2 **(a)** Define the moment of a force about a point.

.....

..... [1]

(b) A tree of mass 270 kg grows out of sloping ground and is supported by a post, as shown in Fig. 2.1.

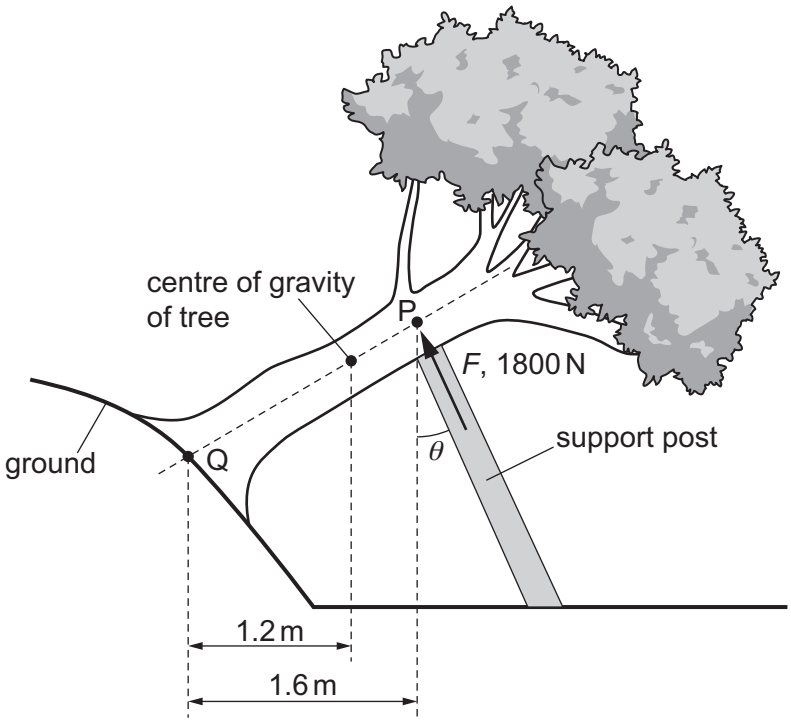

Fig. 2.1 (not to scale)

The ground applies a total force R on the tree at point Q.
The centre of gravity of the tree is a horizontal distance of 1.2 m from Q.
The post applies a force F of 1800 N perpendicular to the line PQ. The line of action of F passes through point P at an angle θ to the vertical. P is a horizontal distance of 1.6 m from Q.
The tree is in equilibrium and all forces act on the tree in the same plane.

(i) By taking moments about point Q, show that θ is 25°.

[3]

(ii) On Fig. 2.2, draw a labelled scale vector triangle to represent the forces acting on the tree. The weight of the tree has been drawn to scale.

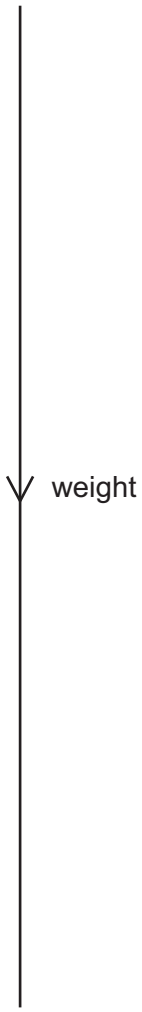

Fig. 2.2

[2]

(iii) The tree exerts a pressure of 150 kPa on the top of the post.

Determine the surface area of the tree in contact with the post.

area = ... m^2 [2]

[Total: 8]