

RESOLVING FORCES

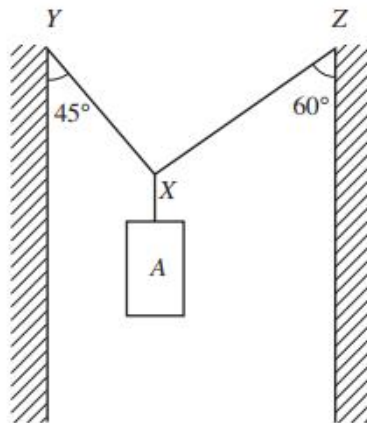
A2 Unit 4: Applied Mathematics B

Section B: Mechanics

WJEC past paper questions: 2010 – 2017

Total marks available 98 (approximately 2 hours)

1. The diagram shows an object A, of mass 15 kg, suspended in equilibrium in a shaft with vertical walls by means of two ropes XY and XZ. The rope XY makes an angle of 45° with the vertical and the rope XZ makes an angle of 60° with the vertical.

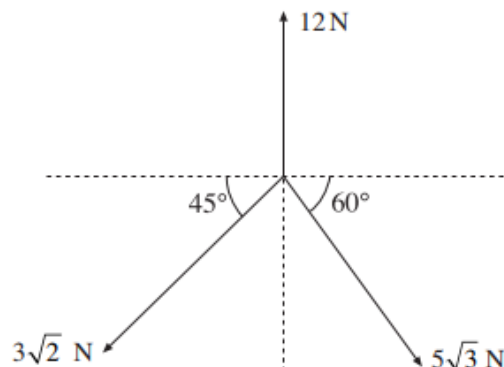


Calculate the tension in each of the ropes XY and XZ.

[7]

(January 10)

2. Three horizontal forces of magnitudes 12 N, $5\sqrt{3}$ N and $3\sqrt{2}$ N act in the directions shown in the diagram below.

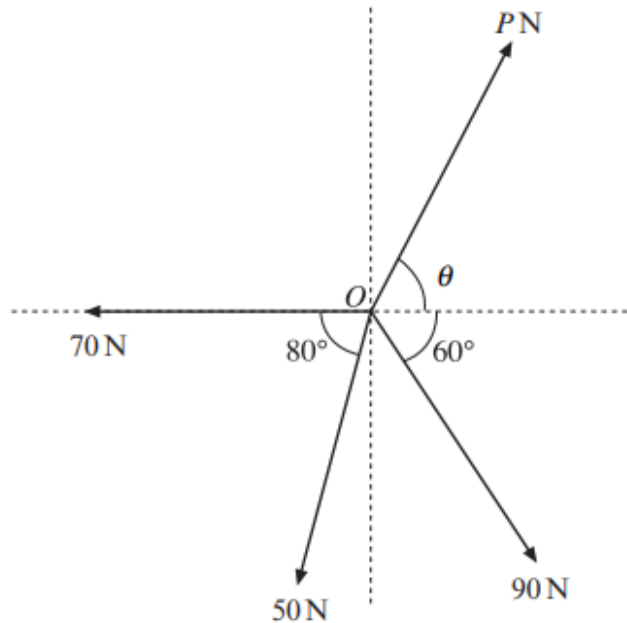


Find the magnitude and direction of the resultant of the three forces.

[8]

(Summer 10)

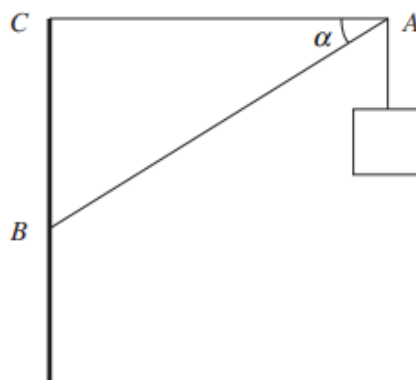
3. The diagram shows four horizontal forces acting at a point O . The forces are in equilibrium.



Calculate the value of P and the size of the angle θ . Give each of your answers correct to one decimal place. [8]

(January 11)

4. The diagram shows a sign attached to a point A . It is supported by two light rods AB and AC . The rod AC is horizontal and the rod AB is inclined at an angle of α to the horizontal, where $\sin \alpha = 0.6$.

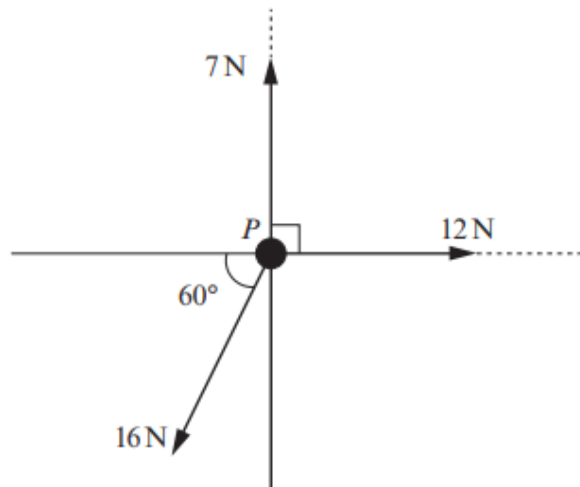


The mass of the sign is 12 kg. Calculate

- (a) the thrust in the rod AB , [3]
 (b) the tension in the rod AC . [3]

(Summer 11)

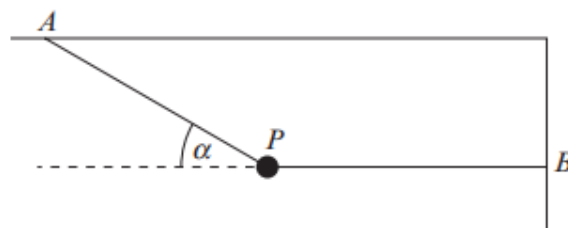
5. A particle P lies on a horizontal plane. Three horizontal forces of magnitude 7 N, 12 N and 16 N acting in directions as shown in the diagram are applied to P .



- (a) Show that the magnitude of the resultant of the three forces is approximately 7.9 N. Find the angle between the direction of the resultant and the direction of the 12 N force. [8]
- (b) The particle P has mass 5 kg and the coefficient of friction between P and the plane is 0.1. Taking the magnitude of the resultant of the three forces to be 7.9 N, calculate the magnitude of the acceleration of P . [4]

(January 12)

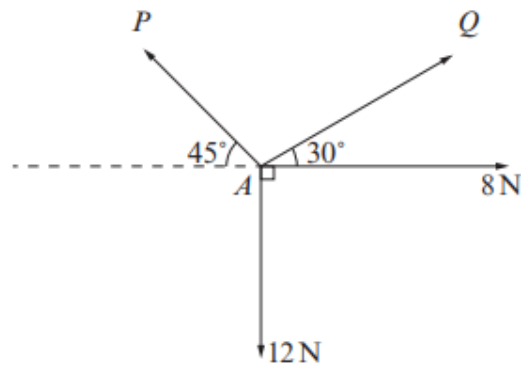
6. The diagram shows a particle P , of mass 4 kg, held in equilibrium by two light inextensible strings AP and BP . The string AP makes an angle α with the horizontal and is attached to the ceiling at the point A . The string BP is horizontal and is attached to the wall at the point B . The tension in the string BP is 30 N.



Find the angle α and the tension in the string AP . Give your answers correct to 2 decimal places. [8]

(Summer 12)

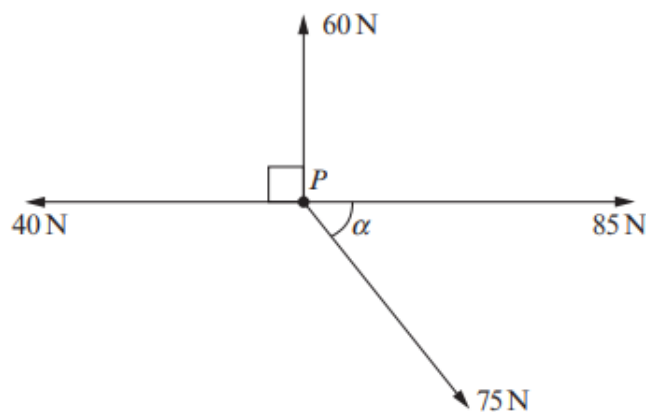
7. The diagram shows four forces acting at a point A in a horizontal plane.



Given that the forces are in equilibrium, calculate the value of P and the value of Q . Give your answers correct to one decimal place. [7]

(January 13)

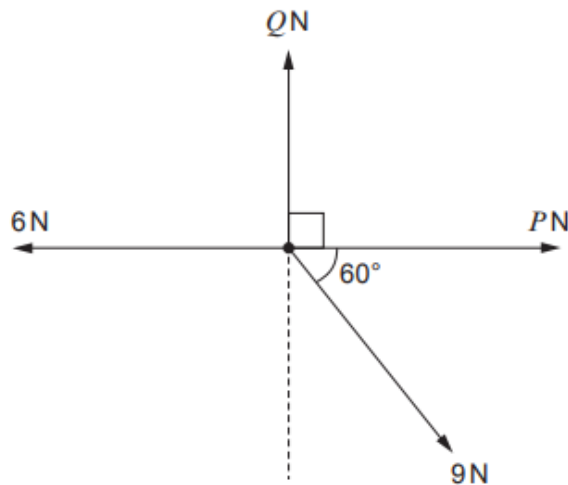
8. Four coplanar horizontal forces of magnitude 60 N, 85 N, 75 N and 40 N act on a particle P , of mass 5 kg, in the directions shown in the diagram, where $\tan \alpha = \frac{3}{4}$.



- (a) Calculate the magnitude of the resultant force and determine the angle it makes with the 85 N force. [9]
 (b) Deduce the magnitude of the acceleration of the particle P . [2]

(Summer 13)

9. Four horizontal forces of magnitude 6 N, 9 N, P N and Q N acting at a point are in equilibrium. Directions are as shown in the diagram.

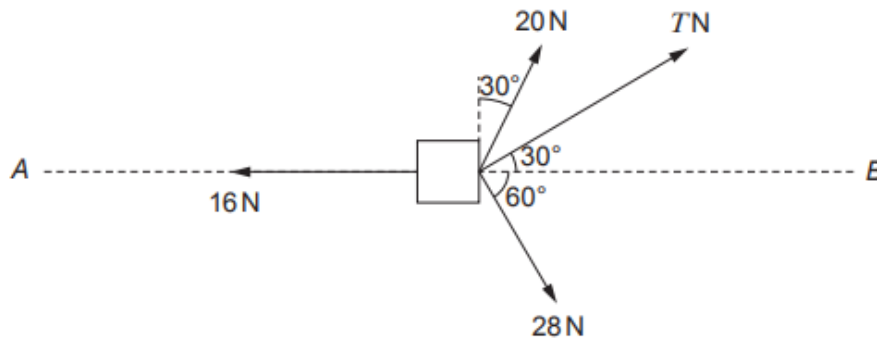


Find the value of P and the value of Q .

[5]

(January 14)

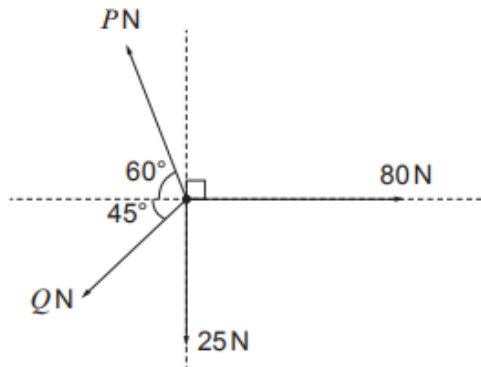
10. An object of mass 80 kg is being dragged along a straight line AB by means of three horizontal forces of magnitude and direction as shown in the diagram. The resistance to the motion of the object is constant and of magnitude 16 N.



- (a) Show that $T = 8\sqrt{3}$. [3]
- (b) Determine the magnitude of the acceleration of the object. [4]
- (c) When the object is moving with a speed of 12 ms^{-1} , the three horizontal forces of 20 N, 28 N, and T N are removed. Calculate the time taken for the speed of the object to reduce to 4 ms^{-1} . [5]

(Summer 14)

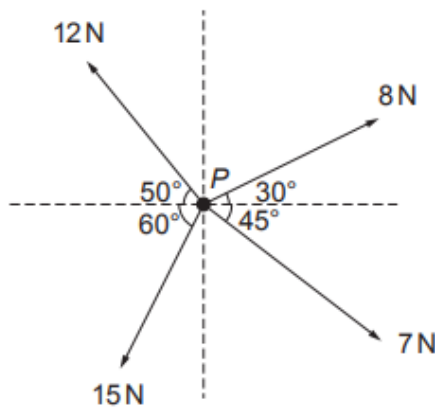
11. The diagram shows four horizontal forces of magnitude P N, Q N, 25 N and 80 N acting at a point.



Given that the forces are in equilibrium, calculate the value of P and the value of Q . Give your answers correct to one decimal place. [7]

(Summer 15)

12. The diagram shows four horizontal forces of magnitude 12 N, 8 N, 7 N and 15 N acting on a particle P of mass 4 kg. Directions are as shown in the diagram.



Calculate the magnitude of the resultant of the forces, giving your answer correct to one decimal place, and determine the magnitude of the acceleration of P . [7]

(Summer 16)