Version No.			

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⑤	⑤	⑤	⑤
⑥	⑥	⑥	⑥
⑦	⑦	⑦	⑦
⑧	⑧	⑧	⑧
⑨	⑨	⑨	⑨

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⑥	⑥	⑥	⑥	⑥	⑥	⑥
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Answer Sheet No.____________

Sign. of Candidate___________

Sign. of Invigilator___________

MATHEMATICS SSC–I (2nd Set)

(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) What is resultant matrix when $\begin{bmatrix} 1 & -2 & 4 \\ 3 & 1 & 6 \\ 2 & 3 & 1 \end{bmatrix}$ is multiplied by 2?

A. $\begin{bmatrix} 2 & -2 & 4 \\ 6 & 1 & 6 \\ 4 & 3 & 1 \end{bmatrix}$ ◯ B. $\begin{bmatrix} 2 & -4 & 8 \\ 3 & 1 & 6 \\ 2 & 3 & 1 \end{bmatrix}$ ◯

C. $\begin{bmatrix} 2 & -2 & 4 \\ 3 & 2 & 6 \\ 2 & 3 & 2 \end{bmatrix}$ ◯ D. $\begin{bmatrix} 2 & -4 & 8 \\ 6 & 2 & 12 \\ 4 & 6 & 2 \end{bmatrix}$ ◯

(2) The values of a and b in $\frac{2-3i}{i} = a - bi$.

A. a = –3, b = –2 ◯ B. a = 3, b = 2 ◯

C. a = 3, b = 2 ◯ D. a = 3, b = -2 ◯

(3) Which one of the following represents the identity $x^3 - y^3$?

A. $(x-y)(x^2+xy-y^2)$ ◯

B. $(x-y)(x^2-xy-y^2)$ ◯

C. $(x-y)(x^2-xy+y^2)$ ◯

D. $(x-y)(x^2+xy+y^2)$ ◯

(4) The factorized form of $12x^2 - 4x - 1$?

A. $(2x-1)(6x+1)$ ◯ B. $(2x+1)(6x-1)$ ◯

C. $(4x-1)(3x-1)$ ◯ D. $(4x-1)(3x+1)$ ◯

(5) The solution of $\frac{x-5}{-7} < 3$ is :

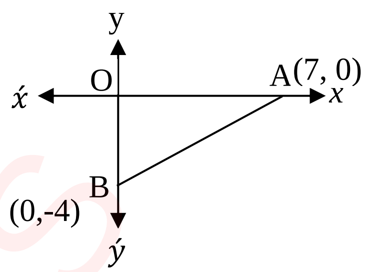
A. $x > -16$ and $x = -16$ ◯

B. $x < -16$ or $x = -16$ ◯

C. $x > -16$ or $x = -16$ ◯

D. $x < -16$ or $x = -16$ ◯

(6) In the figure what is the mid point of $\overline{AB}$?



A.	$(\frac{7}{2}, -2)$	◯	
B.	$(-2, \frac{7}{2})$	◯	
C.	$(7, -4)$	◯	
D.	$(-4, 7)$	◯	

(7) The simplest form of $1 - \frac{2x-1}{x-3}$ is :

A.	$\frac{-x-2}{x-3}$	◯	B.	$\frac{x-2}{x-3}$	◯
C.	$\frac{-x-4}{x-3}$	◯	D.	$\frac{x-4}{x-3}$	◯

(8) The logarithmic form of $2^x = 32$ is:

A.	$\log_2 32 = x$	◯	B.	$\log_2 x = 32$	◯
C.	$\log_{32} 2 = x$	◯	D.	$\log_x 32 = 2$	◯

(9) What is remainder when $x^3 - 3x^2 + x - 1$ is divided by $2x + 1$?

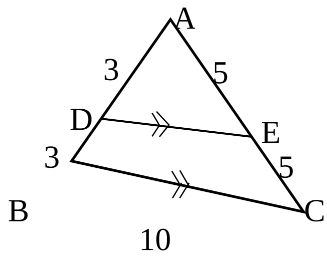
A.	$\frac{-19}{8}$	◯	B.	0	◯
C.	$\frac{3}{8}$	◯	D.	$\frac{-7}{8}$	◯

(10) Which one of the following identifies right triangle BAC with a > b and a > c?

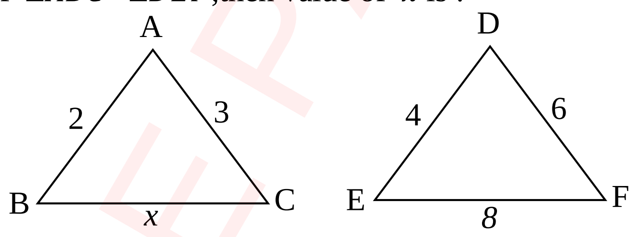
A.	$c^2 = a^2 + b^2$	◯	B.	$a^2 = b^2 + c^2$	◯
C.	$b^2 = a^2 + c^2$	◯	D.	$a^2 = b^2 - c^2$	◯

(11) What is the value of $m\overline{DE}$?

A.	5	◯
B.	5.5	◯
C.	6	◯
D.	6.5	◯



(12) If $\Delta ABC \sim \Delta DEF$,then value of x is :



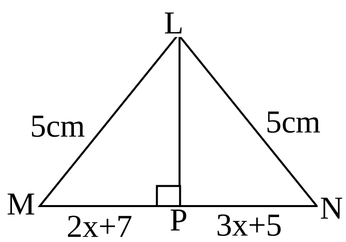
A.	4	◯	B.	8	◯
C.	5	◯	D.	1	◯

(13) Which one of the following options is the solution of $|2x + 3| = -5$?

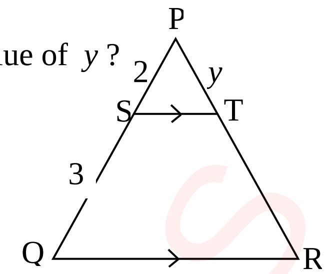
A.	{4}	◯	B.	{−4,1}	◯
C.	{4, 1}	◯	D.	{ }	◯

(14) What is the length of $\overline{MN}$?

A.	2	◯
B.	4	◯
C.	−2	◯
D.	12	◯



(15) In the figure $\overline{ST} \parallel \overline{QR}$ and $m\overline{PR} = 10$. What is value of y ?



A. 15

B. 5

C. $\frac{20}{3}$

D. 4

Model Question Paper SSC-I

Mathematics(Science Group)

(2^{nd} Set)SOLUTION

SECTION-A

1	D	2	A	3	D	4	A	5	D	6	A	7	A	8	A
9	A	10	B	11	A	12	A	13	D	14	B	15	D		

SECTION-B

Question-2(i)

BC= $\begin{bmatrix} -5 & -3 \\ 2 & 1 \end{bmatrix}\begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} -18 & -11 \\ 7 & 4 \end{bmatrix}$

A (BC)= $\begin{bmatrix} 0 & 2 \\ 3 & -1 \end{bmatrix}\begin{bmatrix} -18 & -11 \\ 7 & 4 \end{bmatrix} = \begin{bmatrix} 14 & 8 \\ -61 & -37 \end{bmatrix}$

AB= $\begin{bmatrix} 0 & 2 \\ 3 & -1 \end{bmatrix}\begin{bmatrix} -5 & -3 \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} 4 & 2 \\ -17 & -10 \end{bmatrix}$

(AB) C= $\begin{bmatrix} 4 & 2 \\ -17 & -10 \end{bmatrix}\begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 14 & 8 \\ -61 & -37 \end{bmatrix}$

From above A (BC) = (AB) C

Question-2(ii)

Let $x = \frac{\sqrt[3]{46.3}(0.05)^2}{\sqrt{8.54}}$

Taking log of both sides

$logx = log\sqrt[3]{46.3} + log(0.05)^2 - log\sqrt{8.54}$

$logx = log(46.3)^{1/3} + log(0.05)^2 - log(8.54)^{1/2}$

$logx = \frac{1}{3}log46.3 + 2log0.05 - \frac{1}{2}log8.54$

$logx = \frac{1}{3}(1.6660) + 2(\bar{2}.6990) - \frac{1}{2}(0.9315)$

$logx = 0.5553 + 2(-2 + 0.6990) - 0.4658$

$logx = 0.5553 - 4 + 1.3980 - 0.4658$

$logx = -2.5125 = \bar{2}.5125$

$x = antilog\bar{2}.5125$

$x = 0.03256$

Question-2(iii)

$$\left(\frac{15m^3n^{-2}p^{-1}}{25m^{-2}n^{-9}}\right)^{-3}$$

$$= \left(\frac{3m^{3+2}n^{-2+9}p^{-1}}{5}\right)^{-3}$$

$$= \left(\frac{3m^5n^7}{5p}\right)^{-3} = \left(\frac{5p}{3m^5n^7}\right)^3$$

$$= \left(\frac{5^3p^3}{3^3m^{5\times3}n^{7\times3}}\right)$$

$$= \left(\frac{125p^3}{27m^{15}n^{21}}\right)$$

Question-2(iv)

$(1 + i)^3(x + yi) = (4 + 5i)$

$(1 + 3i + 3i^2 + i^3)(x + yi) = 4 + 5i$

$(1 + 3i - 3 - i)(x + yi) = 4 + 5i$

$(2i - 2)(x + yi) = 4 + 5i$

$2xi + 2yi^2 - 2x - 2yi = 4 + 5i$

$2xi - 2y - 2x - 2yi = 4 + 5i$

$(-2x - 2y) + (2x - 2y)i = 4 + 5i$

Equating the real and imaginary parts

$-2x - 2y = 4 \longrightarrow eqn - I$ $\qquad$ $2x - 2y = 5 \longrightarrow eqn - II$

Adding equations I and II

$-2x - 2y + 2x - 2y = 4 + 5$

$-4y = 9 \qquad \Longrightarrow y = -\frac{9}{4}$

Subtracting equations II from I

$-2x - 2y - 2x + 2y = 4 - 5$

$-4x = -1 \qquad \Longrightarrow x = \frac{1}{4}$

Question-2(v)

$$x - \frac{1}{x} = 7$$

$$\left(x - \frac{1}{x}\right)^3 = 7^3$$

$$x^3+\frac{1}{x^3}-3\left(x-\frac{1}{x}\right)=343$$

$$x^3+\frac{1}{x^3}-3(7)=343 \qquad \because x-\frac{1}{x}=7$$

$$x^3+\frac{1}{x^3}=343+21$$

$$x^3+\frac{1}{x^3}=364$$

Question-2(vi)

(a) $x=-3+\sqrt{2}$

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

$$\frac{1}{x}=\frac{1}{-3+\sqrt{2}}\times\frac{-3-\sqrt{2}}{-3-\sqrt{2}}$$

$$\frac{1}{x}=\frac{-3-\sqrt{2}}{(-3)^2-\left(\sqrt{2}\right)^2}=\frac{-3-\sqrt{2}}{7}=-\frac{3+\sqrt{2}}{7}$$

(b) $x+\frac{1}{x}=-3+\sqrt{2}-\frac{3+\sqrt{2}}{7}$

$$x+\frac{1}{x}=\frac{-21+7\sqrt{2}-3-\sqrt{2}}{7}=\frac{-24+6\sqrt{2}}{7}$$

(c) $x-\frac{1}{x}=-3+\sqrt{2}+\frac{3+\sqrt{2}}{7}$

$$x-\frac{1}{x}=\frac{-21+7\sqrt{2}+3+\sqrt{2}}{7}=\frac{-18+8\sqrt{2}}{7}$$

(d) $x^2+\frac{1}{x^2}=\left(-3+\sqrt{2}\right)^2+\left(-\frac{3+\sqrt{2}}{7}\right)^2$

$$x^2+\frac{1}{x^2}=9+2-6\sqrt{2}+\frac{9+2+6\sqrt{2}}{49}$$

$$x^2+\frac{1}{x^2}=11-6\sqrt{2}+\frac{11+6\sqrt{2}}{49}$$

$$x^2+\frac{1}{x^2}=\frac{550-288\sqrt{2}}{49}$$

Question-2(vii) $2x^2+7x+\frac{6}{x}$

$2x^2$	$4x^4+28x^3+49x^2+24x+84+\frac{36}{x^2}$ $\pm 4x^4$
$4x^2+7x$	$28x^3+49x^2+24x+84+\frac{36}{x^2}$ $\pm 28x^3 \pm 49x^2$

$4x^2 + 14x + \frac{6}{x}$ $\quad$ $24x + 84 + \frac{36}{x^2}$

$\pm 24x \pm 84 \pm \frac{36}{x^2}$

0

$$\sqrt{4x^4 + 28x^3 + 49x^2 + 24x + 84 + \frac{36}{x^2}} = \pm\left(2x^2 + 7x + \frac{6}{x}\right)$$

Question-2(viii)

$x^2 + 4x - 12 = x^2 + 6x - 2x - 12 = x(x+6) - 2(x+6) = (x+6)(x-2)$

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

$x^3 - 2^3 = (x-2)(x^2 + 2x + 4)$

H.C.F= $(x-2)$

Question-2(ix)

$P(x) = x^3 - 2x^2 - 5x + 6$

At $x = 1$

$P(1) = 1 - 2 - 5 + 6 = 0$

$x - 1$ is a factor of $P(x)$

$x - 1$) $x^3 - 2x^2 - 5x + 6$ ($x^2 - x - 6$

$\pm x^3 \mp x^2$

$-x^2 - 5x + 6$

$\mp x^2 \pm x$

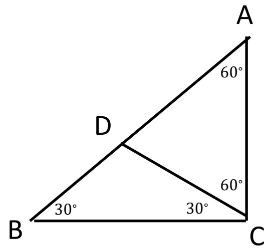
$-6x + 6$

$\mp 6x \pm 6$

$P(x) = (x-1)(x^2 - x - 6)$

$P(x) = (x-1)(x-3)(x+2)$

Question-2(x)



Given: In $\triangle ABC$, $\angle C = 90°$, $\angle A = 60°$

To Prove: $\overline{BC} = \frac{1}{2}\overline{AB}$

Construction: At C construct $\angle BCD = 30°$. Let $\overline{CD}$ cuts $\overline{AB}$ at D.

Proof:

Statements $\quad$ Reasons

In $\triangle$ADC, $\angle A = 60°$ — Given

$\angle CDA = 60°$ — $m\angle BCD + m\angle CDA = 90°$

$\therefore \triangle$ADC is equilateral

$\overline{AC} = \overline{CD} = \overline{AD}$

$\overline{AB} = \overline{BD} + \overline{AD}$ — $\triangle BDC$ is isosceles

$\overline{AB} = \overline{DC} + \overline{AC}$ — $\overline{BD} = \overline{DC}$ & $\overline{AD} = \overline{AC}$

$\overline{AB} = \overline{AC} + \overline{AC}$

$\overline{AB} = 2\overline{AC}$

$\overline{AC} = \frac{1}{2}\overline{AB}$

Question-2(xi)

A(1, 1), B(3, 1), C(4, 3)

$|\overline{AB}|^2 = (3-1)^2 + (1-1)^2 = 2$

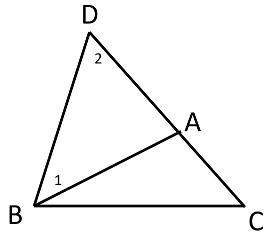
$|\overline{BC}|^2 = (4-3)^2 + (3-1)^2 = 5$

$|\overline{AC}|^2 = (4-1)^2 + (3-1)^2 = 13$

Since $|\overline{AB}|^2 + |\overline{BC}|^2 = 2 + 5 = 7 \neq |\overline{AC}|^2$

Hence ABC is not a right angled triangle.

Question-2(xii)



Given: In $\triangle$ABC

To Prove: (i) $m\overline{AB} + m\overline{AC} > m\overline{BC}$

(ii) $m\overline{AB} + m\overline{BC} > m\overline{AC}$

(iii) $m\overline{BC} + m\overline{AC} > m\overline{AB}$

Construction: Take a point D on $\overline{CA}$ such that $\overline{AD} = \overline{AB}$. Join B to D.

Proof:

Statements		Reasons
In $\triangle$ABD		Given
$\angle 1 \cong \angle 2$		Construction
$m\angle DBC > m\angle 1$	eqn(i)	$m\angle DBC + m\angle 1 + m\angle ABC$
$m\angle DBC > m\angle 2$	eqn(ii)	from (i) and (ii)
In $\triangle DBC$	eqn(iii)	

$m\overline{DC} > m\overline{BC}$ from (iii)

$m\overline{AD} + m\overline{AC} > m\overline{BC}$ $m\overline{CD} = m\overline{AD} + m\overline{AC}$

Hence $m\overline{AB} + m\overline{AC} > m\overline{BC}$ $m\overline{AD} = m\overline{AB}$

Similarly

$m\overline{AB} + m\overline{BC} > m\overline{AC}$

$m\overline{BC} + m\overline{AC} > m\overline{AB}$

Question-2(xiii)

A$(2,4)$, B$(4,4)$, C$(-1,3)$, D$(-3,3)$

$|\overline{AB}| = \sqrt{(4-2)^2 + (4-4)^2} = 2$

$|\overline{DC}| = \sqrt{(-1+3)^2 + (3-3)^2} = 2$

$|\overline{AD}| = \sqrt{(-3-2)^2 + (3-4)^2} = \sqrt{26}$

$|\overline{BC}| = \sqrt{(-1-4)^2 + (3-4)^2} = \sqrt{26}$

Since $|\overline{AB}| = |\overline{DC}|$ and $|\overline{AD}| = |BC|$

i.e. opposite sides of the quadrilateral ABCD are equal.

Hence ABCD is a parallelogram.

Question-2(xiv)

$2y - x - 3 = 0$

x	-1	1	3	5
y	1	2	3	4

SECTION-C

Q3. (a) $\left|\frac{x+8}{12}\right| = \frac{x-1}{5}$

$\frac{x+8}{12} = +\left(\frac{x-1}{5}\right)$

$12(x-1) = 5(x+8)$

$12x - 12 = 5x + 40$

$12x - 5x = 40 + 12$

$7x = 52$

$x = \frac{52}{7}$

$\frac{x+8}{12} = -\left(\frac{x-1}{5}\right)$

$12(x-1) = -5(x+8)$

$12x - 12 = -5x - 40$

$12x + 5x = 12 - 40$

$17x = -28$

$x = -\frac{28}{17}$

Solution set= $\left\{\frac{52}{7}, -\frac{28}{17}\right\}$

(b) $2 \leq \frac{2}{3} - 4x < 3 - 5x$

Multiply by 3

$6 \leq 2 - 12x < 9 - 15x$

$6 \leq 2 - 12x$

$12x \leq 2 - 6$

$12x \leq -4$

$x \leq -\frac{1}{3}$

$2 - 12x < 9 - 15x$

$15x - 12x < 9 - 2$

$3x < 7$

$x < \frac{7}{3}$

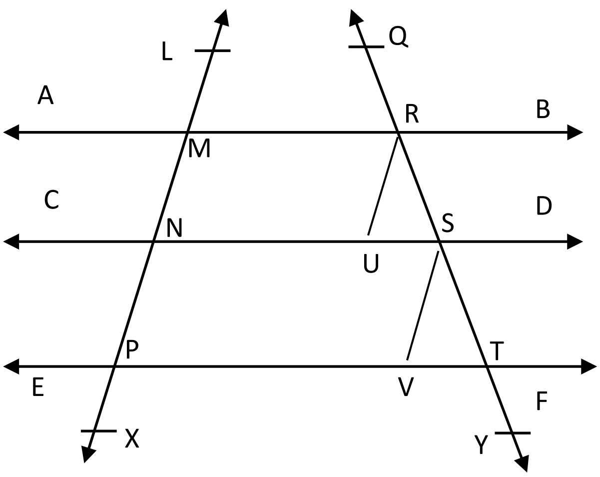
Solution Set = $\left\{x \middle| -\frac{1}{3} \geq x < \frac{7}{3}\right\}$

Q4

Statement: If three or more parallel lines make congruent segments on transversal, they also intercept congruent segments on any other

line that cuts them.

Figure:



Given: $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD} \parallel \overleftrightarrow{EF}$

The transversal $\overleftrightarrow{LX}$ intersects $\overleftrightarrow{AB}, \overleftrightarrow{CD}$ and $\overleftrightarrow{EF}$ at the points M, N and P respectively, such that $\overline{MN} \cong \overline{NP}$. The transversal $\overleftrightarrow{QY}$ intersects them at points R, S and T respectively.

To Prove: $\overline{RS} = \overline{ST}$

Construction: From R, draw $\overline{RU} \parallel \overline{LX}$, which meets $\overline{CD}$ at U. From S, draw $\overline{SV} \parallel \overline{LX}$ which meets $\overline{EF}$ at V. As shown in the figure let the angles be labelled as $\angle 1, \angle 2, \angle 3$ and $\angle 4$.

Proof:

Statements	**Reasons**
MNUR is a parallelogram.	$\overline{RU} \parallel \overline{LX}$, $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD}$
$\overline{MN} \cong \overline{RU} \quad \longrightarrow (i)$	Opposite sides of a $\parallel gram$
Similarly,	
$\overline{NP} \cong \overline{SV} \quad \longrightarrow (ii)$	
But $\overline{MN} \cong \overline{NP} \longrightarrow (iii)$	Given
$\therefore \overline{RU} \cong \overline{SV}$	From (i), (ii) and (iii)
Also $\overline{RU} \parallel \overline{SV}$	each is $\parallel \overleftrightarrow{LX}$
$\therefore \angle 1 \cong \angle 2$ and $\quad \angle 3 \cong \angle 4$	Corresponding angles
In $\Delta RUS \leftrightarrow \Delta SVT$	
$\overline{RU} \cong \overline{SV}$	Proved
$\angle 1 \cong \angle 2$	Proved
$\angle 3 \cong \angle 4$	Proved
$\Delta RUS \cong \Delta SVT$	S.A.A≅S.A.A
Hence $\overline{RS} = \overline{ST}$	Corresponding sides of congruent triangles.

Q5.

Let cost of chair $= x$

Let cost of Table $= y$

According to First condition

$x = \frac{y}{2} + 3$

$\Longrightarrow 2x = y + 6 \quad \Longrightarrow 2x - y = 6 - - - (1)$

According to 2nd condition

$3x + y = 54 - - - (2)$

These equations can be written in form of matrices as ;

$$\begin{bmatrix} 2 & -1 \\ 3 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 6 \\ 54 \end{bmatrix}$$

Let $A = \begin{bmatrix} 2 & -1 \\ 3 & 1 \end{bmatrix}$,$X = \begin{bmatrix} x \\ y \end{bmatrix}$, $B = \begin{bmatrix} 6 \\ 54 \end{bmatrix}$

$\therefore AX = B \Longrightarrow X = A^{-1}B - - - (3)$

Now $|A| = \begin{vmatrix} 2 & -1 \\ 3 & 1 \end{vmatrix} = 2(1) - (-1 \times 3) = 5 \neq 0 - - - (4)$

$Adj\ A = \begin{bmatrix} 1 & 1 \\ -3 & 2 \end{bmatrix} - - - (5)$

$A^{-1} = \frac{Adj\ A}{|A|}$ ------(6)

Using Equation (4) and Equation (5) in Equation (6)

$$A^{-1} = \frac{1}{5}\begin{bmatrix} 1 & 1 \\ -3 & 2 \end{bmatrix} - - - (6)$$

Putting the values in Equation (3)

$$\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{5}\begin{bmatrix} 1 & 1 \\ -3 & 2 \end{bmatrix}\begin{bmatrix} 6 \\ 54 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{5}\begin{bmatrix} 6 + 54 \\ -18 + 108 \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \frac{1}{5}\begin{bmatrix} 60 \\ 90 \end{bmatrix} \quad \Rightarrow \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 12 \\ 18 \end{bmatrix}$$

By definition of equal matrices their corresponding elements are equal

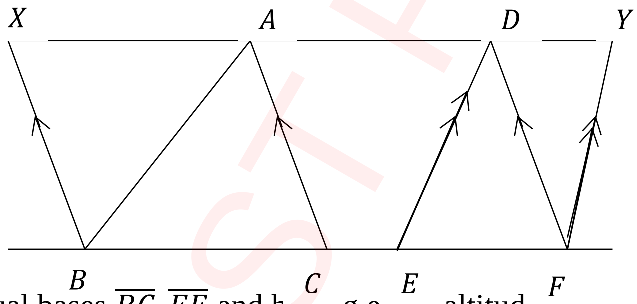
So   x= 12 , y =18

∴ Cost of chair= Rs 12   and Cost of table=Rs 18

Q6.

Statement: Triangles on equal bases and of equal altitudes are equal in area.

Figure:



Given: As ABS, DEF on equal bases $\overline{BC}, \overline{EF}$ and having equal altitudes.

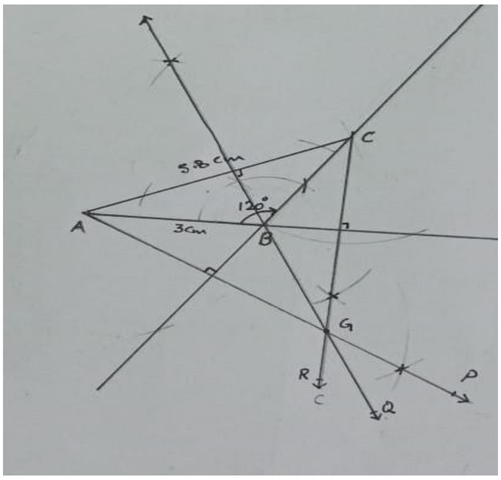
To prove: Area of ΔABC = Area of ΔDEF

Construction: Place the Δs ABC and DEF so that their equal bases $\overline{BC}$ and $\overline{EF}$ are on the same straight lines $BCEF$ and their vertices on the same side of it. Draw $\overline{BX} \parallel \overline{CA}$ and $\overline{FY} \parallel \overline{ED}$ meeting AD produces in X and Y, respectively.

Proof:

Statements	**Reasons**
$\Delta ABC, \Delta DEF$ are between the same parallels	Their altitudes are equal (Given).
∴ $XADY$ is parallel to $BCEF$	
∴ Area of ‖gm $BCAX$ = Area of ‖gm $EFYD \rightarrow (i)$	These ‖gms are on equal bases and between the same parallel lines.
But, Area of $\Delta ABC = \frac{1}{2}$(Area of ‖gm $BCAX$) $\rightarrow (ii)$	Diagonals of a ‖gm bisect it.
And Area of $\Delta DEF = \frac{1}{2}$(Area of ‖gm$EFYD$) $\rightarrow (iii)$	
∴ Area of ΔABC = Area of ΔDEF	From $(i), (ii)$ and (iii)

Q7 $m\overline{AB} = 3cm$, $m\angle B = 120°$, $m\overline{BC} = 5.8cm$



Construction Steps:

a. Draw $m\overline{AB} = 3cm$

b. Using pair of compasses to draw $m\angle B = 120°$.

c. With A as centre draw an arc of radius 5.8 cm that cuts $m\angle B$ at C.

d. ΔABC is completed.

d. Construct $\overline{AP}$ altitude from vertex A.

e. Construct $\overline{BQ}$ altitude from vertex B.

f. Construct $\overline{CR}$ altitude from vertex C.

g. The altitudes intersect at point G.

i.e. altitudes of ΔABC are concurrent.