

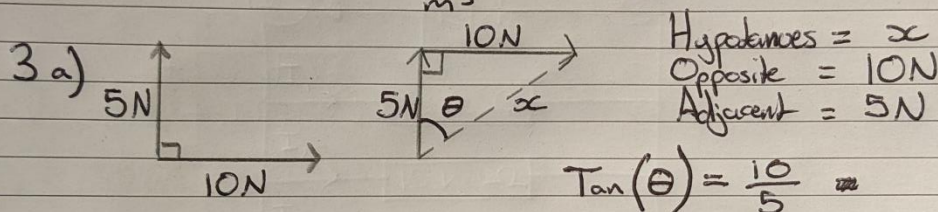
Introduction to Mathematics and Science
(ACHA3000)

- 1
- a) Area = m^2
 - b) Volume = m^3
 - c) Mass = kg
 - d) Force = kgm/s^2 and N
 - e) Weight = kgm/s^2 and N

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$$\text{Density} = \frac{\text{Mass}}{\text{Volume}} \quad \text{Mass} = \frac{\text{kg}}{\text{Volume} = m^3}$$

$$\text{Density} = \frac{\text{kg}}{m^3} = \text{kg}/m^3$$



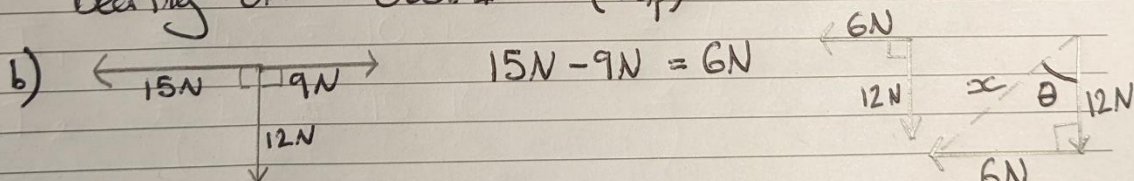
$$\tan(\theta) = \frac{10}{5}$$

$$\theta = \tan^{-1}(2) = 63.435^\circ \quad \tan(\theta) = 2$$

$$a^2 + b^2 = c^2$$

$$10^2 + 5^2 = x^2 \quad x = \sqrt{125} = 11.180N \text{ (3dp)}$$

$\therefore$ The resultant of this vector is of a magnitude of 11.180N (3dp), diagonally up and to the right, on a bearing of 063.4° (1dp)



$$\begin{aligned} \text{Opposite} &= 6N \\ \text{Adjacent} &= 12N \\ \text{Hypotenuses} &= x \end{aligned} \quad \tan(\theta) = \frac{6}{12} \quad \text{Bearing} = 180^\circ + 26.565^\circ = 206.565^\circ$$

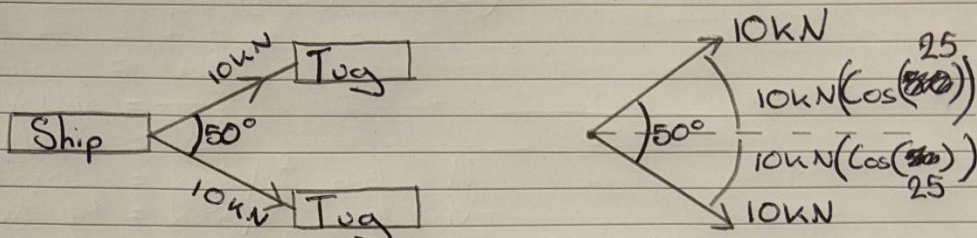
$$\tan^{-1}(0.5) = \theta = 26.565^\circ \text{ (3dp)}$$

$$a^2 + b^2 = c^2 \quad 12^2 + 6^2 = x^2 \quad x = 13.416N \text{ (3dp)}$$

$\therefore$ The resultant vector is of a magnitude of 13.416N (3dp), diagonally down and to the left, on a bearing of 206.565° (3dp).

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~~$10 \times 10^3 \text{ N} (\cos(50)) = 6.4279 \times 10^3 \text{ N}$~~

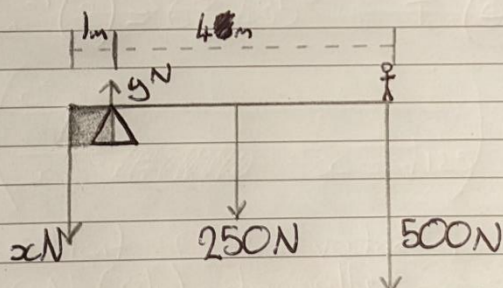
$$10 \times 10^3 (\cos(25)) = 9.063 \times 10^3 \text{ N}$$

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a) $\therefore$ The resultant force on the ship is $18.126 \times 10^3 \text{ N}$

b) $10 \text{ kN} + 10 \text{ kN} = 20 \text{ kN}$ $20 \times 10^3 \text{ N} - 18.126 \times 10^3 \text{ N} = 1874 \text{ N}$

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a) Moments about pivot point, labelled " Δ " " yN "

$$CW = ACW \quad (500 \text{ N} \times 1 \text{ m}) + (250 \text{ N} \times 1.5 \text{ m}) = (x \text{ N} \times 2.5 \text{ m})$$

$$2000 \text{ Nm} + 375 \text{ Nm} = x \text{ Nm} \quad x = 2375 \text{ N}$$

$\therefore$ The force on the bolts = 2375 N

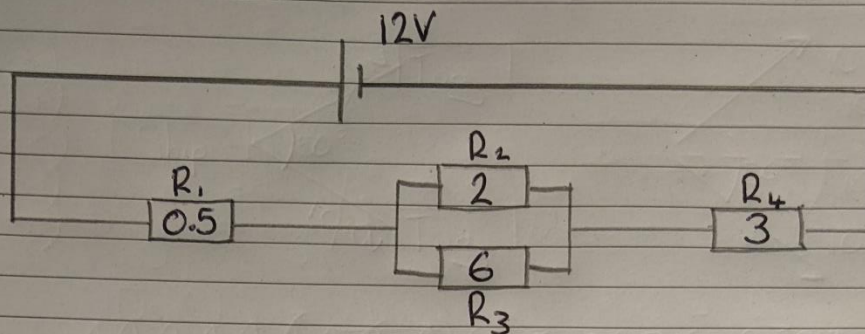
b) Moments about the bolts, labelled " xN "

$$CW = ACW \quad (500 \text{ N} \times 5 \text{ m}) + (250 \text{ N} \times 2.5 \text{ m}) = (y \text{ N} \times 1 \text{ m})$$

$$2500 \text{ Nm} + 625 \text{ Nm} = y \text{ Nm} \quad y = 3125 \text{ N}$$

$\therefore$ The force on the edge of the pool is $= 3125 \text{ N}$

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a) The direction of conventional flow is 'A' positive to negative

b) $R_T = R_1 + \left(\frac{1}{\frac{1}{R_2} + \frac{1}{R_3}} \right) + R_4 \therefore R_T = 5 \Omega$

c) $V = IR \quad 12V = I \times 5 \Omega \quad \frac{12}{5} = I = 2.4A$

d) $V = IR \quad V = 2.4 \times 3 \Omega \quad R_4 V = 7.2V$

e) **KVL** $12V - R_1 V - R_2 V - 7.2V = 0$

$R_1 V = 2.4A \times 0.5 \Omega = R_1 V = 1.2V$

$12V - 1.2V - 7.2V = R_2 V = 3.6V$

$V = IR \quad 3.6V = I \times 2 \Omega \quad I = \frac{3.6}{2} = 1.8A$

f) $V = IR \quad 3.6V = I \times 6 \Omega \quad I = \frac{3.6}{6} = 0.6A$

g) energy = power power = $V \times I$

$R_1 = 1.2V \times 2.4A = 2.88W$

$R_2 = 3.6V \times 1.8A = 6.48W$

$R_3 = 3.6V \times 0.6A = 2.16W$

$R_4 = 7.2V \times 2.4A = 17.28W$

$\therefore$ Resistor 4 transfers the highest amount of energy