

## **1.3 Moments**

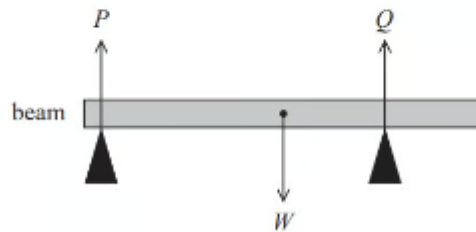
### **MCQ**

1



1 mark

A beam is balanced on two supports as shown.



The beam has a weight  $W$  and the reaction forces at the two supports are  $P$  and  $Q$ .

Which of the following statements about the magnitudes of the forces is correct?

- A.  $P > Q$
- B.  $Q > W$
- C.  $Q > P$
- D.  $(P + Q) > W$

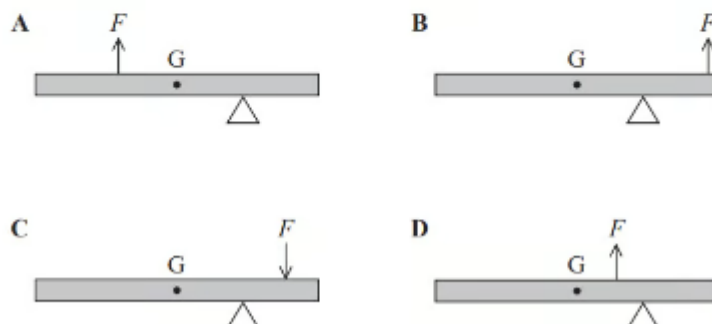
2



1 mark

A beam is supported by a pivot as shown in the diagrams. The centre of gravity of the beam is at  $G$ . The beam is acted on by a force  $F$ .

Which diagram shows an arrangement where the beam could **not** be in equilibrium?



# Structured Questions

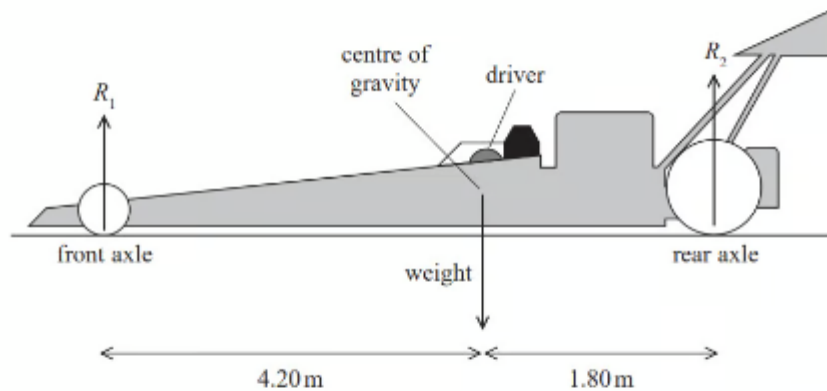
Medium

1a



3 marks

A dragster is a racing car designed for a very short race along a completely straight track, so must be able to accelerate at a very high rate. The dragster and driver shown below have a combined weight of  $1.23 \times 10^4 \text{ N}$ . The centre of gravity is 1.80 m in front of the rear axle.



The front axle of the dragster is 6.00 m from the rear axle.

Calculate the reaction forces  $R_1$  and  $R_2$ , shown on the diagram, when the dragster is stationary and not accelerating.

$R_1 = \dots\dots\dots$

$R_2 = \dots\dots\dots$

1b



2 marks

When the dragster starts, there is a driving force that gives the dragster an initial forward acceleration of  $5.50 \text{ g}$ .

Calculate the initial driving force on the dragster.

Initial driving force =  $\dots\dots\dots$

1c



2 marks

The power from the car's engine is constant.

Explain how the force from the engine varies as the car accelerates.

**Hard**

1a

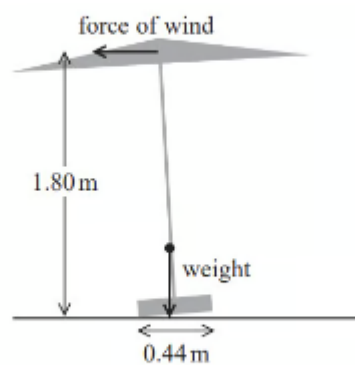


4 marks

A large parasol has been set up on a windy day. The centre of gravity of the parasol is vertically above the centre of the base. The bottom of the parasol starts to lift from the ground as shown. The weight of the parasol is 110 N.



The force of the wind is 14 N in a horizontal direction.



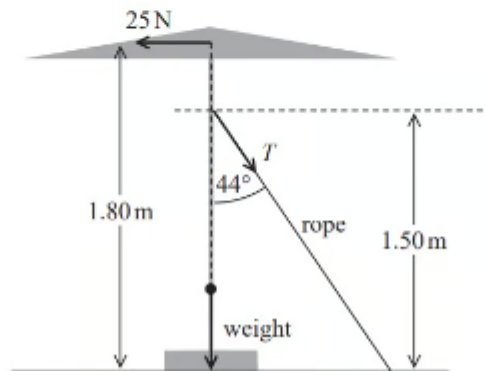
Explain why the parasol will topple. Your answer should include a calculation.

1b



5 marks

To prevent the parasol from toppling, a rope is attached to the parasol at 1.50 m from the ground as shown. The rope makes an angle of  $44^\circ$  to the vertical.



The horizontal force from the wind is now 25 N.

Determine, by taking moments about the centre of the base, the vertical force that the base exerts on the ground.

Assume that the force which the ground exerts on the base acts through the midpoint of the base.

Force exerted on the ground = .....