

$$\underline{- \quad + \quad -}$$

$$-7x^2 + 27x - 20$$

$\times 5$

$$-35x^2 + 135x - 100$$

$$-35x^2 + 42x - 7$$

$$\underline{+ \quad - \quad +}$$

$$93x - 93$$

$$93(x-1)$$

$$x-1 \overline{) 5x^2 - 6x + 1}$$

$$5x^2 - 5x$$

$$\underline{- \quad +}$$

$$-x + 1$$

$$-x + 1$$

$$\underline{+ \quad -}$$

$$x$$

1 mark

1 mark

1 mark

HCF =  $x-1$  1 mark

viii. Find values of l and m for which the following expression become a perfect square

$$64x^4 + 153x^2 + 48x^3 + lx + m$$

Sol.

$$64x^4 + 48x^3 + 153x^2 + lx + m \quad \text{rearranging}$$

0.5 mark

$$8x^2 \overline{) \begin{array}{r} 8x^2 + 3x + 9 \\ 64x^4 + 48x^3 + 153x^2 + lx + m \\ \underline{64x^4} \end{array}}$$

$$\begin{array}{r} \underline{\phantom{16x^2 + 3x}} \\ 16x^2 + 3x \quad | \quad 48x^3 + 153x^2 + lx + m \\ \underline{48x^3 + 9x^2} \end{array}$$

0.5 mark

$$\begin{array}{r} \underline{\phantom{16x^2 + 6x + 9}} \\ 16x^2 + 6x + 9 \quad | \quad 144x^2 + lx + m \\ \underline{144x^2 + 54x + 81} \end{array}$$

0.5 mark

$$\underline{\phantom{lx - 54x + m - 81}} \\ lx - 54x + m - 81$$

1 mark

The given expression will be perfect square if remainder is zero

0.5 mark

$$lx - 54x + m - 81 = 0$$

$$(l-54)x + (m-81) = 0$$

$$l-54=0 \quad \text{and} \quad m-81=0$$

1 mark

ix. Prove that, any point on right bisector of a line segment is equidistant from its end points.

**Given**

A line  $\overleftrightarrow{LM}$  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.

1 mark

**Proof**

**Statements**

In  $\triangle ACP \leftrightarrow \triangle BCP$

$$\overline{AC} \cong \overline{BC}$$

$$\angle ACP \cong \angle BCP$$

$$\overline{PC} \cong \overline{PC}$$

$$\triangle ACP \cong \triangle BCP$$

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

**Reasons**

given

given  $\overleftrightarrow{LM} \perp \overline{AB}$  so that each  $\angle$  at C =  $90^\circ$

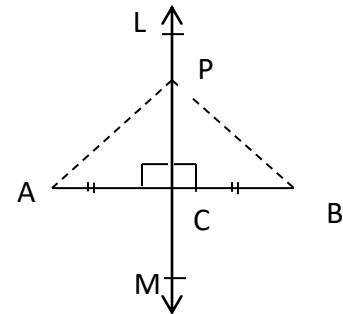
Common

S.A.S. postulate

corresponding sides of congruent triangles

1 mark

2 mark



x. Solve for  $x \frac{3|x-5|}{2} - 8 = 12 - |x-5|$

Sol.

$$\frac{3|x-5|}{2} + |x-5| = 12 + 8$$

$$|x-5| \left( \frac{3}{2} + 1 \right) = 20$$

$$|x-5| \left( \frac{3+2}{2} \right) = 20$$

1 mark



$$|x - 5| \left(\frac{5}{2}\right) = 20$$

$$|x - 5| = 20 \left(\frac{2}{5}\right)$$

$$|x - 5| = 8$$

$$\pm(x - 5) = 8$$

$$(x - 5) = 8 \quad \text{or} \quad -(x - 5) = 8$$

$$x = 8 + 5 \quad \text{or} \quad -x + 5 = 8$$

$$x = 13 \quad \text{or} \quad -x = 8 - 5 = 3 \Rightarrow x = -3$$

$$\text{Sol. Set} = \{13, -3\}$$

1 mark

1 mark

1 mark

xi. Simplify  $\frac{a+b}{a^2+b^2} \cdot \frac{a}{a-b} \div \frac{(a+b)^2}{a^4-b^4}$

Sol.

$$= \frac{a+b}{a^2+b^2} \cdot \frac{a}{a-b} \times \frac{a^4-b^4}{(a+b)^2}$$

$$= \frac{a+b}{a^2+b^2} \cdot \frac{a}{a-b} \times \frac{(a^2-b^2)(a^2+b^2)}{(a+b)(a+b)}$$

$$= \frac{a}{a-b} \times \frac{(a+b)(a-b)}{(a+b)}$$

$$= a$$

1 mark

1 mark

1 mark

1 mark

xii. Evaluate  $\log_{\sqrt[3]{3}} 81$  to the base  $\sqrt[3]{3}$

Sol.

$$\text{Let } \log_{\sqrt[3]{3}} 81 = x$$

$$\therefore \log_a y = x \Rightarrow a^x = y$$

1 mark

$$\text{So } \log_{\sqrt[3]{3}} 81 = x$$

$$\Rightarrow (\sqrt[3]{3})^x = 81$$

1 mark

$$\Rightarrow ((3)^{\frac{1}{3}})^x = (3)^4$$

$$\Rightarrow (3)^{\frac{x}{3}} = (3)^4$$

1 mark

Bases are same exponents can be equated

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

$$\Rightarrow x = 3 \times 4$$

$$\Rightarrow x = 12$$

$$\text{Hence } \log_{\sqrt[3]{3}} 81 = 12$$

1 mark

xiii. Find the values of x and y for the given congruent triangles

Sol.

$$\Delta RSU \cong \Delta RUT \quad \text{Given}$$

$$m \angle T = m \angle S$$

$$(5x + 5)^\circ = 50^\circ$$

1 mark

$$5x = 50 - 5$$

$$5x = 45$$

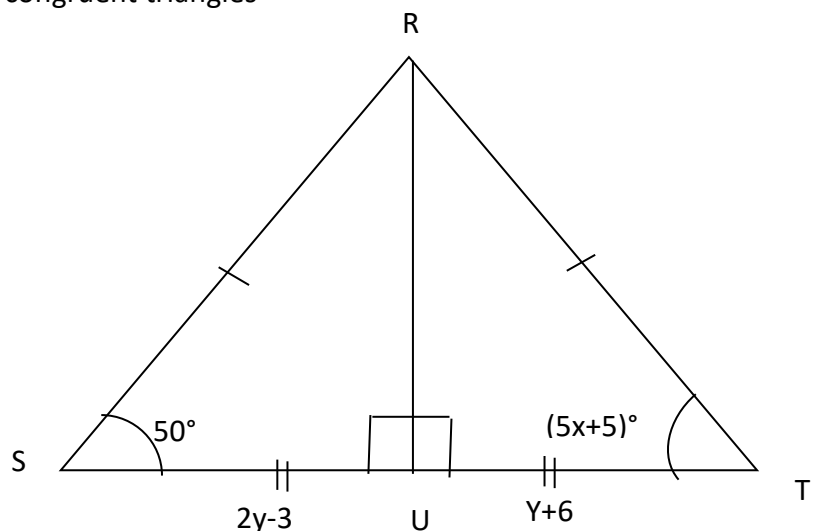
$$x = 45/5$$

$$x = 9^\circ$$

1 mark

also

$$SU = UT$$



$$2y-3 = y + 6 \quad 1 \text{ mark}$$

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

$$y = 9 \quad 1 \text{ mark}$$

Xiv. Given

$$m\overline{AB} = 5 \text{ cm,}$$

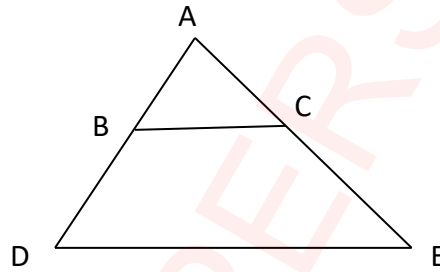
$$m\overline{BD} = 10 \text{ cm}$$

$$m\overline{AE} = 18 \text{ cm,}$$

$$\overline{BC} \parallel \overline{DE}$$

To find

$$m\overline{AC} = ?$$



Sol.

$$\overline{BC} \parallel \overline{DE}$$

$$\frac{m\overline{AB}}{m\overline{AD}} = \frac{m\overline{AC}}{m\overline{AE}} \quad \text{-----i)}$$

1 mark

$$m\overline{AD} = m\overline{AB} + m\overline{DB}$$

$$m\overline{AD} = 5 + 10$$

$$m\overline{AD} = 15$$

1 mark

Put values in eq. i)

$$\frac{5}{15} = \frac{m\overline{AC}}{18}$$

1 mark

$$15 m\overline{AC} = 5 \times 18$$

$$m\overline{AC} = \frac{90}{15}$$

$$m\overline{AC} = 6 \text{ cm}$$

1 mark

### Section C (8x3=24)

Q no 3:

Part a) L.H.S =  $(AB)^t$

$$AB = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} 5 & 7 \\ 6 & 8 \end{bmatrix}$$

$$= \begin{bmatrix} (1)(5) + (3)(6) & (1)(7) + (3)(8) \\ (2)(5) + (4)(6) & (2)(7) + (4)(8) \end{bmatrix}$$

$$= \begin{bmatrix} 23 & 31 \\ 34 & 46 \end{bmatrix}$$

L.H.S =  $(AB)^t$

$$= \begin{bmatrix} 23 & 31 \\ 34 & 46 \end{bmatrix}^t$$

$$= \begin{bmatrix} 23 & 34 \\ 31 & 46 \end{bmatrix} \text{-----eq(1)}$$

Now R.H.S=  $B^t A^t$

$$B^t = \begin{bmatrix} 5 & 7 \\ 6 & 8 \end{bmatrix}^t$$

$$= \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$$

$$A^t = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}^t$$

$$= \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

R.H.S=  $B^t A^t$

$$= \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix} \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} (5)(1) + (6)(3) & (5)(2) + (6)(4) \\ (7)(1) + (8)(3) & (7)(2) + (8)(4) \end{bmatrix}$$

$$= \begin{bmatrix} 23 & 34 \\ 31 & 46 \end{bmatrix} \text{-----eq(2)}$$

From eq(1) and eq(2) L.H.S=R.H.S

Q No 3:

Part b:

$$A^{-1} = \frac{adj A}{|A|}$$

$$|A| = \begin{vmatrix} 1 & 3 \\ 2 & 4 \end{vmatrix}$$

$$= (1)(4) - (3)(2)$$

$$= -2$$

$$adj A = \begin{bmatrix} 4 & -3 \\ -2 & 1 \end{bmatrix}$$

$$A^{-1} = \frac{\begin{bmatrix} 4 & -3 \\ -2 & 1 \end{bmatrix}}{-2}$$

$$= \begin{bmatrix} \frac{4}{-2} & \frac{-3}{-2} \\ \frac{-2}{-2} & \frac{1}{-2} \end{bmatrix}$$

$$= \begin{bmatrix} -2 & \frac{3}{2} \\ 1 & \frac{-1}{2} \end{bmatrix}$$

$$L.H.S = A.A^{-1}$$

$$= \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} -2 & \frac{3}{2} \\ 1 & \frac{-1}{2} \end{bmatrix}$$

$$= \begin{bmatrix} -2 + 3 & \frac{3}{2} - \frac{3}{2} \\ -4 + 4 & 3 - 2 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \text{-----eq(3)}$$

$$R.H.S = A^{-1}.A$$

$$= \begin{bmatrix} -2 & \frac{3}{2} \\ 1 & \frac{-1}{2} \end{bmatrix} \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$$

$$= \begin{bmatrix} -2 + 3 & -6 + 6 \\ 1 - 1 & 3 - 2 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \text{-----eq(4)}$$

From eq(3) and eq(4)

$$L.H.S = R.H.S$$

Q No 4:

**Given:**  $\Delta ABC$  is a right angled triangle in which  $m \angle C = 90^\circ$  and  $\overline{BC} = a$ ,

$m\overline{AC} = b$  and  $m\overline{AB} = c$ .

**To Prove:**

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

**Construction:**

Draw  $\overline{CD}$  perpendicular from  $C$  on  $\overline{AB}$ .

;

Let  $m\overline{CD} = h$ ,  $m\overline{AD} = x$  and  $m\overline{BD} = y$ . Line segment  $CD$  splits  $\Delta ABC$  into two

$\Delta s$   $ADC$  and  $BDC$  which are separately shown in the figures (ii)-a and (ii)-b

Respectively.

**Proof (Using similar  $\Delta s$ )**

	Statements	Reasons
In	$\Delta ADC \leftrightarrow \Delta ACB$ $\angle A \cong \angle A$ $\angle ADC \cong \angle ACB$ $\angle C \cong \angle B$ $\therefore \Delta ADC \sim \Delta ACB$ $\therefore \frac{x}{b} = \frac{b}{c}$	Refer to figures (ii)-a and (i) Common-self congruent Construction – given, each angle = $90^\circ$ $\angle C$ and $\angle B$ , complements of $\angle A$ Congruency of three angles Measures of corresponding sides of similar triangles are proportional
Or	$x = \frac{b^2}{c}$ .....(I)	
Again in	$\Delta BDC \leftrightarrow \Delta BCA$ $\angle B \cong \angle B$ $\angle BDC \cong \angle BCA$ $\angle C \cong \angle A$ $\therefore \Delta BDC \sim \Delta BCA$ $\therefore \frac{y}{a} = \frac{a}{c}$	Refer to fig(ii)-b and (i) Common-self congruent Construction-given, each angle = $90^\circ$ $\angle C$ and $\angle A$ , complements of $\angle B$ Congruency of three angles
Or	$y = \frac{a^2}{c}$ .....(II)	Supposition
But	$y + x = c$	By (I) and (II)
Or	$\therefore \frac{a^2}{c} + \frac{b^2}{c} = c$	
Or	$a^2 + b^2 = c^2$	

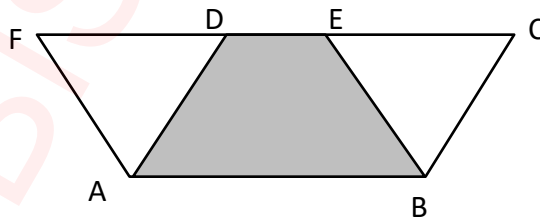
Q 6.  
 Prove that parallelograms on the same base between the same parallel lines (or of same altitude) are equal in area.

Given:

Two parallelograms  $ABCD$  and  $ABEF$  having the same base  $\overline{AB}$  and between the same parallel lines  $\overline{AB}$  and  $\overline{DE}$ .

To prove:

Area of parallelogram  $ABCD$  = Area of parallelogram  $ABEF$



Proof:

Statements	Reasons
Area of parallelogram ABCD= area of quad ABED + area of $\triangle CBE$ -----i	Area addition axiom
Area of parallelogram ABEF= area of quad ABED + area of $\triangle DAF$ -----ii	Area addition axiom
In $\triangle CBE \leftrightarrow \triangle DAF$	
$m\overline{CB} = m\overline{DA}$	Opposite sides of parallelogram
$m\overline{BE} = m\overline{AF}$	Opposite sides of parallelogram
$m\angle CBE = m\angle DAF$	$\overline{BC} \parallel \overline{AD}$ and $\overline{BE} \parallel \overline{AF}$
$\triangle CBE \cong \triangle DAF$	S.A.S congruent axiom
area of $\triangle CBE =$ area of $\triangle DAF$ .....iii	Congruent area axiom
Hence Area of parallelogram ABCD =Area of parallelogram ABEF	From eq. I, eq. ii and eq. iii

Q.7.  
Find b such that the points A(2, b) , B(5, 5) and C(-6, 0) are the vertices of right angle triangle ABC with  $m\angle BAC = 90^\circ$

Sol.  
Given  
A(2, b) , B(5, 5) and C(-6, 0)  
 $\triangle ABC$  is right angle triangle  
 $m\angle BAC = 90^\circ$

To find  
B=?

Distance Formula:

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

$$d^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$$

$$|AB|^2 = (5-2)^2 + (5-b)^2$$

$$= (3)^2 + (5-b)^2$$

$$|AB|^2 = 9 + (5-b)^2 \text{-----1}$$

$$|BC|^2 = (-6-5)^2 + (5-0)^2$$

$$= (-11)^2 + (5)^2$$

$$= 121 + 25$$

$$|BC|^2 = 146 \text{-----2}$$

$$|AC|^2 = (-6-2)^2 + (b-0)^2$$

$$= (-8)^2 + (b)^2$$

$$|AC|^2 = 64 + b^2 \text{-----3}$$

According to Pythagoras Theorem

$$|BC|^2 = |AB|^2 + |AC|^2$$

$$146 = (3)^2 + (5-b)^2 + 64 + b^2$$

$$146 = 9 + 5^2 + b^2 - 10b + 64 + b^2$$

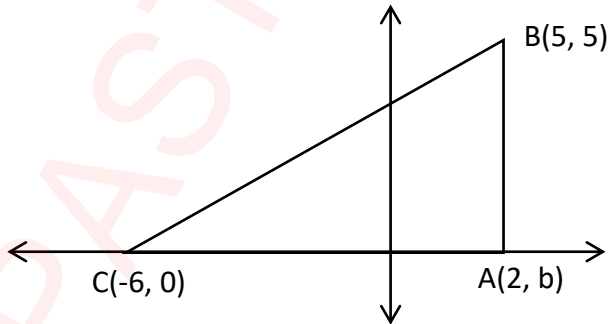
$$146 = 9 + 25 + 64 + b^2 + b^2 - 10b$$

$$146 = 98 + 2b^2 - 10b$$

$$2b^2 - 10b + 98 - 146 = 0$$

$$2b^2 - 10b - 48 = 0$$

$$2(b^2 - 5b - 24) = 0$$



2 marks

1 mark

1 mark

1 mark

from eq. 1, eq. 2 and eq. 3

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

1 mark

$$b^2 - 5b - 24 = 0$$

1 mark

$$b^2 - 5b - 24 = 0$$

$$b^2 - 8b + 3b - 24 = 0$$

$$b(b-8) + 3(b-8) = 0$$

$$(b-8)(b+3) = 0$$

$$b-8=0 \text{ or } b+3=0$$

$$b=8 \text{ or } b=-3$$

1 mark

Q. 7

If  $\overline{mZX} = 5 \text{ cm}$ ,  $m\angle X = 75^\circ$  and  $m\angle Y = 45^\circ$

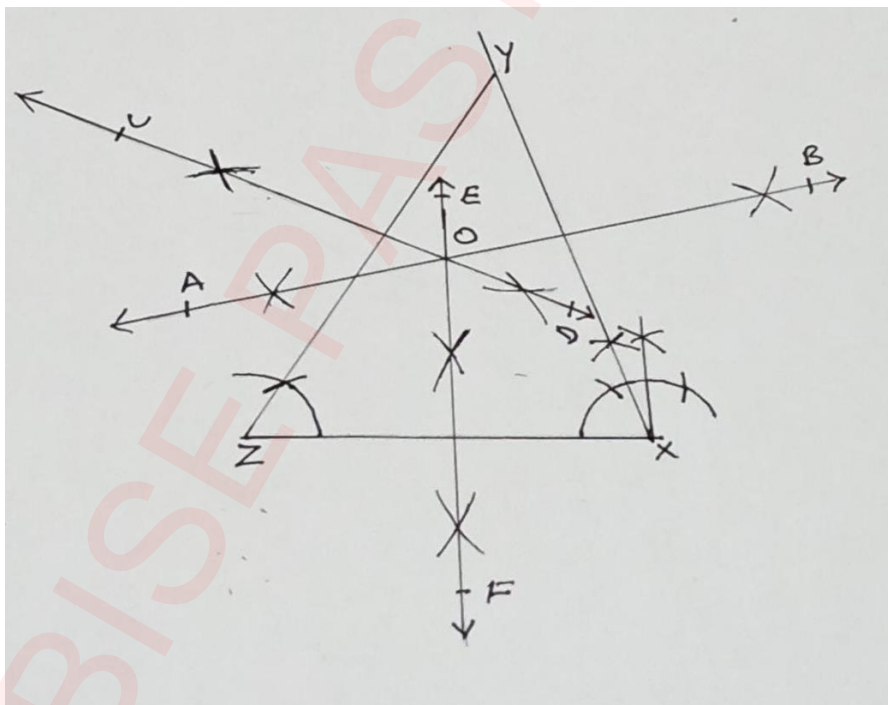
- Construct triangle XYZ
- Draw perpendicular bisectors of the three sides of  $\Delta XYZ$
- Are the perpendicular bisectors concurrent.

Given

$\overline{mZX} = 5 \text{ cm}$ ,  $m\angle X = 75^\circ$  and  $m\angle Y = 45^\circ$

Required:

- Construct triangle XYZ
- Draw perpendicular bisectors of the three sides of  $\Delta XYZ$
- Are the perpendicular bisectors concurrent.



3 marks

Steps of construction:

Part a.

- Draw the line segment  $\overline{mZX} = 5 \text{ cm}$
- At the end point X of ZX make  $m\angle X = 75^\circ$
- $m\angle X + m\angle Y + m\angle Z = 180^\circ$

$$75^\circ + 45^\circ + m \angle Z = 180^\circ$$

$$m \angle Z = 180^\circ - 75^\circ - 45^\circ$$

$$m \angle Z = 60^\circ$$

$$\text{At } Z \text{ make } m \angle Z = 60^\circ$$

4. Arms of  $\angle X$  and  $\angle Z$  intersect at point Y.  $\triangle XYZ$  is required triangle. 3 marks

Part b.

Draw perpendicular bisectors  $\overleftrightarrow{AB}$ ,  $\overleftrightarrow{CD}$ ,  $\overleftrightarrow{EF}$ , of the sides  $\overline{XY}$ ,  $\overline{YZ}$  and  $\overline{ZX}$  respectively. 1 mark

Part c.

Yes the perpendicular bisectors are concurrent at O. 1 mark

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