

Ex 2A

①

$$M\bar{x} = \sum M_i x_i$$

$$(1+2+3)\bar{x} = (1 \times 1) + (3 \times 2) + (6 \times 3)$$

$$6\bar{x} = 25$$

$$\bar{x} = \frac{25}{6} = 4\frac{1}{6}$$

\therefore C.O.M @ $(4\frac{1}{6}, 0)$

②

$$M\bar{y} = \sum M_i y_i$$

$$(4+3+2+5)\bar{y} = (2 \times 4) + (4 \times 3) + (5 \times 2) + (6 \times 5)$$

$$14\bar{y} = 8 + 12 + 10 + 30$$

$$\bar{y} = 4\frac{1}{2}$$

Com @ $(0, 4\frac{1}{2})$

③

$$M \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \sum M_i \begin{pmatrix} x_i \\ y_i \end{pmatrix}$$

$$(2+4+4) \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = 2 \begin{pmatrix} 1 \\ 1 \end{pmatrix} + 4 \begin{pmatrix} 3 \\ 3 \end{pmatrix} + 4 \begin{pmatrix} 4 \\ 4 \end{pmatrix}$$

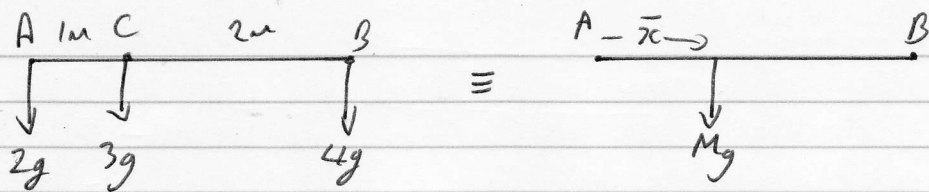
$$10 \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 2 \\ 2 \end{pmatrix} + \begin{pmatrix} 12 \\ 12 \end{pmatrix} + \begin{pmatrix} 16 \\ 16 \end{pmatrix}$$

$$10 \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 30 \\ 30 \end{pmatrix}$$

$$\begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 3 \\ 3 \end{pmatrix}$$

Com @ $(3, 3)$

(4)



$$M \bar{x} = \sum M_i x_i$$

$$(2+3+4) \bar{x} = (2 \times 0) + (3 \times 1) + (4 \times 3)$$

$$9 \bar{x} = 15$$

$$\bar{x} = \frac{15}{9} = 1\frac{2}{3}$$

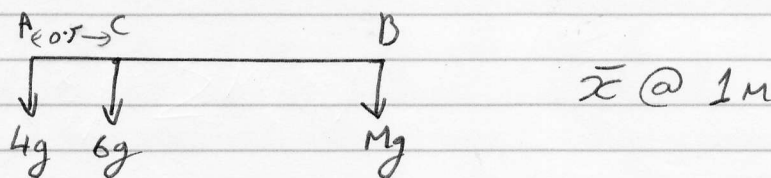
(5)

$$(3+5+M) \times 4 = (3 \times 2) + (5 \times 4) + (M \times 5)$$

$$32 + 4M = 26 + 5M$$

$$M = 32 - 26 = 6 \text{ kg}$$

(6)



$$(4+6+M) \times 1 = (4 \times 0) + (6 \times 0.5) + (M \times 2)$$

$$10 + M = 3 + 2M$$

$$M = 7 \text{ kg}$$

(7)

$$(2+3+2) \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = 2 \begin{pmatrix} 2 \\ 3 \end{pmatrix} + 3 \begin{pmatrix} 3 \\ 6 \end{pmatrix} + 2 \begin{pmatrix} -3 \\ 2 \end{pmatrix}$$

$$7 \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 4 \\ 6 \end{pmatrix} + \begin{pmatrix} 9 \\ 18 \end{pmatrix} + \begin{pmatrix} -6 \\ 4 \end{pmatrix}$$

$$7 \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 7 \\ 28 \end{pmatrix}$$

$$\begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 1 \\ 4 \end{pmatrix}$$

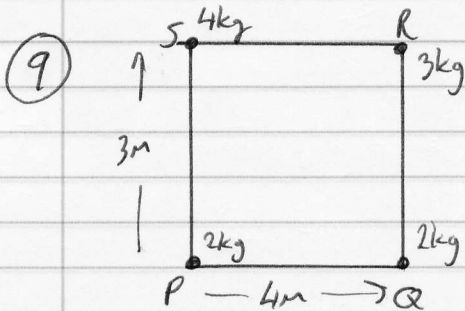
∴ Com @ (1, 4)

$$(8) (M+M+M+M) \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = M \begin{pmatrix} 3 \\ 5 \end{pmatrix} + M \begin{pmatrix} -1 \\ 2 \end{pmatrix} + M \begin{pmatrix} 3 \\ -4 \end{pmatrix} + M \begin{pmatrix} -3 \\ -2 \end{pmatrix}$$

$$4 \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 0.5 \\ 0.25 \end{pmatrix}$$

\therefore com @ $(0.5, 0.25)$



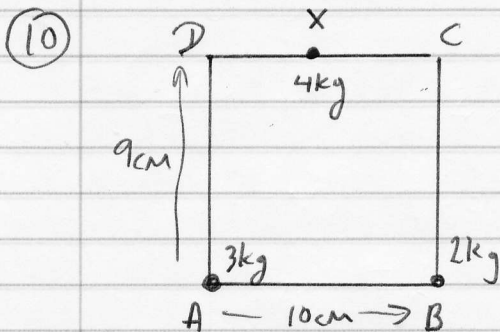
Taking P as origin...

$$(2+2+3+4) \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = 2 \begin{pmatrix} 0 \\ 0 \end{pmatrix} + 2 \begin{pmatrix} 4 \\ 0 \end{pmatrix} + 3 \begin{pmatrix} 4 \\ 3 \end{pmatrix} + 4 \begin{pmatrix} 0 \\ 3 \end{pmatrix}$$

$$11 \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 20 \\ 21 \end{pmatrix}$$

$$\begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 1.82 \\ 1.91 \end{pmatrix}$$

\therefore (a) 1.91 from PQ (b) 1.82 from PS



Taking A as origin...

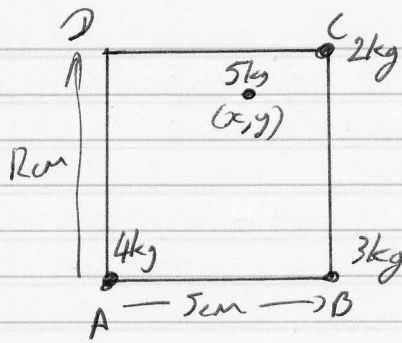
$$(3+2+4) \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = 3 \begin{pmatrix} 0 \\ 0 \end{pmatrix} + 2 \begin{pmatrix} 10 \\ 0 \end{pmatrix} + 4 \begin{pmatrix} 5 \\ 9 \end{pmatrix}$$

$$9 \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 40 \\ 36 \end{pmatrix}$$

$$\begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 4.4 \\ 4 \end{pmatrix}$$

\therefore Com is (a) 4cm from AB (b) 4.4cm from AD.

(11)



Com @ (2.5, 6)

$$(4+3+2+5) \begin{pmatrix} 2.5 \\ 6 \end{pmatrix} = 4 \begin{pmatrix} 0 \\ 0 \end{pmatrix} + 3 \begin{pmatrix} 5 \\ 0 \end{pmatrix} + 2 \begin{pmatrix} 5 \\ 12 \end{pmatrix} + 5 \begin{pmatrix} x \\ y \end{pmatrix}$$

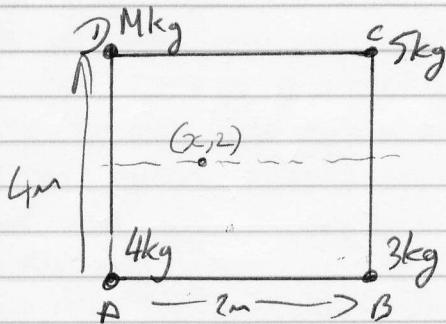
$$\begin{pmatrix} 35 \\ 84 \end{pmatrix} = \begin{pmatrix} 25 \\ 24 \end{pmatrix} + 5 \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\begin{pmatrix} 10 \\ 60 \end{pmatrix} = 5 \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 2 \\ 12 \end{pmatrix}$$

∴ 5 kg mass is 2 cm from AD and 12 cm from AB

(12)



y of com on line y = 2

$$(4+3+5+M) \begin{pmatrix} \bar{x} \\ 2 \end{pmatrix} = 4 \begin{pmatrix} 0 \\ 0 \end{pmatrix} + 3 \begin{pmatrix} 2 \\ 0 \end{pmatrix} + 5 \begin{pmatrix} 2 \\ 4 \end{pmatrix} + M \begin{pmatrix} 0 \\ 4 \end{pmatrix}$$

$$(12+M) \begin{pmatrix} \bar{x} \\ 2 \end{pmatrix} = \begin{pmatrix} 16 \\ 20+4M \end{pmatrix}$$

$$\text{So } (12+M)2 = 20+4M$$

$$24+2M = 20+4M$$

$$2M = 4$$

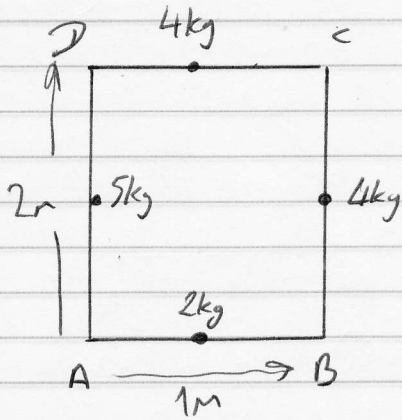
$$M = 2$$

$$\text{and } (12+M)\bar{x} = 16$$

$$14\bar{x} = 16$$

$$\bar{x} = \frac{16}{14} = 1\frac{1}{7} \text{ cm}$$

13



Taking A as origin...

$$(2+4+4+5) \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = 2 \begin{pmatrix} 0.5 \\ 0 \end{pmatrix} + 4 \begin{pmatrix} 1 \\ 1 \end{pmatrix} + 4 \begin{pmatrix} 0.5 \\ 2 \end{pmatrix} + 5 \begin{pmatrix} 0 \\ 1 \end{pmatrix}$$

$$15 \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 7 \\ 17 \end{pmatrix}$$

$$\therefore \begin{pmatrix} \bar{x} \\ \bar{y} \end{pmatrix} = \begin{pmatrix} 0.47 \\ 1.13 \end{pmatrix}$$

\therefore Com is (a) 1.13 m from AB (b) 0.47 m from AD.