SOLUTIONS TO TUTORIAL EXAMPLES

CHAPTER 9

Question (a)

Vertical equilibrium:

$R_A + R_B = (40 \text{ kN/m} \times 3 \text{ m}) = 120 \text{ kN}$

Taking moments about A:

$4 \text{ m} \times R_B = (40 \text{ kN/m} \times 3 \text{ m} \times 1.5 \text{ m})$

$4R_B = 180$

$R_B = 180/4 = 45 \text{ kN}$

Taking moments about B:

$4 \text{ m} \times R_A = (40 \text{ kN/m} \times 3 \text{ m} \times 2.5 \text{ m})$

Note: the 2.5 m is the horizontal distance from B to the centre-line of the 40 kN/m uniformly distributed load (UDL).

$4R_A = 300$

$R_A = 300/4 = 75 \text{ kN}$

Check: $R_A + R_B = 75 + 45 = 120 \text{ kN}$ √ OK

Question (b)

Vertical equilibrium:

$R_A + R_B = 6 + 18 = 24$ kN.

Taking moments about A:

4 m $\times R_B = (6$ kN $\times 2$m$) + (18$ kN $\times 3$ m$)$

$4R_B = 12 + 54 = 66$

$R_B = 66/4 = 16.5$ kN.

Taking moments about B:

4 m $\times R_A = (6$ kN $\times 2$ m$) + (18$ kN $\times 1$ m$)$

$4R_A = 12 + 18 = 30$ kN.

$R_A = 30/4 = 7.5$ kN.

Check: $R_A + R_B = 7.5 + 16.5 = 24$ kN √ OK

Question (c)

Vertical equilibrium:

$R_A + R_B = 30 + 10 = 40$ kN.

Taking moments about A:

4 m $\times R_B = (30$ kN $\times 1$ m$) + (10$ kN $\times 6$ m$)$

$4R_B = 30 + 60 = 90$ kN.

$R_B = 90/4 = 22.5$ kN.

Taking moments about B:

$$(4 \text{ m} \times R_A) + (10 \text{ kN} \times 2 \text{ m}) = (30 \text{ kN} \times 3\text{m})$$

Note: Remember to check which moments are clockwise and which are anti-clockwise.

$$4R_A + 20 = 90$$

$$4R_A = 70$$

$$R_A = 70/4 = 17.5 \text{ kN}$$

Check: $R_A + R_B = 17.5 + 22.5 = 40 \text{ kN} \ \sqrt{} \ \text{OK}$

Question (d)

Vertical equilibrium:

$$R_A + R_B = 20 \text{ kN} + (5 \text{ kN/m} \times 2 \text{ m}) = 30 \text{ kN}.$$

Taking moments about A:

$$4 \text{ m} \times R_B = (20 \text{ kN} \times 1 \text{ m}) + (5 \text{ kN/m} \times 2 \text{ m} \times 3 \text{ m})$$

$$4R_B = 20 + 30 = 50 \text{ kN}.$$

$$R_B = 50/4 = 12.5 \text{ kN}.$$

Taking moments about B:

$$4 \text{ m} \times R_A = (20 \text{ kN} \times 3 \text{ m}) + (5 \text{ kN/m} \times 2 \text{ m} \times 1 \text{ m})$$

$$4R_A = 60 + 10 = 70 \text{ kN}.$$

$$R_A = 70/4 = 17.5 \text{ kN}.$$

Check: $R_A + R_B = 17.5 + 12.5 = 30 \text{ kN} \ \sqrt{} \ \text{OK}$