UDAAN 2024

– FOR CLASS 10th STUDENTS

Lecture No.- 03

- **Subject Name-** Mathematics

- **Chapter Name-** Coordinate Geometry

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Topic to be Covered

Topic — Section formula

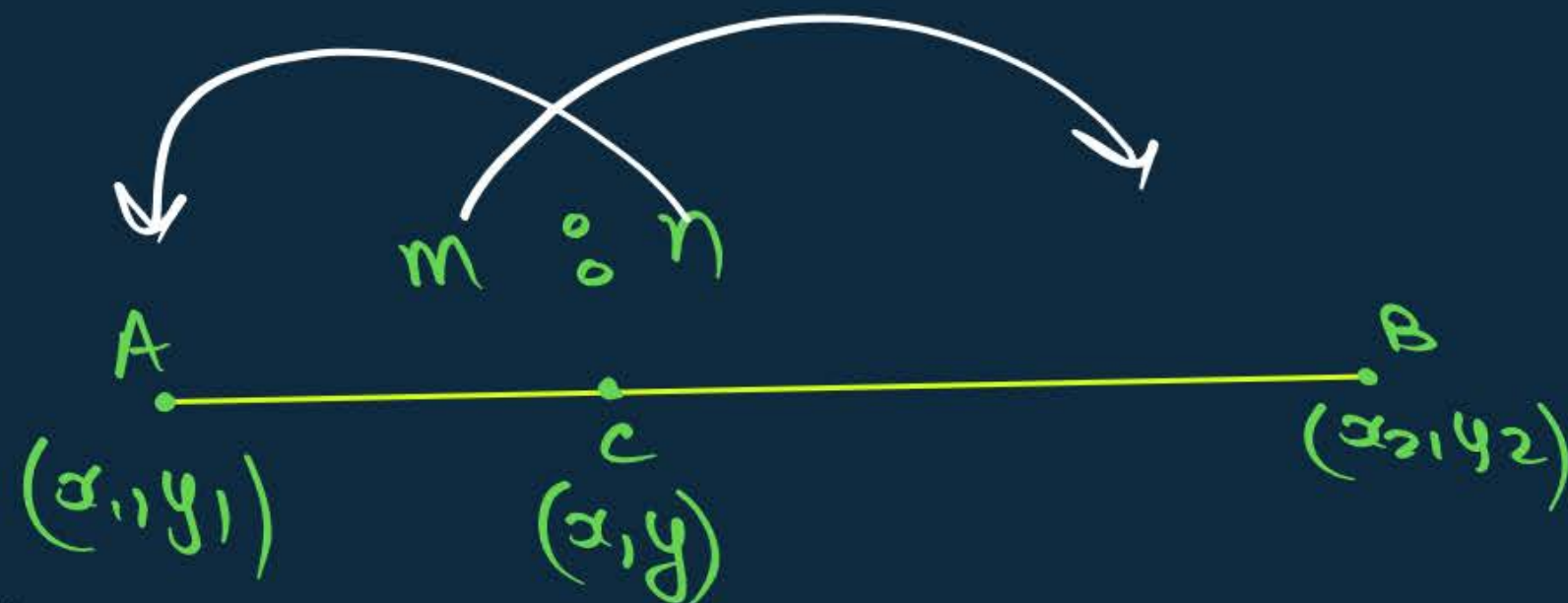**Topic** — Mid point formula

Recap of Previous Lecture

Topic Questions on distance formula

$$m : n$$

A _____ B

(x_1, y_1)

C

(x, y)

(x_2, y_2)

Mid-point Formula

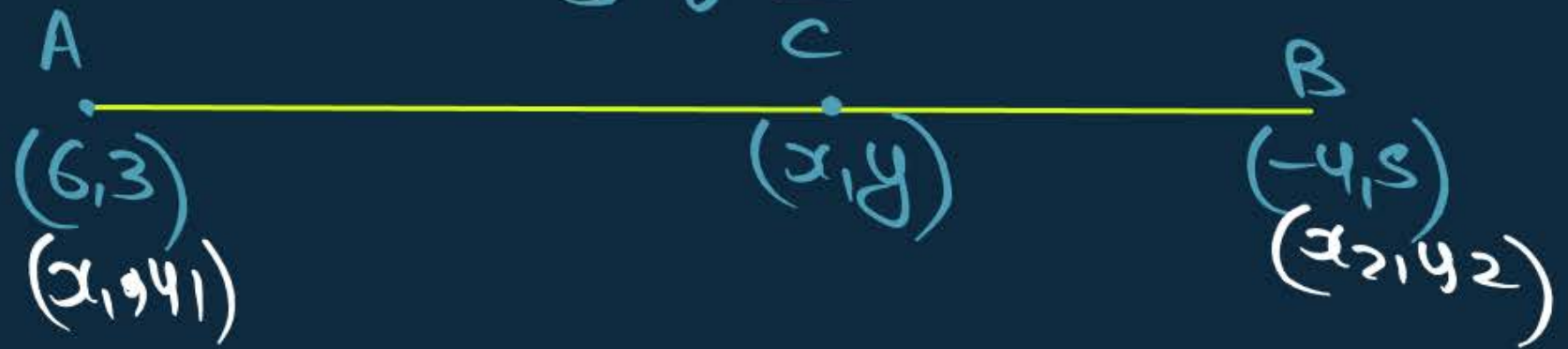$$x = \frac{mx_2 + nx_1}{m+n}$$

$$y = \frac{my_2 + ny_1}{m+n}$$

If 'C' is a mid-point:

$$x = \frac{x_2 + x_1}{2}$$

$$y = \frac{y_2 + y_1}{2}$$

#Q. Find the coordinates of the point which divides the line segment joining the points $(6, 3)$ and $(-4, 5)$ in the ratio $3 : 2$ internally.

$\therefore$ the coordinates of point C which divides AB in the ratio $3:2$ are $\left(0, \frac{21}{5}\right)$.

$m : n$
$3 : 2$

A $(6, 3)$ (x_1, y_1)

C (x, y)

B $(-4, 5)$ (x_2, y_2)

$$x = \frac{mx_2 + nx_1}{m+n} \quad , \quad y = \frac{my_2 + ny_1}{m+n}$$

$$x = \frac{-12 + 12}{5} \quad , \quad y = \frac{15 + 6}{5}$$
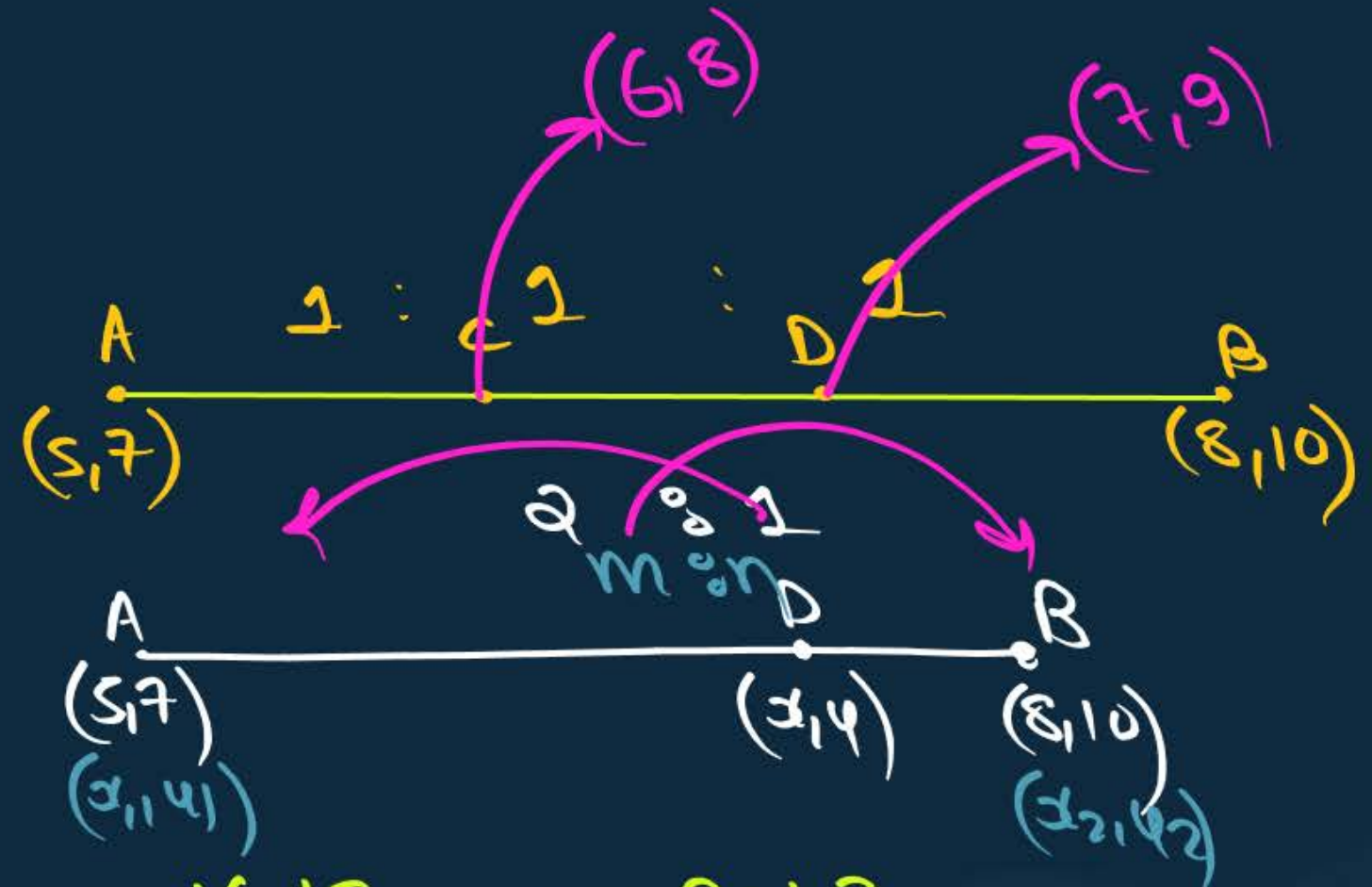
$$\boxed{x = 0, \ y = 21/5}$$

#Q. Find the co-ordinates of the points which divide the line segment joining the points (5, 7) and (8, 10) in 3 equal parts. [Board SQP, 2016]

$$\underset{1 : 2}{m : n}$$

A — C — B

(5,7)   (x,y)   (8,10)
(x_1, y_1)   (x_2, y_2)

$$x = \frac{mx_2 + nx_1}{m+n}, \quad y = \frac{my_2 + ny_1}{m+n}$$

$$x = \frac{8+10}{3}, \quad y = \frac{10+14}{3}$$

$$x = 6 \quad , \quad y = 8$$

(6,8)   (7,9)

1 : 1 : 1

A ———— D ———— B
(5,7)   (8,10)

2 : 1

m : n

A ———— D — B
(5,7)   (x,y)   (8,10)
(x_1, y_1)   (x_2, y_2)

$$x = \frac{16+5}{3}, \quad y = \frac{20+7}{3}$$

$$x = 7 \quad , \quad y = 9$$

midpoint

C
$(6,8)$
(x_1, y_1)

D
(x, y)

B
$(8,10)$
(x_2, y_2)
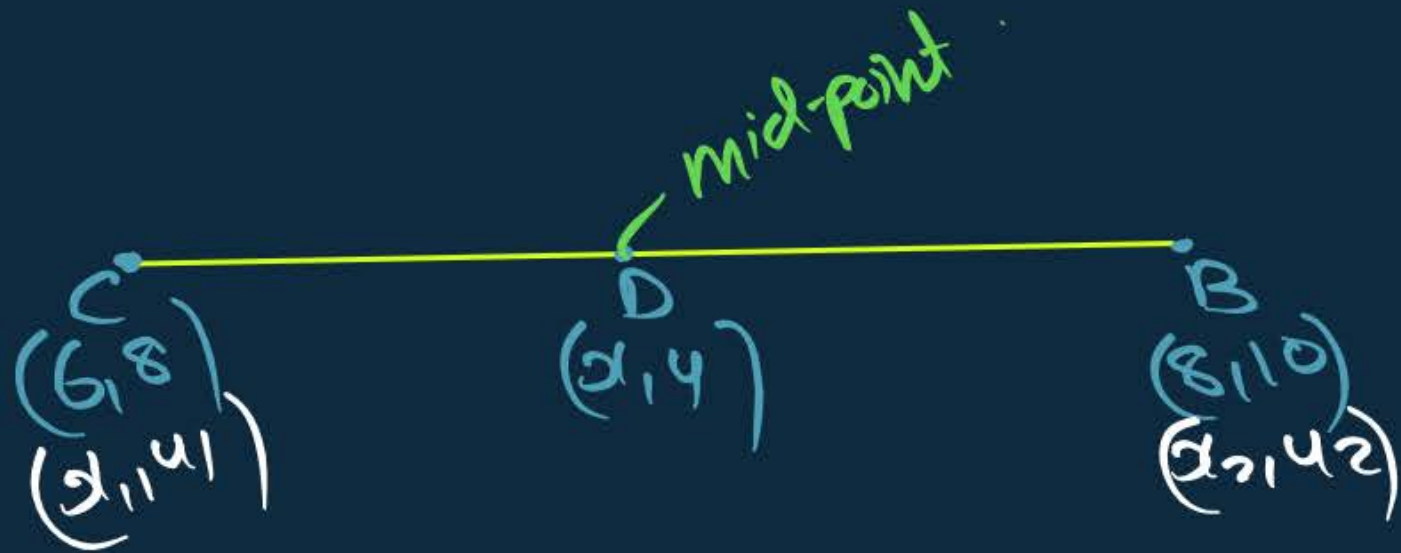
$$x = \frac{x_2 + x_1}{2}, \quad y = \frac{y_2 + y_1}{2}$$

$$x = \frac{14}{2}, \quad y = \frac{10+8}{2}$$

$$\boxed{x = 7, \quad y = 9}$$

#Q. Find the coordinate of points which trisect the line segment joining (1, –2) and

(–3, 4).   [CBSE 2017]

3equal parts

H.w

#Q. If the point $P(k, 0)$ divides the line segment joining the points $A(2, -2)$ and $B(-7, 4)$ in the ratio $1 : 2$, then the value of k is
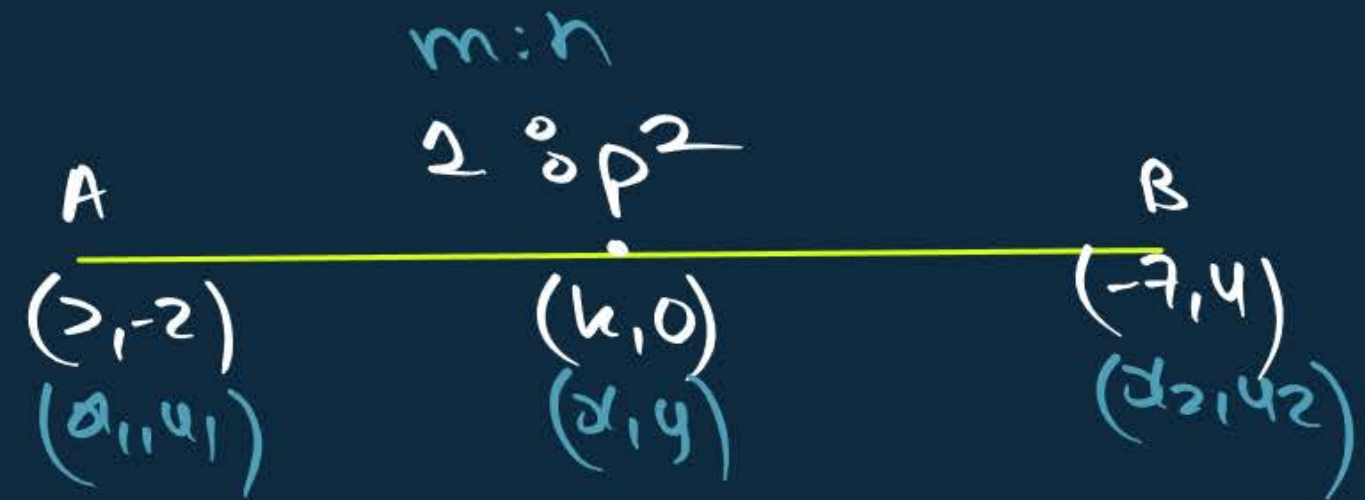
[CBSE, Delhi Set – I, 2020]

A 1

B 2

C −2

D −1

$$m : n$$

$$\underset{A}{} \quad 1 \overset{\bullet}{\underset{}{\circ}} p^2 \quad \underset{B}{}$$

$$\underset{\substack{(2,-2) \\ (a_1, y_1)}}{A} \quad \underset{\substack{(k,0) \\ (x,y)}}{} \quad \underset{\substack{(-7,4) \\ (x_2, y_2)}}{B}$$

$$x = \frac{m x_2 + n x_1}{m+n}$$

$$k = \frac{-7+4}{3} = \frac{-3}{3} = \boxed{-1}$$

#Q. If the point $P(6, 2)$ divides the lines segment joining $A(6, 5)$ and $B(4, y)$ in the ratio $3 : 1$, then the value of y is

A 4

B 3

C 2

D 1

$m : n$

$3 : 1$

$A(6,5)$ $P(6,2)$ B

(x_1, y_1) (a, b) $(4, y)$

(x_2, y_2)

$$b = \frac{my_2 + ny_1}{m + n}$$
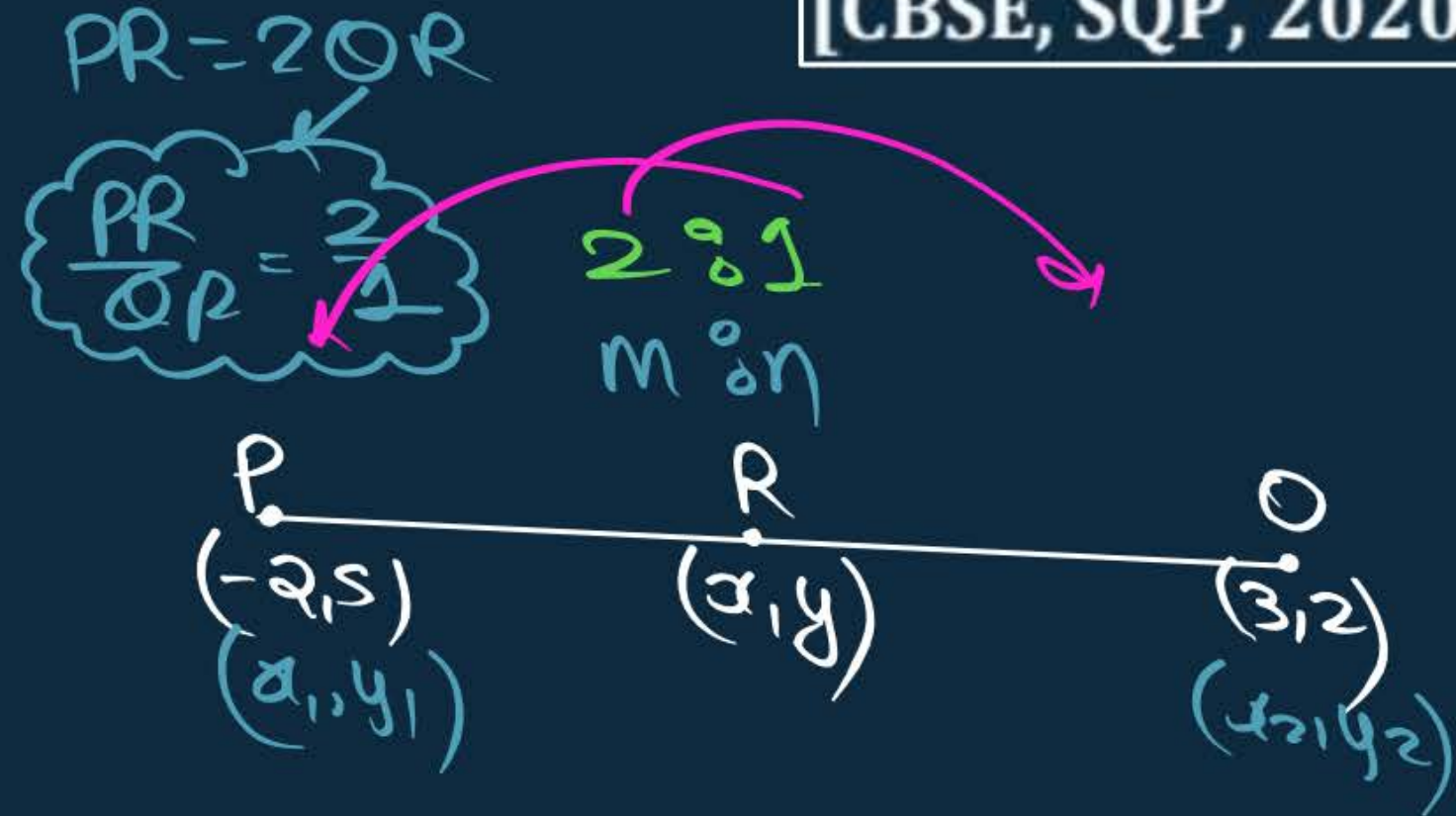
$3 = 3y$

$1 = y$

$$2 = \frac{3y + 5}{4}$$

$$8 = 3y + 5$$

#Q. P(–2, 5) and Q(3, 2) are two points. Find the co-ordinates of the point R on PQ such that PR = 2QR.

[CBSE, SQP, 2020-21]

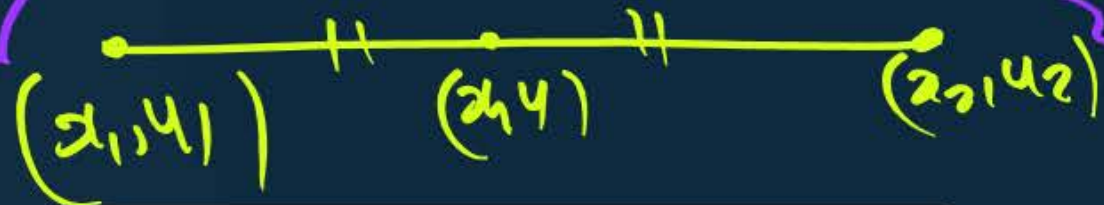$$x = \frac{mx_2 + nx_1}{m+n}, \quad y = \frac{my_2 + ny_1}{m+n}$$

$$x = \frac{6+ -2}{3}, \quad y = \frac{4+5}{3}$$

$$x = \frac{4}{3}, \quad y = 3$$

$$PR = 2QR$$

$$\frac{PR}{QR} = \frac{2}{1}$$

$$2 : 1$$
$$m : n$$

P
(–2,5)
(x_1, y_1)

R
(x, y)

Q
(3,2)
(x_2, y_2)

#Q. If the mid-point of the line segment joining $A\left[\dfrac{x}{2}, \dfrac{y+1}{2}\right]$ and $B(x+1, y-3)$ is C$(5, -2)$, find x,y.
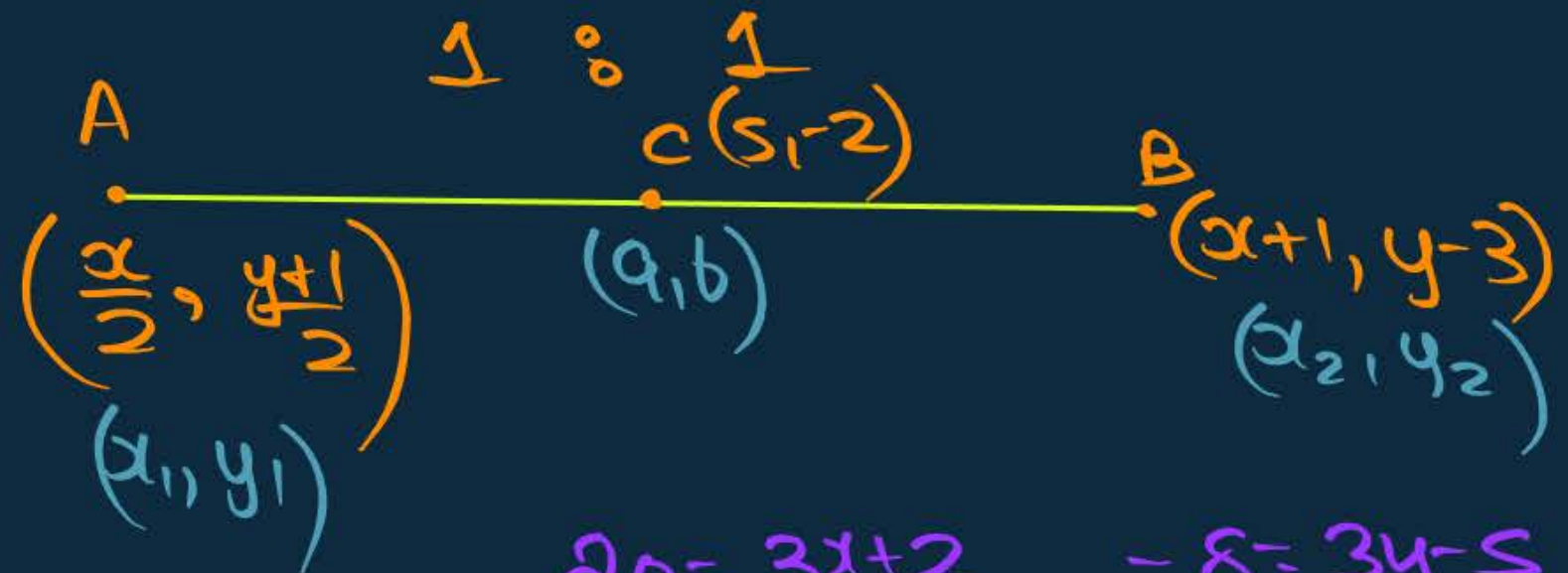
(x_1, y_1) — (x, y) — (x_2, y_2)

$$x = \frac{x_1 + x_2}{2} , \quad y = \frac{y_1 + y_2}{2}$$

$$a = \frac{\frac{x}{2} + x + 1}{2}, \quad b = \frac{\frac{y+1}{2} + y - 3}{2}$$

$$5 = \frac{\frac{x + 2x + 2}{2}}{\frac{2}{1}} \qquad -2 = \frac{\frac{y + 1 + 2y - 6}{2}}{\frac{2}{1}}$$

$$\boxed{5 = \frac{3x + 2}{4}, \qquad -2 = \frac{3y - 5}{4}}$$

$$A \xrightarrow{\quad 1 : 1 \quad} \overset{C(5,-2)}{\bullet} \longrightarrow B$$

$A\left(\dfrac{x}{2}, \dfrac{y+1}{2}\right)$ (x_1, y_1)

$C(5,-2)$ (a, b)

$B(x+1, y-3)$ (x_2, y_2)

$$20 = 3x + 2 \qquad -8 = 3y - 5$$
$$18 = 3x \qquad -8 + 5 = 3y$$
$$\boxed{6 = x} \qquad \frac{-3}{3} = y$$
$$\boxed{-1 = y}$$

$(9,4)$

mid-point

$(2,4)$

(x_1, y_1)

$\dfrac{2+5}{2}, \dfrac{4+6}{2}$

$\dfrac{7}{2}, 5$

$(5,6)$

(x_2, y_2)
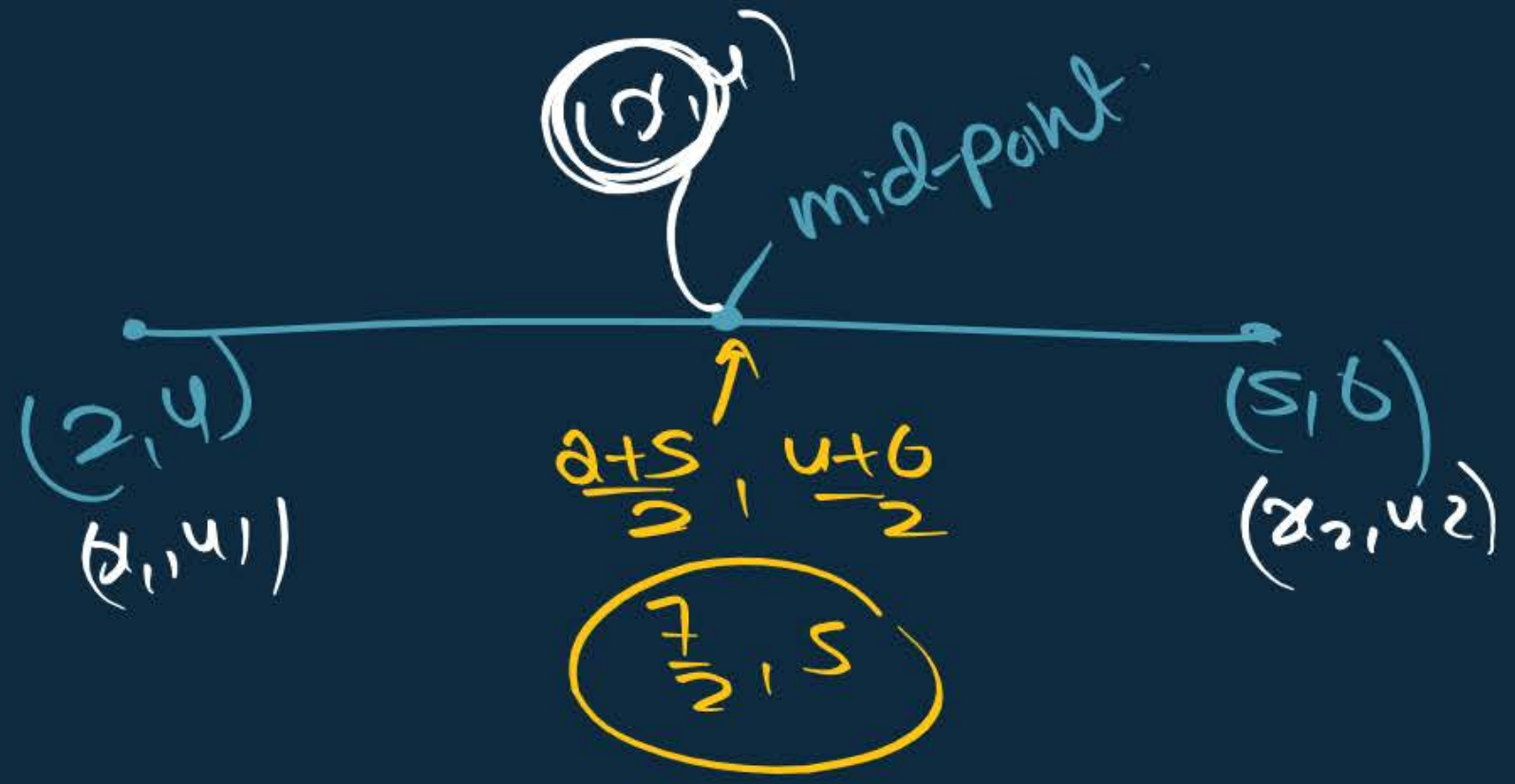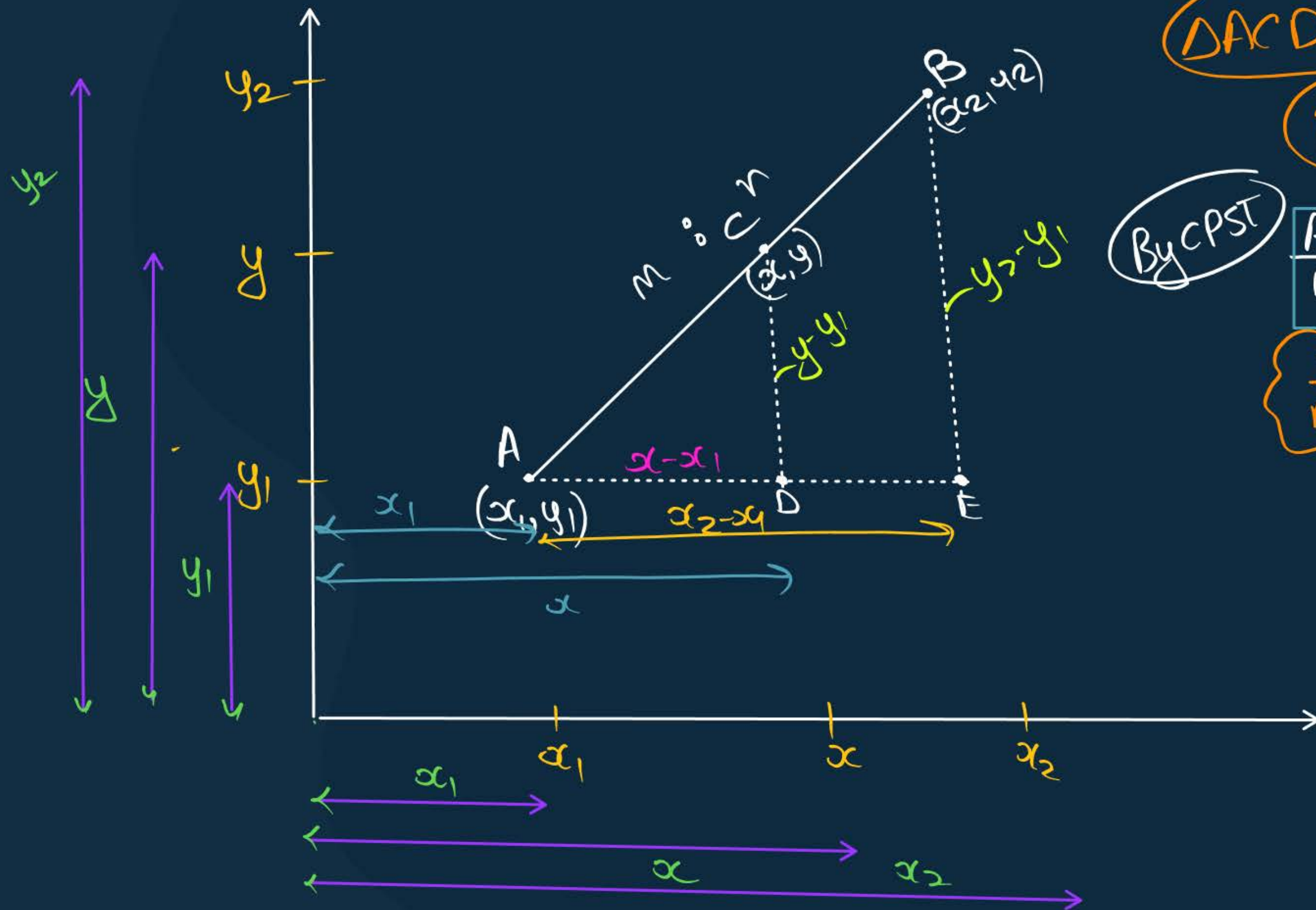
$\triangle ACD \sim \triangle ABE$

By AA

By CPST

$$\frac{AC}{AB} = \frac{CD}{BE} = \frac{AD}{AE}$$

$$\frac{m}{m+n} = \frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$$

$m : c : n$

(x, y)

B (x_2, y_2)

$y_2 - y_1$

$y - y_1$

A

$x - x_1$

(x_1, y_1)

$x_2 - x_1$

D

E

y_2

y

y_1

x_1

x

x_2

$$\frac{M}{m+n} = \frac{y-y_1}{y_2-y_1}$$

$$m(y_2-y_1) = (y-y_1)(m+n)$$

$$my_2 - my_1 = my + ny - my_1 - ny_1$$

$$my_2 = my + ny - ny_1$$

$$my_2 + ny_1 = my + ny$$

$$my_2 + ny_1 = y(m+n)$$

$$\boxed{\frac{my_2 + ny_1}{m+n} = y}$$

$$\frac{M}{m+n} = \frac{x-x_1}{x_2-x_1}$$

$$m(x_2-x_1) = (m+n)(x-x_1)$$

$$mx_2 - mx_1 = mx - mx_1 + nx - nx_1$$

$$mx_2 = mx + nx - nx_1$$

$$mx_2 + nx_1 = mx + nx$$

$$mx_2 + nx_1 = x(m+n)$$

$$\boxed{\frac{mx_2 + nx_1}{m+n} = x}$$