

6. SECTION & AREA OF TRIANGLES

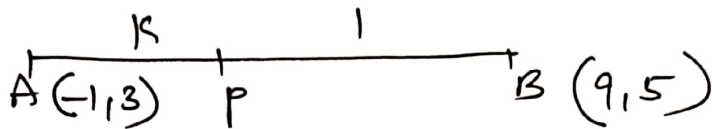
Class: 8th . Foundation Plus ①

SOLUTIONS

TEACHING TASK

JEE MAINS LEVEL QUESTIONS

01.



$$P = \left(\frac{9k-1}{k+1}, \frac{5k+3}{k+1} \right) \text{ lies on } x-y+2=0$$

$$\therefore \left(\frac{9k-1}{k+1} \right) - \left(\frac{5k+3}{k+1} \right) + 2 = 0$$

$$\Rightarrow k = \frac{2}{3}$$

Ans: A

02.



Required ratio: $x_1 - x : x - x_2$

$$\Rightarrow 4 - 2 : 2 - (-2)$$

$$\Rightarrow 2 : 4$$

$$\Rightarrow 1 : 2$$

Ans: D

03



03

(2)

$$\overbrace{P(7,5) \quad Q(x_2, y_2) \quad P(22, 23)}^{x_1, y_1 \quad x \quad y}$$

$$3:5$$

$$m:n$$

$$(22, 23) = \left(\frac{3x_2 - 95}{3-5}, \frac{3y_2 + 25}{3-5} \right)$$

$$\therefore 3x_2 - 95 = -44 \quad \left| \begin{array}{l} \text{Similarly } y_2 = -7 \end{array} \right.$$

$$\Rightarrow x_2 = -3$$

$$\therefore (-3, -7)$$

Ans: D

04

$$\begin{aligned} \text{Centroid} &= \left(\frac{1+2+4}{3}, \frac{-1-1-3}{3} \right) \\ &= \left(\frac{7}{3}, -\frac{5}{3} \right) \end{aligned}$$

Ans: A

05

$$\overbrace{A(3, -4) \quad P(p, -2) \quad Q \quad B(1, 2)}$$

P divides AB in the ratio 1:2

$$p = \frac{1 \times 1 + 2 \times 3}{1+2}$$

$$\therefore q = \frac{2 \times 2 + 1(-4)}{1+2}$$

$$\therefore p = \frac{7}{3}$$

$$q = \frac{4-4}{3} = 0$$

$$\therefore (p, q) = \left(\frac{7}{3}, 0 \right)$$

Ans: D



06 $Q = \left(\frac{1-1+3}{3}, \frac{4-1+2}{3} \right)$
 $= \left(1, \frac{1}{3} \right)$

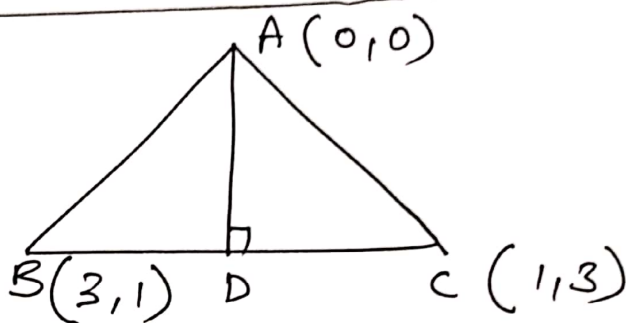
Ans: B

07 $D = \left(\frac{3+1}{2}, \frac{1+3}{2} \right)$
 $= \left(2, 2 \right)$

Eqn of AD $\Rightarrow y = x$

$\Rightarrow x - y = 0$

option A: $\left(\frac{3}{2}, \frac{3}{2} \right)$ satisfies the eqn
 Ans: A



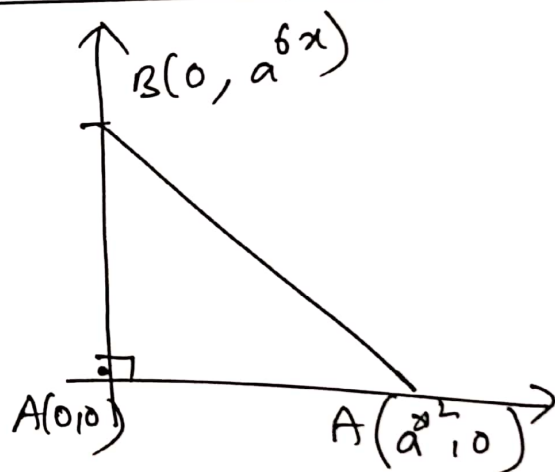
08 Area of $\Delta = \frac{1}{2} \times a^2 \times a^{6x}$
 $= \frac{1}{2} \times a^{a^2+6a}$

$\frac{1}{2a^5} = \frac{1}{2} a^{a^2+6a}$

$\Rightarrow a^2 + 6a + 5 = 0$

$\Rightarrow (a+1)(a+5) = 0$

$\Rightarrow a = -1 \text{ or } -5$



Ans: D

09. $\frac{1}{2} | 1(3-4) + 2(4-2) + 1(2-3) | = 40$

$\Rightarrow x = -77, 83$

Ans: C

10. Third vertex lies on $y = x + 3$ (4)
 $\therefore \left(\frac{1}{2}, \frac{13}{2}\right), \left(-\frac{3}{2}, \frac{3}{2}\right)$ satisfies above eqn.
 Ans: D

11.

$$\begin{array}{c} \text{K} \qquad \qquad \qquad 1 \\ \hline P(-5, 1) \qquad \qquad A(x, y) \qquad \qquad Q(3, 5) \end{array}$$

$$A(x, y) = \left(\frac{3K - 5}{K + 1}, \frac{5K + 1}{K + 1} \right), B(1, 5), C(7, -2)$$

$$\text{Area of } \triangle ABC = 2$$

$$\left| \left(\frac{3K - 5}{K + 1} \right) (5 + 2) + 1 \left(-2 - \frac{5K + 1}{K + 1} \right) + 7 \left(\frac{3K - 5}{K + 1} - \frac{5K + 1}{K + 1} \right) \right| = 2$$

$$\Rightarrow K = 7, \frac{31}{9}$$

Ans: A, B

12. A(-1, -4), B(b, c), C(5, -1) collinear

$$\Rightarrow \text{Area } \triangle ABC = 0$$

$$\Rightarrow \frac{1}{2} \left| -1(c + 1) + b(-1 + 4) + 5(-4 - c) \right| = 0$$

$$\Rightarrow \left| -c - 1 + 3b - 20 - 5c \right| = 0$$

$$\Rightarrow \left| 3b - 6c - 21 \right| = 0$$

$$\Rightarrow b - 2c - 7 = 0 \rightarrow (1)$$

$$2b + c - 4 = 0 \rightarrow (2)$$

$$\text{Solving } \Rightarrow b = 3 \quad c = -2$$

Ans: B, C

13. Statement I:

$$AB = \sqrt{4+4} = 2\sqrt{2}$$

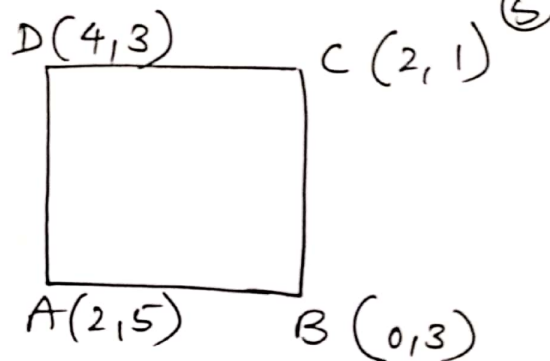
$$BC = \sqrt{4+4} = 2\sqrt{2}$$

$$CD = \sqrt{4+4} = 2\sqrt{2}$$

$$AD = \sqrt{4+4} = 2\sqrt{2}$$

$$\therefore AB = BC = CD = DA$$

$\therefore \triangle ABCD$ is a square. (True)



Also mid pt of AC = (2, 3)

mid pt of BD = (2, 3)

Statement II:

$$A(-a, -b), B(0, 0), C(a, b), D(a^2, ab)$$

$$\text{Now slope of } AB = \frac{b}{a} \quad \left| \quad \text{slope of } CD = \frac{ab-b}{a^2-a}$$

$$\text{slope of } BC = \frac{b}{a} \quad \left| \quad = \frac{b(a-1)}{a(a-1)} = \frac{b}{a}$$

Hence, the given points are collinear. (True)

Ans: A

14. Statement I: $A(-1, 3), B(0, 4), C(-5, 2)$

$$\text{Centroid} = \left(\frac{-1+0-5}{3}, \frac{3+4+2}{3} \right)$$

$$= (-2, 3)$$

$$\text{median} \rightarrow x - 2y + k = 0$$

$$\Rightarrow -2 + 6 + k = 0$$

$$\Rightarrow k = 8 \quad (\text{True})$$

17

(6)

$$\begin{array}{c} \text{A}(-3, 4) \quad \text{M}(3, 4) \quad \text{B}(x, y) \end{array}$$

$$\frac{-3+x}{2} = 3 \quad \Bigg| \quad \frac{4+y}{2} = 4$$

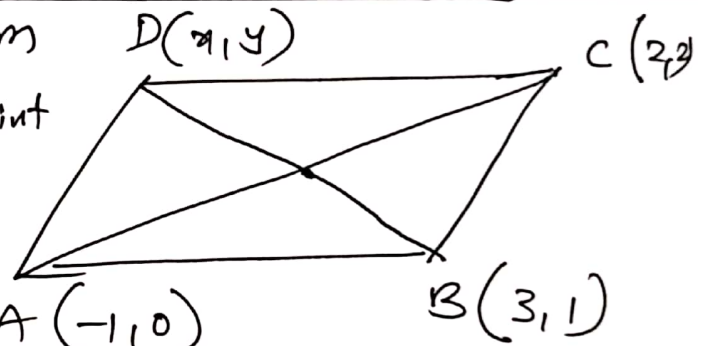
$$\Rightarrow x = 9 \quad \Bigg| \quad y = 4$$

$$\therefore B(9, 4)$$

Ans: B

18

ABCD is a parallelogram
mid-point of AC = mid-point
of BD



$$\Rightarrow \left(\frac{x+3}{2}, \frac{y+1}{2} \right) = \left(\frac{-1+2}{2}, \frac{0+2}{2} \right)$$

$$\Rightarrow \begin{array}{l} x+3=1 \\ x=-2 \end{array} \quad \Bigg| \quad \begin{array}{l} y+1=2 \\ y=1 \end{array}$$

$$\therefore D(-2, 1)$$

Ans: B

21

$$\begin{array}{c} \text{A}(2, 5) \quad \text{C}(-1, 2) \quad \text{B}(x, y) \end{array}$$

$$(-1, 2) = \left(\frac{3x+8}{7}, \frac{3y+20}{7} \right)$$

$$\therefore x = -5, \quad y = -2$$

$$\therefore x^2 + y^2 = 25 + 4 = 29$$

Ans: 29

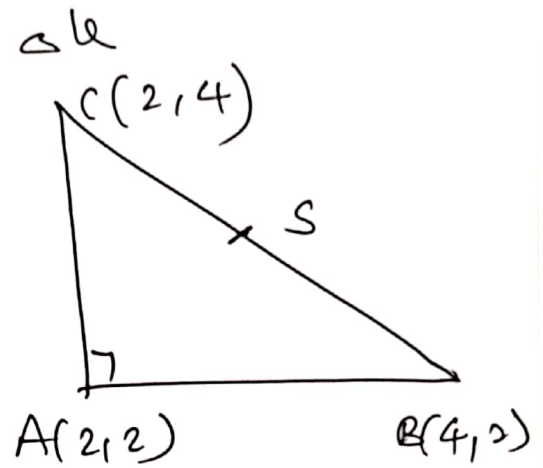
$$A(2,2), B(4,2), C(2,4)$$

$\triangle ABC$ is a right angled $\triangle$

$$\text{Circumcentre} = \left(\frac{2+4}{2}, \frac{4+2}{2} \right)$$

$$= (3,3)$$

$$\therefore \text{Ortho centre} = (2,2)$$



$$\therefore SO = \sqrt{(3-2)^2 + (3-2)^2}$$

$$= \sqrt{1+1}$$

$$= \sqrt{2} = \sqrt{a} \Rightarrow a = 2$$

Am: 2

a) $A(1,-1), B(2,1), C(4,5)$

$$\text{Slope of AB} = \frac{1-(-1)}{2-1} = \frac{2}{1} = 2$$

$$\text{Slope of BC} = \frac{5-1}{4-2} = \frac{4}{2} = 2$$

A, B, C are collinear.

b) $(p,q), (m,n), (p-m, q-n)$

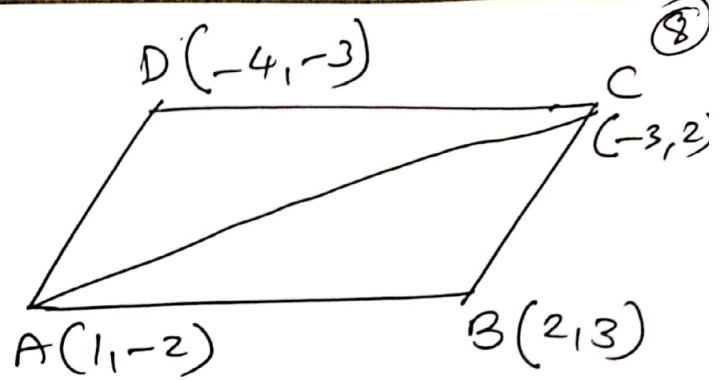
$$\frac{n-q}{m-p} = \frac{q-n-n}{p-m-m}$$

$$\Rightarrow \frac{n-q}{m-p} = \frac{q-2n}{p-2m}$$

$$\Rightarrow np - 2mn - pq + 2mq = mq - 2mn - pq + 2pn$$

$$\Rightarrow np = mq$$

c) Area of $\triangle ABC$



$$= \frac{1}{2} | 1(3-2) + 2(2+2) - 3(-2-3) |$$

$$= \frac{1}{2} | 1 + 8 + 15 | = \frac{1}{2} 24 = 12$$

Area of 11^{th} ABCD = $2 \times 12 = 24$.

d) Area of $\triangle DEF =$

$$= \frac{1}{2} \left| -\frac{1}{5} \left(3 - \frac{7}{2} \right) + 7 \left(\frac{7}{2} - \frac{5}{2} \right) + \frac{7}{2} \left(\frac{5}{2} - 3 \right) \right|$$

$$= \frac{1}{2} \left| -\frac{1}{5} \times \frac{-1}{2} + 7 + 7 \times \frac{-1}{2} \right|$$

$$= \frac{1}{2} \left| \frac{2 + 40 - 35}{20} \right| = \frac{1}{2} \left| \frac{7}{20} \right| = \frac{7}{40}$$

Area of $\triangle ABC = 4 \times 7 = 28$

$$= 4 \times \frac{7}{40} = \frac{7}{10} = 0.7$$

9

Conceptual

Ans: D

02. Conceptual

Am : C

03. Conceptual

Am : D

04 | Conceptual

Ans: B

05	Conceptual
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Ans: D

06	Conceptual
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Ans: A

07.	Conceptual
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Ans : C

08	conceptual
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Ans: A

09.	Conceptual
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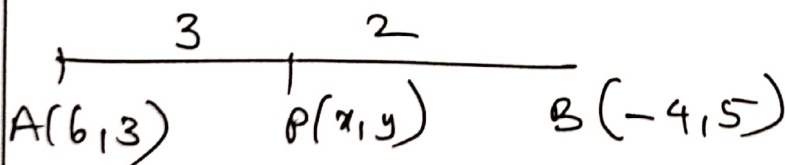
Ans: A

10.	Conceptual
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Ans: B

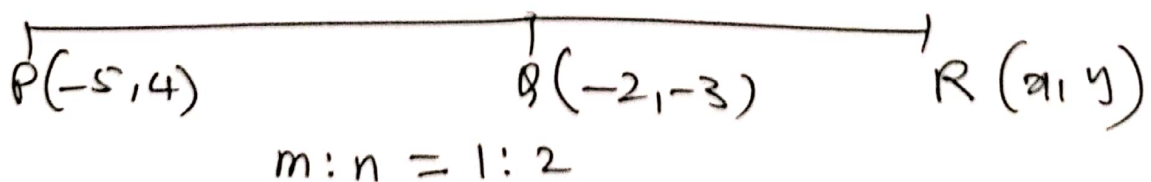
JEE MAINS LEVEL QUESTIONS

01.



$$P(a, y) = \left(\frac{-12 + 12}{5}, \frac{15 + 6}{5} \right) = \left(0, \frac{21}{5} \right) \quad \text{Ans: A}$$

02



$$(-5, 4) = \left(\frac{x+4}{1-2}, \frac{y+6}{1-2} \right)$$

(10)

$$\Rightarrow (-5)$$

$$\Rightarrow \begin{array}{l|l} x+4=5 & y+6=-4 \\ \hline x=1 & y=-10 \end{array}$$

$$\therefore R(1, -10)$$

Ans: B

03 $A(0,0), B(3,1), C(1,3)$

Let $S(x,y)$ be the Circumcentre.

$$\therefore SA = SB \Rightarrow SA^2 = SB^2$$

$$\Rightarrow (x-3)^2 + (y-1)^2 = (x-0)^2 + (y-0)^2$$

$$\Rightarrow -6x + 9 - 2y + 1 = 0$$

$$\Rightarrow 6x + 2y - 10 = 0$$

$$\Rightarrow 3x + y - 5 = 0.$$

$$\therefore C\left(\frac{5}{4}, \frac{5}{4}\right) \text{ satisfies above eqn.}$$

Ans: C

04. $L \equiv 3x + y - 9 = 0$ $A(1,3), B(2,7)$

$$L_{11}: 3(1) + 3 - 9 = -3$$

$$L_{22}: 3(2) + 7 - 9 = 4$$

$$\text{Required ratio: } -L_{11} : L_{22} \\ = 3 : 4$$

Ans: B

05

$$\begin{matrix} (1,0), & (0,1), & (0,0) \\ (a,0) & (0,b) \end{matrix}$$

(11)

$$\begin{aligned} \text{Incentre} &= \left(\frac{ab}{a+b+\sqrt{a^2+b^2}}, \frac{ab}{a+b+\sqrt{a^2+b^2}} \right) \\ &= \left(\frac{1}{1+1+\sqrt{1+1}}, \frac{1}{1+1+\sqrt{1+1}} \right) \\ &= \left(\frac{1}{2+\sqrt{2}}, \frac{1}{2+\sqrt{2}} \right) \\ &= \left(\frac{2-\sqrt{2}}{2}, \frac{2-\sqrt{2}}{2} \right) \end{aligned}$$

Ans: A

06

$$A(3, -8), B(4, -11), C(5, -K) \text{ Collinear}$$

$$\Rightarrow \text{slope of } AB = \text{slope of } BC$$

$$\Rightarrow \frac{-11+8}{4-3} = \frac{-K+11}{5-4}$$

$$\Rightarrow K = -8$$

Ans: B

07

$$A(1,1), B(7,-3), C(12,2) \text{ \& } D(7,2)$$

$$\begin{matrix} x_1 y_1 & x_2 y_2 & x_3 y_3 & x_4 y_4 \end{matrix}$$

$$\begin{aligned} \text{Area of } \square ABCD &= \frac{1}{2} \left| x_1(y_2 - y_4) + x_2(y_3 - y_1) + x_3(y_4 - y_2) \right. \\ &\quad \left. + x_4(y_1 - y_3) \right| \\ &= 132 \text{ sq. units} \end{aligned}$$

Ans: B

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

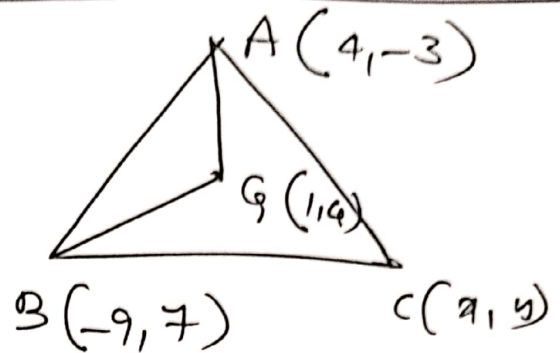
(12)

Area of $\square ABCD = 18$

Ans: A

09. $A(4, -3), B(-9, 7), G(1, 4)$

Area of $\triangle ABG = \frac{61}{2}$



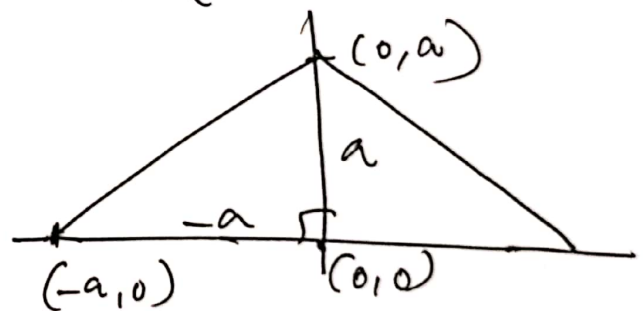
Area of $\triangle ABC = 3 \times \text{Area of } \triangle ABG$
 $= 3 \times \frac{61}{2} = \frac{183}{2}$

Ans: B

10. $A(-a, 0), B(0, 0), C(0, a)$

~~These points are collinear -~~

Area $= \frac{1}{2} |a \times (-a)| = \frac{a^2}{2}$



Ans: —

11. $A(6, 3), B(-3, 5), C(4, -2), D(x, 3x)$

Area of $\triangle ABC = \text{Area of } \triangle DBC$

$\frac{1}{2} |6(5+2) - 3(-2-3) + 4(3-5)|$

$= \frac{1}{2} |-3(-2-3x) + 4(3x-5) + x(5+2)|$

$\Rightarrow x = -\frac{3}{8}, \frac{11}{8}$

Ans: B, C

13

Statement I: $A(K, 2-2K), B(-K, 2K),$ (13)
 $C(-4-K, 6-2K)$

put $K=2$

$$A(2, -2), B(-2, 4), C(-6, 2)$$

$$\text{Slope of } AB = \frac{4+2}{-2-2} = \frac{6}{-4} = -\frac{3}{2}$$

$$\text{Slope of } BC = \frac{2-4}{-6+2} = \frac{-2}{-4} = \frac{1}{2}$$

$\therefore$ The given points are not collinear. (False)

Statement II: Conceptual (True) Ans: C

17

$$G = \left(\frac{7+4-5}{3}, \frac{4-6+2}{3} \right)$$

$$= (2, 0)$$

Ans D

21

$$\left(\frac{3-7+x}{3}, \frac{-5+4+y}{3} \right) = (-2, 1)$$

$$\therefore x = -2, y = 4$$

$$\therefore 2x - y = 2(-2) - 4 = -4 - 4 = -8 \quad \text{Ans: } -8$$

$$a) G = \left(\frac{0+8+8}{3}, \frac{6+12+0}{3} \right) \\ = \left(\frac{16}{3}, 6 \right)$$

$$b) G = \left(\frac{-1+0-5}{3}, \frac{3+4+2}{3} \right)$$

$$= (-2, 3)$$

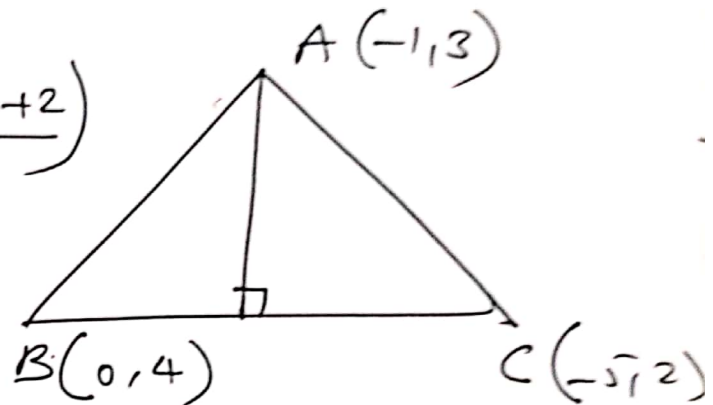
$$x - 2y + k = 0$$

$$\Rightarrow -2 - 6 + k = 0$$

$$\Rightarrow k = 8$$

$$c) G = \left(\frac{1+2+3}{3}, \frac{1-3+4}{3} \right) \\ = \left(2, \frac{2}{3} \right)$$

$$d) 2:1$$



Ans: S, 8, 2, 1

TEACHING TASK
JEE ADVANCED

①

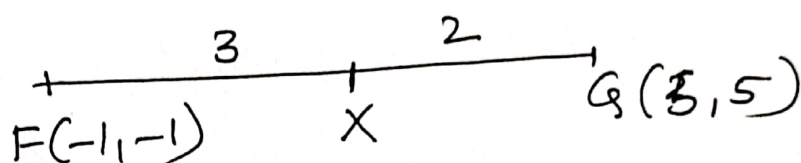
15 Assertion: J(2, 4), K(5, 10), L(8, 16)

$$\begin{aligned} \text{Ar} \Delta JKL &= \frac{1}{2} | 2(10-16) + 5(16-4) + 8(4-10) | \\ &= \frac{1}{2} | 2(-6) + 5(12) + 8(-6) | \\ &= \frac{1}{2} | -12 + 60 - 48 | = 0 \quad (\text{False}) \end{aligned}$$

Reason: Conceptual (True)

Ans: D

16 Assertion:



$$\begin{aligned} \therefore X &= \left(\frac{15-2}{3+2}, \frac{15-2}{3+2} \right) = \left(\frac{13}{5}, \frac{13}{5} \right) \\ &= (2.6, 2.6) \quad (\text{True}) \end{aligned}$$

Reason: Conceptual (True)

Ans: B

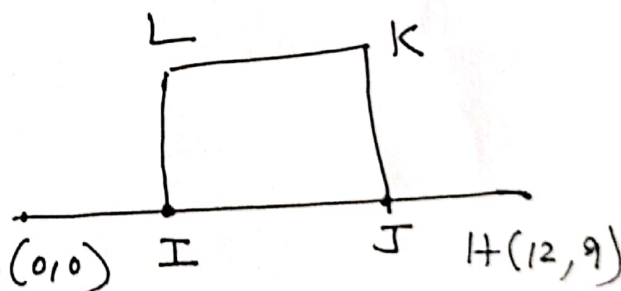
19. I divides $\overline{GH}$ in the ratio 1:2

$$\begin{aligned} I &= \left(\frac{1 \cdot 12 + 2 \cdot 0}{1+2}, \frac{1 \cdot 9 + 2 \cdot 0}{1+2} \right) \\ &= (4, 3) \end{aligned}$$

J divides $\overline{GH}$ in the ratio 2:1

$$\begin{aligned} \therefore J &= \left(\frac{2 \cdot 12 + 1 \cdot 0}{2+1}, \frac{2 \cdot 9 + 1 \cdot 0}{2+1} \right) \\ &= (8, 6) \end{aligned}$$

Ans: B



20 We know, $I(4,3)$, $J(8,6)$, $K(3,6)$, $L(9,3)$. (2)

These four points form a convex quadrilateral with order

$$I(4,3)_{x_1 y_1}, K(3,6)_{x_2 y_2}, J(8,6)_{x_3 y_3}, L(9,3)_{x_4 y_4}$$

Area of $\square IKJL$

$$\begin{aligned} &= \frac{1}{2} | x_1(y_2 - y_4) + x_2(y_3 - y_1) + x_3(y_4 - y_2) + x_4(y_1 - y_3) | \\ &= \frac{1}{2} | 4(6 - 3) + 3(6 - 3) + 8(3 - 6) + 9(3 - 6) | \\ &= \frac{1}{2} | 4(3) + 3(3) + 8(-3) + 9(-3) | \\ &= \frac{1}{2} | 12 + 9 - 24 - 27 | = \frac{30}{2} = 15 \text{ sq. units} \end{aligned}$$

Ans: —

24 a) $M = \left(\frac{1 \cdot 8 + 2 \cdot 2}{1 + 2}, \frac{1 \cdot 10 + 2 \cdot (-2)}{1 + 2} \right) = \left(\frac{8 + 4}{3}, \frac{10 - 4}{3} \right) = (4, 2) \text{ (P)}$

b) Conceptual (2)

c) $M = \left(\frac{-5 + 3}{2}, \frac{7 - 1}{2} \right) = (-1, 3) \text{ (r)}$

d) $M = \left(\frac{2 \cdot 2 - 1 \cdot (-2)}{2 - 1}, \frac{2 \cdot 6 - 1 \cdot (-2)}{2 - 1} \right) = \left(\frac{4 + 2}{1}, \frac{12 + 2}{1} \right) = (6, 14) \text{ (s)}$

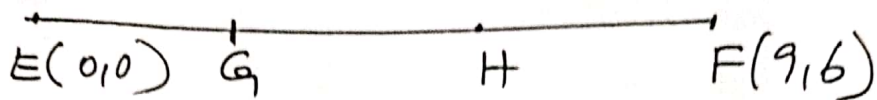
Ans: P, r, s

LEARNERS TASK

ADVANCED LEVEL

12.

(3)



A) G divides $\overline{EF}$ in the ratio 1:2

$$\therefore G = \left(\frac{1 \cdot 9 + 2 \cdot 0}{1+2}, \frac{1 \cdot 6 + 2 \cdot 0}{1+2} \right) = (3, 2) \checkmark$$

B) H divides $\overline{EF}$ in the ratio 2:1

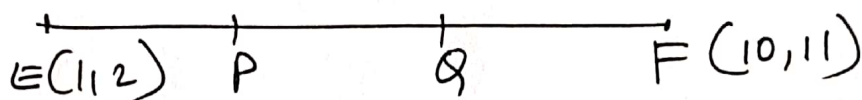
$$H = \left(\frac{2 \cdot 9 + 1 \cdot 0}{2+1}, \frac{2 \cdot 6 + 1 \cdot 0}{2+1} \right) = (6, 4) \checkmark$$

C) Conceptual (True) $\checkmark$

D) Conceptual (True) $\checkmark$

Ans: A, B, C, D

14. Statement I:



P divides $\overline{EF}$ in the ratio 1:2

$$P = \left(\frac{1 \cdot 10 + 2 \cdot 1}{1+2}, \frac{1 \cdot 11 + 2 \cdot 2}{1+2} \right) = (4, 5)$$

Q divides $\overline{EF}$ in the ratio 2:1

$$Q = \left(\frac{2 \cdot 10 + 1 \cdot 1}{2+1}, \frac{2 \cdot 11 + 1 \cdot 2}{2+1} \right) = (7, 8) \text{ (True)}$$

Ans: A

Statement II: Conceptual (True)

15

Assertion:

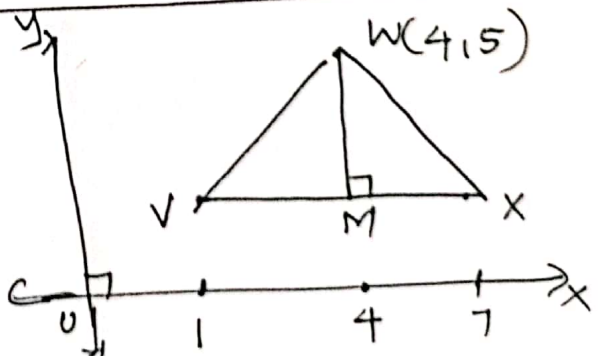
$$VX = |7-1| = 6$$

$$MW = |5-1| = 4$$

$$\therefore \text{Area} = \frac{1}{2} \times 6 \times 4 = 12 \text{ (True)}$$

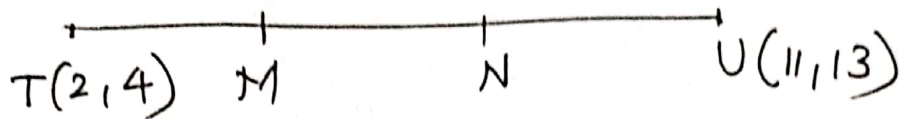
Reason: ~~Ma~~ Logically (True)

Ans: A



16. Assertion:

(4)



$$M = \left(\frac{1 \cdot 11 + 2 \cdot 2}{1+2}, \frac{1 \cdot 13 + 2 \cdot 4}{1+2} \right) = (5, 7)$$

$$N = \left(\frac{2 \cdot 11 + 1 \cdot 2}{2+1}, \frac{2 \cdot 13 + 1 \cdot 4}{2+1} \right) = (8, 10) \quad (\text{True})$$

Reason: Conceptual (True)

Ans. A

18

$$\vec{C} = \left(\frac{4+1+3}{3}, \frac{6+2+7}{3} \right) =$$

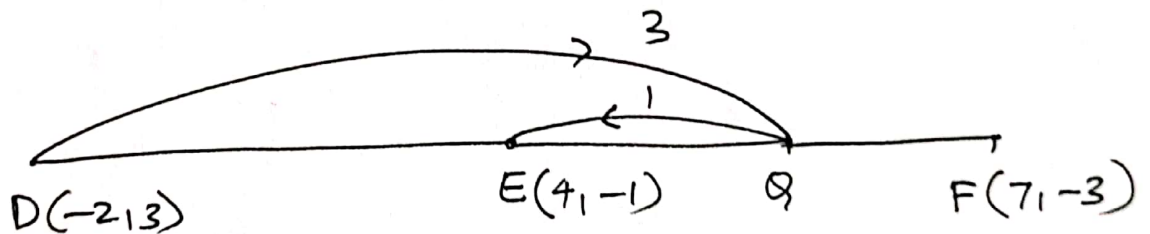
18

$$\left(\frac{1+3+x}{3}, \frac{2+7+y}{3} \right) = (4, 6)$$

$$\Rightarrow (x, y) = (8, 9)$$

Ans. D

19.



$$Q = \left(\frac{3 \cdot 4 - 1(-2)}{3-1}, \frac{3(-1) - 1(3)}{3-1} \right) = (7, -3) \quad \text{Ans. C}$$

20.

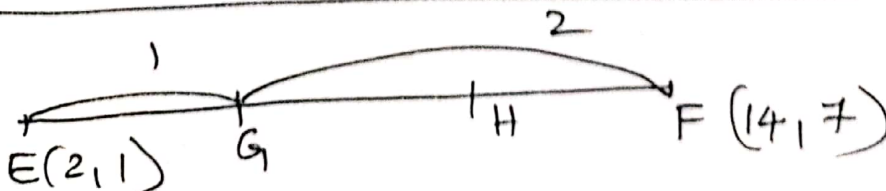
$$Q(7, -3), E(4, -1), F(7, -3)$$

$$\text{slope of } QE = \frac{-1+3}{4-7} = -\frac{2}{3}, \text{ slope of } EF = \frac{-3+1}{7-4} = -\frac{2}{3}$$

$\therefore Q, E, F$ are collinear

C

22

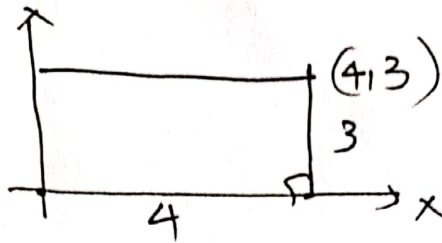


$$G_x = \frac{14+2}{3} = 6$$

Ans. 6

24

a)



$$\text{Area} = 4 \times 3 = 12 \text{ (P)}$$

(5)

$$b) \begin{matrix} (1,1) & (5,1) & (6,4) & (2,4) \\ x_1 y_1 & x_2 y_2 & x_3 y_3 & x_4 y_4 \end{matrix}$$

$$\text{Area} = \frac{1}{2} | x_1(y_2 - y_4) + x_2(y_3 - y_1) + x_3(y_4 - y_2) + x_4(y_1 - y_3) |$$

$$= \frac{1}{2} | 1(1-4) + 5(4-1) + 6(4-1) + 2(1-4) |$$

$$= \frac{1}{2} | -3 + 15 + 18 - 6 | = 12 \text{ (P)}$$

$$c) (2,2), (6,2), (7,5), (3,5)$$

$$\text{Area} = \frac{1}{2} | 2(2-5) + 6(5-2) + 7(5-2) + 3(2-5) |$$

$$= \frac{1}{2} | -6 + 18 + 21 - 9 |$$

$$= \frac{1}{2} | 24 | = 12 \text{ (P)}$$

$$d) (0,0), (3,0), (5,2), (1,4)$$

$$\text{Area} = \frac{1}{2} | 0(0-4) + 3(2-0) + 5(4-0) + 1(0-2) |$$

$$= \frac{1}{2} | 6 + 20 - 2 | = \frac{24}{2} = 12 \text{ (P)}$$

Ans: P, P, P, P

 $\Rightarrow$ THE END $\Leftarrow$