

Calculate Reaction Forces

Calc REV

Consider rotational equilibrium of moments about A.

$$\overset{\curvearrowleft}{M_A} = \overset{\curvearrowright}{M_A}$$

$$100\text{kN} \times 2.5\text{m} + \text{REV} \times 16\text{m} = 80\text{kN} \times 8\text{m} + 100\text{kN} \times 16\text{m}$$

$$250 + 16\text{REV} = 640 + 1600$$

$$16 \times \text{REV} = 2240 - 250$$

$$\text{REV} = \frac{1990}{16}$$

$$\text{REV} = 124.38$$

$$\underline{\text{REV} = 124\text{kN}}$$

Calculate R_{AV}

$$\overset{\curvearrowleft}{M} = \overset{\curvearrowright}{M}$$

$$100\text{kN} \times 2.5\text{m} + 80\text{kN} \times 8\text{m} + 60\text{kN} \times 16\text{m} = R_{AV} \times 16\text{m}$$

$$250 + 640 + 960 = R_{AV} \times 16\text{m}$$

$$1850 = R_{AV} \times 16\text{m}$$

$$\frac{1850}{16} = R_{AV}$$

$$115.625\text{kN} = R_{AV}$$

$$115.625\text{kN} = R_{AV}$$

$$\underline{116\text{kN} = R_{AV}}$$

checking:

$$\uparrow = \downarrow$$

$$116 + 124 = 60\text{kN} + 80\text{kN} + 100\text{kN}$$

$$\underline{240 = 240}$$

Calculate R_{EH}

Consider B.M at point C

$$124\text{kN} \times 8\text{m} - R_{EH} \times 6\text{m} - 100\text{kN} \times 3\text{m} = 0$$

$$992 - R_{EH} \times 6 - 300 = 0$$

$$692 - R_{EH} \times 6 = 0$$

$$692 = 6 \times R_{EH}$$

$$\frac{692}{6} = R_{EH}$$

$$\underline{115.3 = R_{EH}}$$

Calculate $\overleftarrow{F} = \overrightarrow{F}$

$$115.3 \text{ kN} + 100 \text{ kN} = R_{AH}$$

$$\underline{215.3 \text{ kN} = R_{AH}}$$

b) determine B.M and shear forces at points A, B, C, D and E

Bending moment at B

$$-115.3 \text{ kN} \times 5 \text{ m}$$

$$\underline{-1076.5 \text{ kNm}}$$

B.M at D

$$-115.3 \text{ kN} \times 5 \text{ m} \quad 100 \text{ kN} \times 2.5 \text{ m}$$

$$-576.6 - 250$$

$$\underline{-826.5 \text{ kNm}}$$

SHEAR FORCES

TO calculate θ :

using tangent ratio

$$\frac{\text{opp}}{\text{adj}} = \tan$$

$$\frac{1 \text{ m}}{8 \text{ m}} = \tan \theta$$

$$\tan^{-1} 0.125 = \theta$$

$$\underline{\theta = 7.12^\circ}$$

TO calculate P

using $F \uparrow = F \downarrow$

$$116 \cos 82.88^\circ + 215.3 \sin 7.12 = 60 \cos 82.88^\circ + P$$

$$14.38 + 26.7 = 7.44 + P$$

$$41.08 = 7.44 + P$$

$$\underline{P = 33.64 \text{ kN}}$$

TO calculate V for B

using $F \uparrow = F \downarrow$

$$116 + V \cos 7.12^\circ = 60 + 33.64 \cos 82.88^\circ$$

$$116 + V \cos 7.12^\circ = 60 + 4.17$$

$$V \cos 7.12^\circ = 64.17 - 116$$

$$V = \frac{51.83}{\cos 7.12^\circ}$$

$$\underline{V = 52.23 \text{ kN}}$$

TO calculate V for BC

using $F \uparrow = F \downarrow$

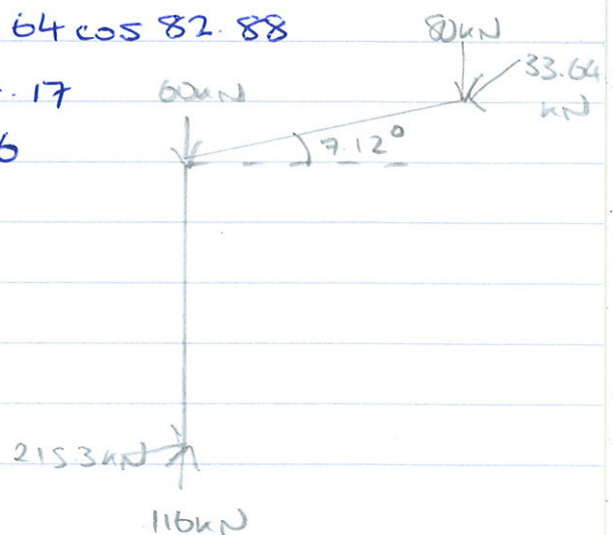
$$116 + V \cos 7.12 = 60 + 80 + 33.64 \cos 82.88$$

$$116 + V \cos 7.12 = 60 + 80 + 4.17$$

$$V \cos 7.12 = 144.17 - 116$$

$$V = \frac{28.17}{\cos 7.12^\circ}$$

$$\underline{V = 28.39 \text{ kN}}$$



TO calculate P

using $F = F$

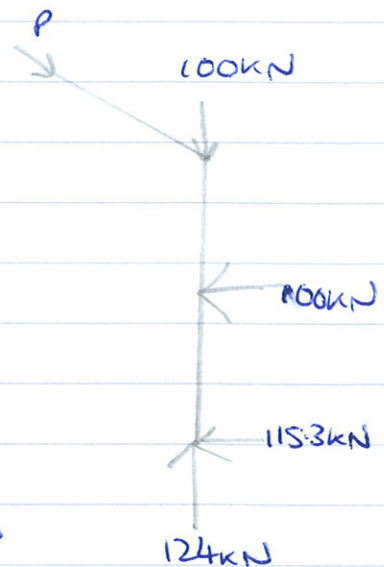
$$124 \cos 82.88^\circ + 115.3 \sin 7.12^\circ = 100 \cos 82.88^\circ + P$$

$$15.37 + 14.30 + 24.79 = 12.39 + P$$

$$54.46 = 12.39 + P$$

$$54.46 - 12.39 = P$$

$$\underline{P = 42.07 \text{ kN}}$$



TO calculate V for D

using $F \downarrow = F \uparrow$

$$124 + V \cos 7.12^\circ = 100 + 42.07 \cos 82.88^\circ$$

$$124 + V \cos 7.12^\circ = 100 + 5.21$$

$$V \cos 7.12^\circ = 105.21 - 124$$

$$V = \frac{18.79}{\cos 7.12^\circ}$$

$$\cos 7.12^\circ$$

$$\underline{V = 18.94 \text{ kN}}$$

TO calculate V for CD

using $F \uparrow = F \downarrow$

$$124 + V \cos 7.12^\circ = 100 + 80 + 42.07 \cos 82.88^\circ + 100 \sin 7.12^\circ$$

$$124 + V \cos 7.12^\circ = 100 + 80 + 5.21 + 12.39$$

$$V \cos 7.12^\circ = 197.6 - 124$$

$$V = \frac{73.6}{\cos 7.12^\circ}$$

$$\underline{V = 74.17 \text{ kN}}$$