Mechanics 2 - Moments 2

SECTION 1

① 2% ② 1%

1) $X \sim N(500, 400)$ ① $z = -2.06 \Rightarrow x = 500 - 2.06 \times 20 = 459$

② $z = 2.3263 \Rightarrow x = 500 + 2.3263 \times 20 = 547$

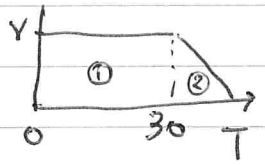
So acceptable between 459 to 547 kg

2) a) $S_{xy} = 55283.6 - \frac{3146 \cdot 72 \times 544 \cdot 5}{31} = 239.276$

$r = \frac{239.276}{\sqrt{2108.81 \times 168.791}} = 0.4011$ (weak positive)

(b) As pressure increases so does temperature (weakly)

b) OCT: as Pressure increases, temp tends to decrease (weakly)
This is the opposite effect in MAT.

3) 

① $30V = \frac{3}{5}D$ ② $\frac{1}{2}(T-30)V = \frac{2}{5}D$

①/② $\Rightarrow \frac{30}{\frac{1}{2}(T-30)} = \frac{3}{2}$ $120 = 3T - 90$ $T = 70$ s

3 a) i) $5 \times 3 + 4 \times 1 - 6 \times 2 - 3 \times 1 = 4$ Nm clockwise

ii) $5 \times 10 \sin 30° = 25$ Nm clockwise

b) i) $P = Q + 60g$ $\uparrow = \downarrow$ ① $Q \times 1 = 30g + 20g \times 2$ ② (PIVOT)

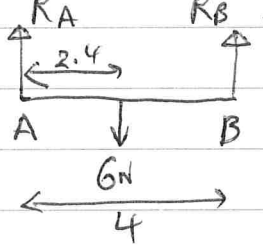
② $\Rightarrow Q = 100g$ ① $\Rightarrow P = 160g$

ii) $P = 5g + 10g + 10g = 25g$ $\downarrow = \uparrow$

(PIVOT) $5g \times 3 + 10g \times 1 = x \times 10g$

$\Rightarrow x = 2.5$ m

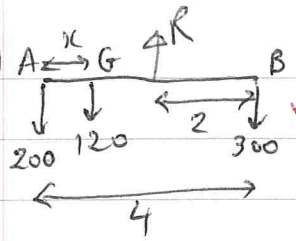
SECTION 2

1) 

① $\uparrow = \downarrow$ $R_A + R_B = 6N$ ✓

② (A) $2.4 \times 6 = 4 \times R_B$ ✓ $\Rightarrow R_B = 3.6N$ ✓

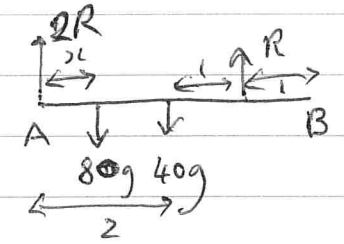
① $\Rightarrow R_A = 2.4N$ ✓

2) 

$\circlearrowright R$ $\quad 2\times 200 + (2-x)\times 120 = 2\times 300$

$400 + 240 - 120x = 600$

$x = \frac{1}{3}$ m

3) 

a) $\downarrow = \uparrow$ $\quad 3R = 120g$

$R = 40g$

b) $\circlearrowright A$ $\quad 80g \times x + 40g \times 2 = R \times 3$

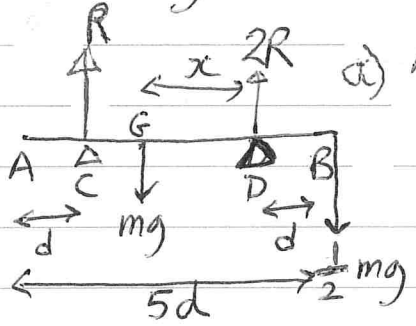
$\Rightarrow \quad 80gx + 80g = 120g$

$\Rightarrow \quad x = \frac{1}{2}$ m

c) i) Weight acts at midpoint

ii) All forces act along a horizontal line

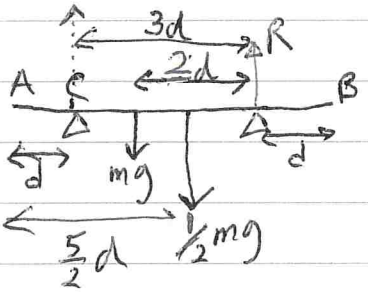
iii) Weight acts at a single point

4) 

a) $\uparrow = \downarrow$ $\quad 3R = \frac{3}{2}mg \Rightarrow R = \frac{1}{2}mg$

$\circlearrowright D$ $\quad x \times mg = R \times 3d + \frac{1}{2}mg \times d$

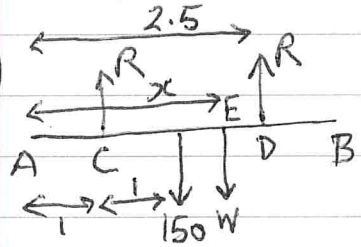
$\Rightarrow x = \frac{1}{2}\times 3d + \frac{1}{2}\times d = 2d$



b) $\circlearrowright C$ $\quad R \times 3d = \frac{1}{2}mg \times \frac{3}{2}d + mg \times d$

$\Rightarrow \quad 3R = \frac{3}{4}mg + mg = \frac{7}{4}mg$

$R = \frac{7}{12}mg$

5) 

a) $\uparrow = \downarrow$ $\quad 2R = W + 150$ $\quad (1)$

$\circlearrowright A$ $\quad Wx + 150\times 2 = R\times 1 + R\times 2.5$

$Wx + 300 = 3.5R$ $\quad (2)$

$(1) \Rightarrow Wx + 300 = 3.5\left(\frac{W+150}{2}\right) \times 4$

$4Wx + 1200 = 7W + 1050$

$\Rightarrow 7W - 4Wx = 150$

$W(7-4x) = 150 \Rightarrow W = \frac{150}{7-4x}$

b) $7 - 4x > 0 \Rightarrow x < \frac{7}{4}$ or $0 \le x < \frac{7}{4}$