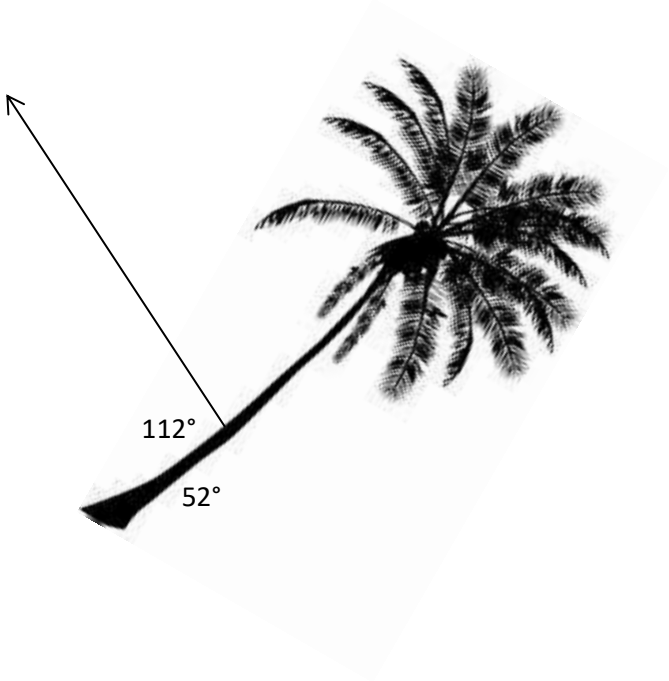
1. A 4 metre palm tree is weakened by one of Perth's storms and begins to fall over towards a fence. A rope is tied 1.2 metres from its base at an angle of 112° to the trunk.
    a. If the palm is 163 kg what tension must the rope be able to support? [4]



[1768N]

    b. What force are the roots still providing? [3]

[886N,4.30]

2. A step ladder with 2 m long legs has a 1 metre long strut securing them half way down each leg. If the combined mass of ladder and person is 80 kg what is the tension in the strut?

[453N]

3. A 300 kg roller with a radius of 40cm is being pulled horizontally over a 10 cm step.
    a. What force is required to pull the roller over this step?

[2590N]

b) What direction SHOULD the roller be pulled to minimise the force required to get the roller over the step and what is the magnitude of this new force?

[41.4° above horizontal, 1944N]

4. A crane (Diagram A) lifts a mass by raising its boom (Diagram B). Explain how this affects tension in the guy line as the crane shifts the mass from its initial position in Diagram A to its position in Diagram B.[4 marks]

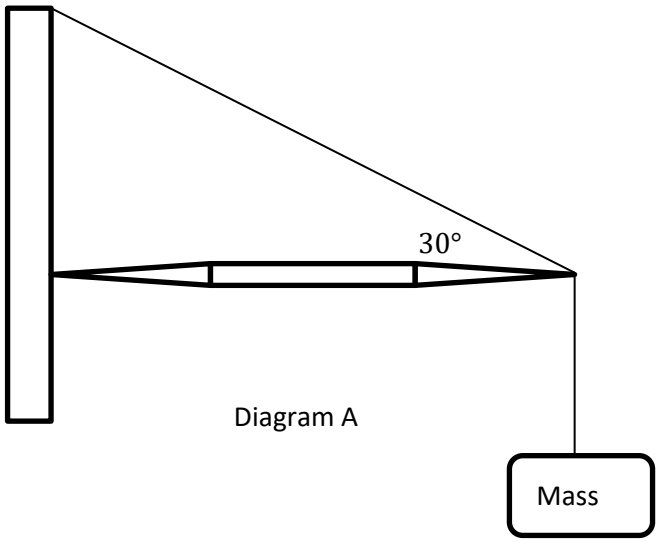


Diagram A

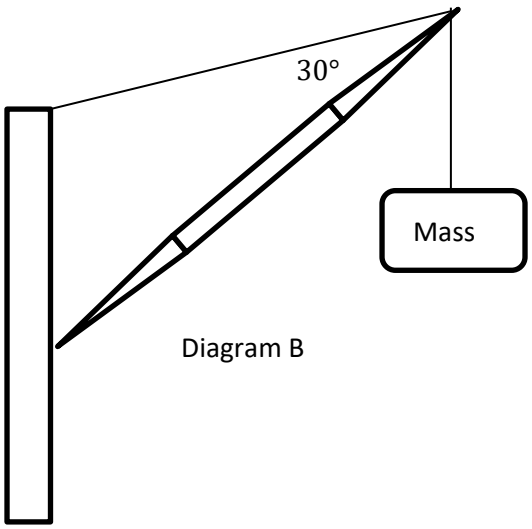
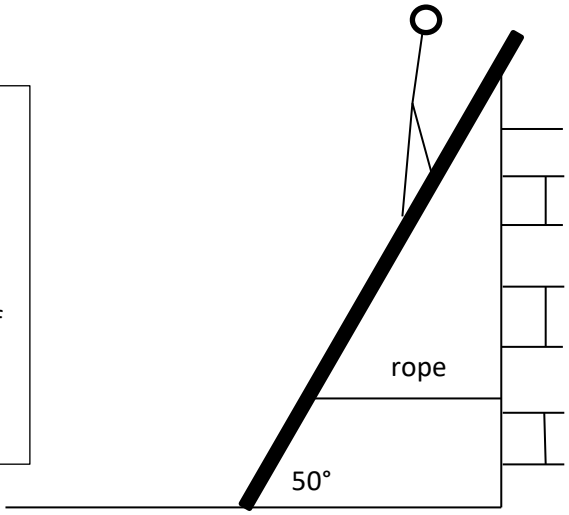


Diagram B

5. A 12 kg, 3 metre ladder is placed on slippery ground and held in place by a horizontal rope tied to the ladder 80 cm from the base. The ladder overhangs a wall it is leaning on by 20cm. A 70 kg painter stand 1 metre from the top of the ladder. The ladder makes an angle of 50 degrees to the ground. Assume wall acts perpendicularly to the ladder.



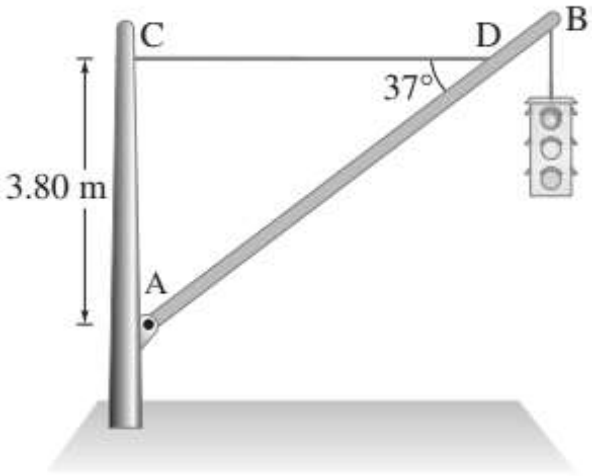
a. What is the tension in the rope? [4 marks]

[327]

b. What is the reaction force of the ground on the ladder? [3 marks]

[529]

6. A traffic light is suspended in a welsh village as shown right from a 14 kg pole. The length of the pole from A to B is 7 metres.



A horizontal cable with a measured tension of 813 N is used as a supporting cable between points C and D.

a. What is the mass of the actual traffic light system hanging from point B?

[529.09]

b. What is the reaction force at point A?

[1023]

Solutions to last 2 question:

1st Question

a. Mcw = Macw

12x9.8x1.5cos50 + 70x9.8x2cos50+ T0.8sin50 = 2.8R

to remove another variable we need another equation.

$F_{left} = F_{right}$

T = Rcos40

T=327 N

b. $F_{up} = F_{down}$

Rsin40 + Vertical ground = 12x9.8+70x9.8

V=529N up

2nd Question

a. Mcw = Macw

14x9.8x3.5cos37 + Mx9.8x7cos37= 3.8x813

M=49.4 kg

$F_{left} = F_{right}$

H = 813 N right

T=327 N

b. $F_{up} = F_{down}$

V=49.4x9.8+14x9.8

V=621 N up

$R^2 = 813^2+621^2$ by Pythagoras so R = 1023 N

for direction (since force is a vector) $\tan\theta = \frac{621}{813}$, θ = 37.4° above the horizontal, away from A.

remember to use at least 5 sig fig in calculations to make sure your answers are correct to 3 sig fig.