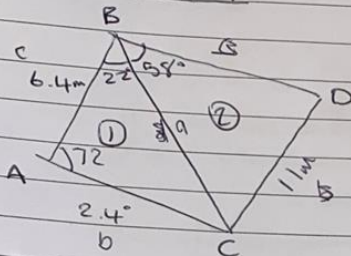


53%

Maths Exam

Cerith Owen Davies
2115743

Question 1



Q1-28

Shape 1

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$a^2 = 2.4^2 + 6.4^2 - 2 \times 2.4 \times 6.4 \times \cos(72)$$

$$a = 37.226$$

$$= \sqrt{37.2}$$

$$= 6.1$$

4

~~$$\cos 72 = \frac{6.4^2 + 2.4^2 - 37.2^2}{2 \times 6.4 \times 2.4}$$~~

$$\frac{\sin 72}{37.226.1} = \frac{\sin B}{2.4} = \frac{\sin C}{6.4}$$

$$\sin B = \frac{2.4 \sin 72}{37.226.1}$$

$$= 0.0618$$

$$B = \sin^{-1}(0.0618)$$

$$= 3.514^\circ$$

$$= 0.3741$$

$$B = \sin^{-1}(0.3741)$$

$$= 21.97^\circ$$

$$= 22^\circ$$

5

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$$\sin C = \frac{6.1 \sin(72)}{8.5786.1} =$$

$$\sin C = \frac{6.1 \sin(72)}{8.5786.1} =$$

$$= 0.9978$$

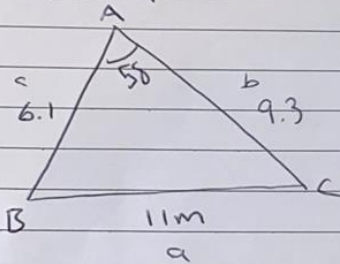
$$= \sin^{-1}(0.9978)$$

$$= 86.19^\circ$$

$$= 86^\circ$$

5

Shape 2



B_x

$$b^2 = a^2 + c^2 - 2ac \cos A$$
$$11^2 + 6.1^2 - 2 \times 11 \times 6.1 \cos(58)$$
$$= \sqrt{87.1}$$
$$b = 9.3m$$

$$\frac{\sin 58}{11} = \frac{\sin B}{9.3}$$

$$\sin B = \frac{9.3 \sin 58}{11}$$

$$= 0.7169$$

$$= \sin^{-1}(0.7169)$$

$$= 45.79^\circ$$

$$= 46^\circ$$

$$\frac{\sin 58}{11} = \frac{\sin C}{6.1}$$

$$\begin{aligned} \sin C &= \frac{6.1 \sin(58)}{11} \\ &= 0.4702 \\ &= \sin^{-1}(0.4702) \\ &= 28.04 \\ &= 28^\circ \end{aligned}$$

4

area of ABC =

$$\frac{1}{2} b \times c \times \sin A$$

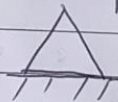
$$\begin{aligned} &= \frac{1}{2} 2.4 \times 6.4 \times \sin 7 \\ &= 7.3 \text{ m}^2 \end{aligned}$$

10

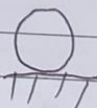
Question 2

a)

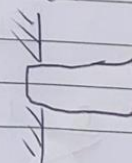
Pin Support



Roller



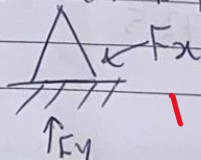
Fixed Support



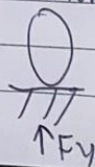
9

b)

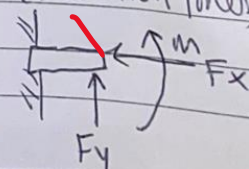
Pin Support
(2 reactions forces)



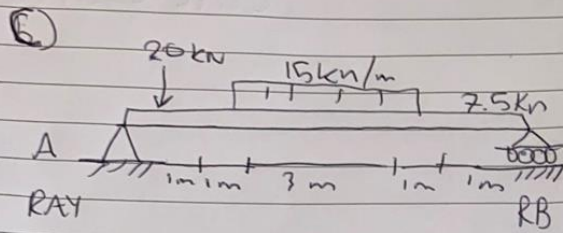
Roller
(1 reaction force)



Fixed support
(3 reaction forces)



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$$\sum H = 0$$

$$R_{Ax} = 0$$

$$R_{Ay} + R_B - 20 - 45 - 7.5 = 0$$

$$R_{Ay} + R_B - 72.5 = 0$$

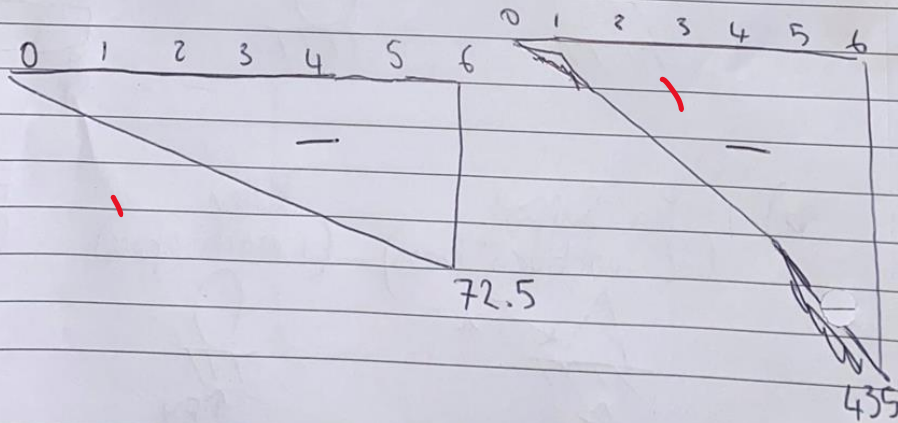
$$R_{Ay} + R_B = 72.5$$

$R_A = ?$
 $R_B = ?$

Ed) Section	Shear force	Bending moments
Point A	SF = 0	Bmo = 0
1m	-20	$-20 \times 1 = -20$
5m	-65	$-65 \times 5 = -325$
6m	-72.5	$-72.5 \times 6 = -435$

SFD

BMD



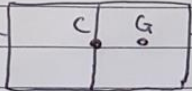
Question 3

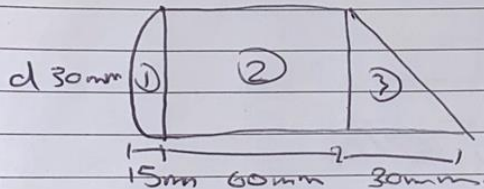
Q3-11

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a) Centre of gravity is the point where gravity acts on the body and centroid is the geometric centre of the object

b) $C = G$ — Block of wood

c)  — Steel



⊕ Shape 1

$$I_{xx1} = \left(\frac{\pi}{8} \times r^4 \right) / 8$$

$$I_{xx1} = (3.142 \times 15^4) / 8$$

$$I_{xx1} = 19,882.97 \text{ mm}^4$$

Centroid

$$I_{yy1} = \left(\frac{\pi}{8} \times r^4 \right) / 8$$

$$I_{yy1} = (3.142 \times 15^4) / 8$$

$$I_{yy1} = 19,882.97 \text{ mm}^4$$

Shape 2

$$I_{xx2} = (b \times d^3) / 12$$

$$I_{xx2} = (60 \times 30^3) / 12$$

$$I_{xx2} = 135000 \text{ mm}^4$$

$$I_{yy2} = (d \times b^3) / 12$$

$$I_{yy2} = (30 \times 60^3) / 12$$

$$I_{yy2} = 540000 \text{ mm}^4$$

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Shape 3

$$I_{xx} = (b \times h^3) / 36$$

$$I_{xx} = (30 \times 30^3) / 36$$

$$I_{xx} = 22500 \text{ mm}^4$$

$$I_{yy} = (h \times b^3) / 36$$

$$I_{yy} = (30 \times 30^3) / 36$$

$$I_{yy} = 22500 \text{ mm}^4$$

$$I_{xx} = I_{xx1} + I_{xx2} + I_{xx3}$$

$$I_{xx} = 177382.97 \text{ mm}^4$$

$$I_{yy} = I_{yy1} + I_{yy2} + I_{yy3}$$

$$I_{yy} = 582382.97 \text{ mm}^4$$

CB