Chapter 2&3: Forces and Motion

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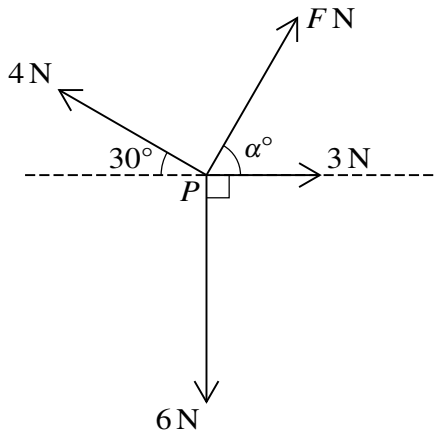

Coplanar forces, of magnitudes F N, 3 N, 6 N and 4 N, act at a point P, as shown in the diagram.

(a) Given that $\alpha = 60$, and that the resultant of the four forces is in the direction of the 3 N force, find F. [3]

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(b) Given instead that the four forces are in equilibrium, find the values of F and α. [5]

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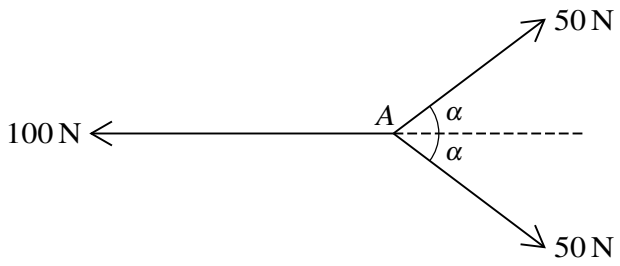

Three coplanar forces of magnitudes 100 N, 50 N and 50 N act at a point A, as shown in the diagram. The value of $\cos\alpha$ is $\frac{4}{5}$.

Find the magnitude of the resultant of the three forces and state its direction. [3]

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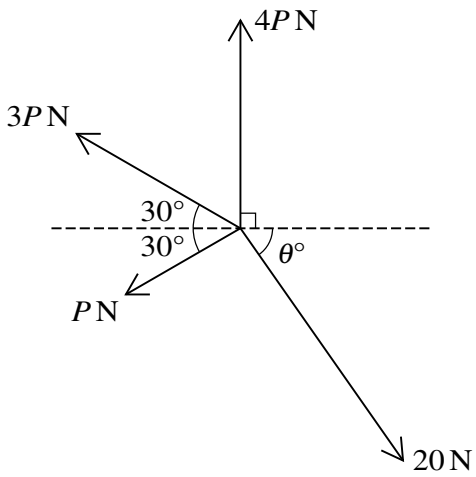

Coplanar forces of magnitudes 20 N, P N, $3P$ N and $4P$ N act at a point in the directions shown in the diagram. The system is in equilibrium.

Find P and θ. [6]

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2 A minibus of mass 4000 kg is travelling along a straight horizontal road. The resistance to motion is 900 N.

(a) Find the driving force when the acceleration of the minibus is $0.5\ \text{m s}^{-2}$. [2]

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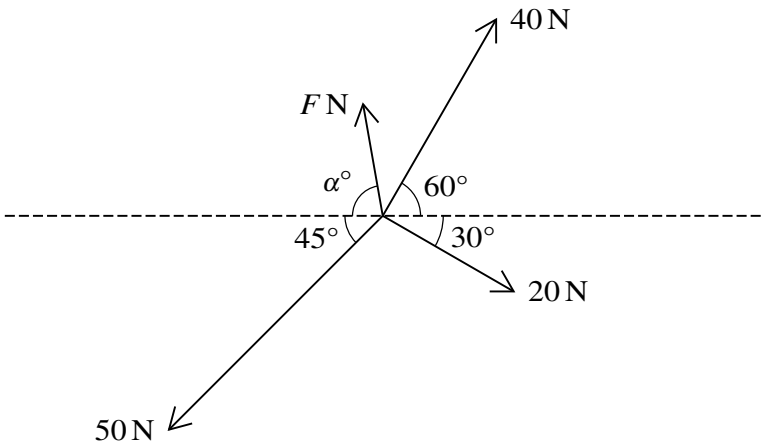

Four coplanar forces of magnitudes 40 N, 20 N, 50 N and F N act at a point in the directions shown in the diagram. The four forces are in equilibrium.

Find F and α. [6]

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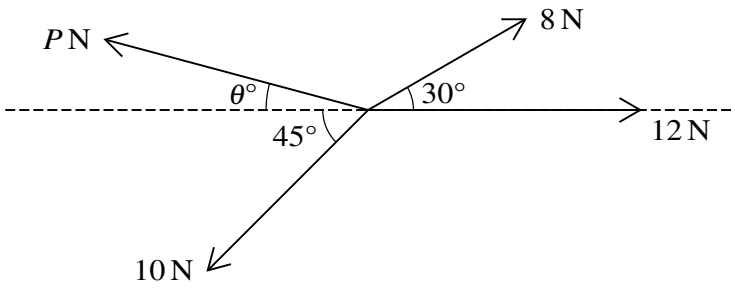

Coplanar forces of magnitudes 8 N, 12 N, 10 N and P N act at a point in the directions shown in the diagram. The system is in equilibrium.

Find P and θ. [6]

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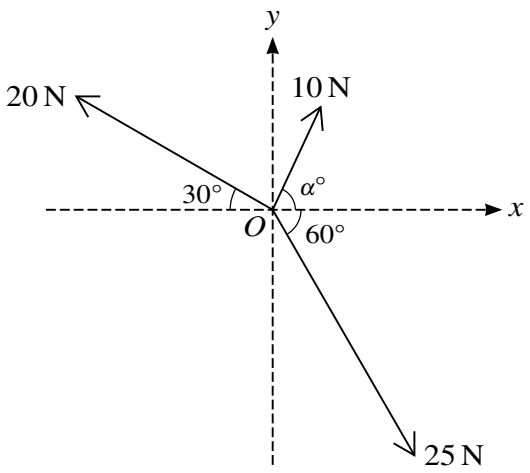

Three coplanar forces of magnitudes 10 N, 25 N and 20 N act at a point O in the directions shown in the diagram.

(a) Given that the component of the resultant force in the x-direction is zero, find α, and hence find the magnitude of the resultant force. [4]

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(b) Given instead that $\alpha = 45$, find the magnitude and direction of the resultant of the three forces. [5]

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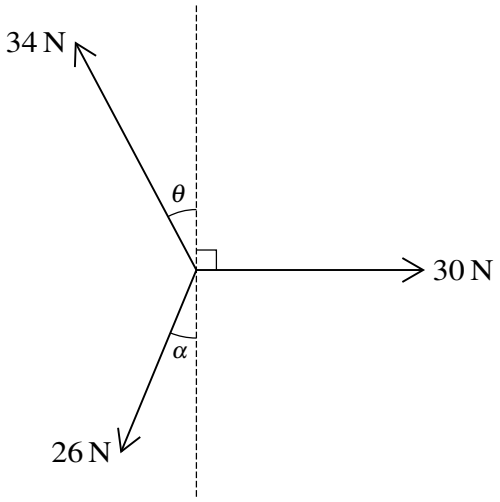

Coplanar forces of magnitudes 34 N, 30 N and 26 N act at a point in the directions shown in the diagram.

Given that $\sin\alpha = \frac{5}{13}$ and $\sin\theta = \frac{8}{17}$, find the magnitude and direction of the resultant of the three forces. [6]

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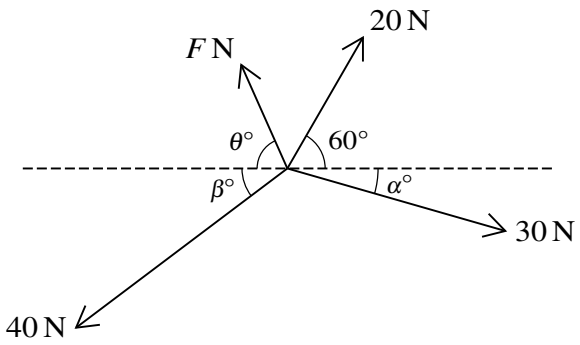

Four coplanar forces act at a point. The magnitudes of the forces are 20 N, 30 N, 40 N and F N. The directions of the forces are as shown in the diagram, where $\sin \alpha° = 0.28$ and $\sin \beta° = 0.6$.

Given that the forces are in equilibrium, find F and θ. [6]

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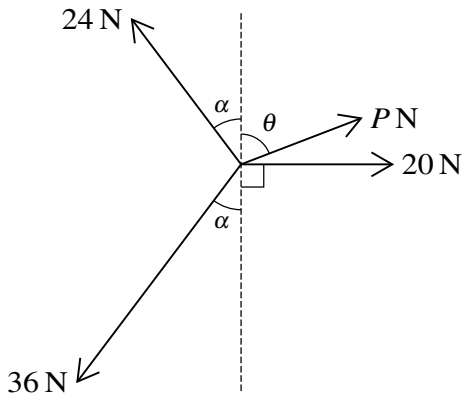

Coplanar forces of magnitudes 24 N, P N, 20 N and 36 N act at a point in the directions shown in the diagram. The system is in equilibrium.

Given that $\sin\alpha = \frac{3}{5}$, find the values of P and θ. [6]

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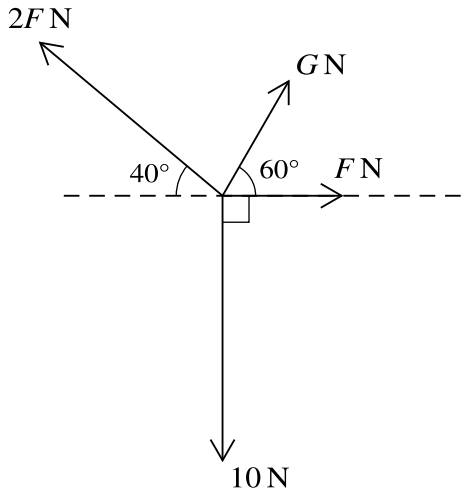

Four coplanar forces act at a point. The magnitudes of the forces are 10 N, F N, G N and $2F$ N. The directions of the forces are as shown in the diagram.

(a) Given that the forces are in equilibrium, find the values of F and G. [5]

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(b) Given instead that $F = 3$, find the value of G for which the resultant of the forces is perpendicular to the 10 N force. [2]

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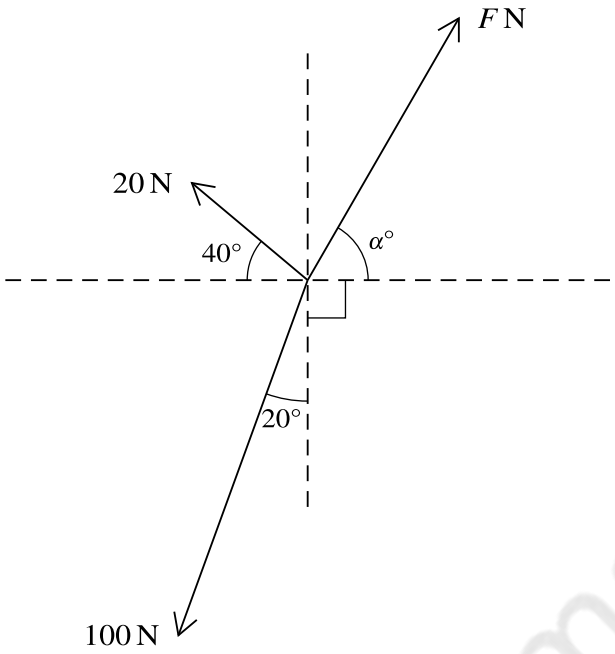

Three coplanar forces of magnitudes 20 N, 100 N and F N act at a point. The directions of these forces are shown in the diagram.

Given that the three forces are in equilibrium, find F and α. [6]

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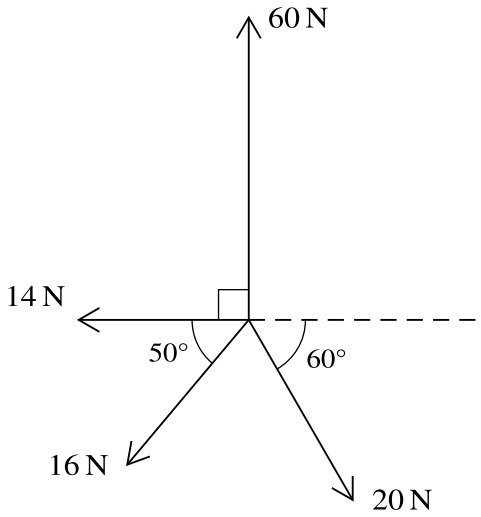

Coplanar forces of magnitudes 60 N, 20 N, 16 N and 14 N act at a point in the directions shown in the diagram.

Find the magnitude and direction of the resultant force. [6]

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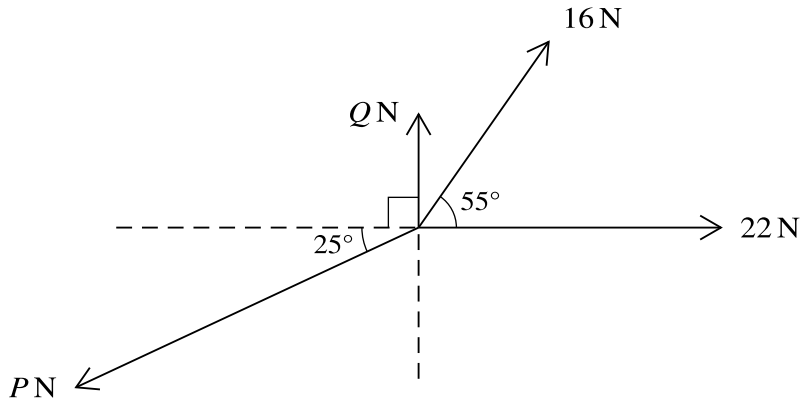

Coplanar forces of magnitudes P N, Q N, 16 N and 22 N act at a point in the directions shown in the diagram. The forces are in equilibrium.

Find the values of P and Q. [5]

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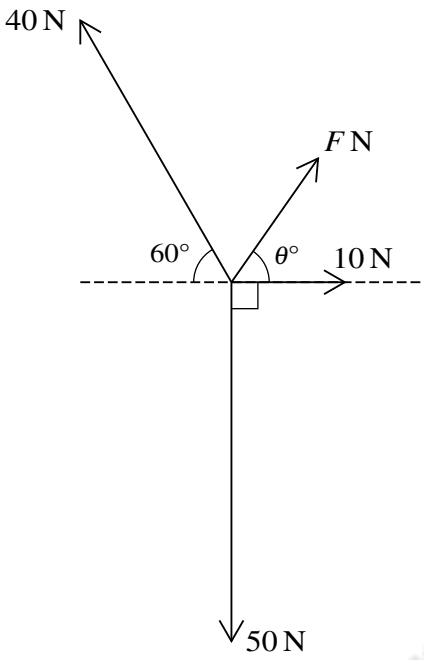

Four coplanar forces act at a point. The magnitudes of the forces are F N, 10 N, 50 N and 40 N. The directions of the forces are as shown in the diagram.

(a) Given that the forces are in equilibrium, find the value of F and the value of θ. [6]

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(b) Given instead that $F = 10\sqrt{2}$ and $\theta = 45$, find the direction and the exact magnitude the resultant force. [3]

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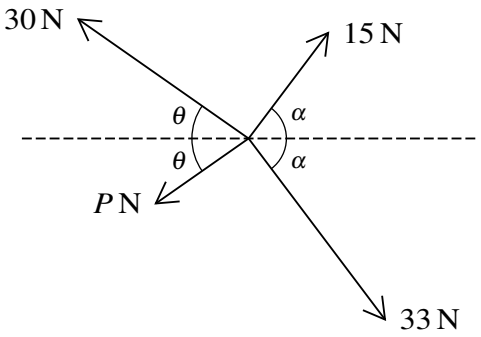

Coplanar forces of magnitudes 30 N, 15 N, 33 N and P N act at a point in the directions shown in the diagram, where $\tan\alpha = \frac{4}{3}$. The system is in equilibrium.

(a) Show that $\left(\frac{14.4}{30-P}\right)^2 + \left(\frac{28.8}{P+30}\right)^2 = 1$. [4]

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(b) Verify that $P = 6$ satisfies this equation and find the value of θ. [2]

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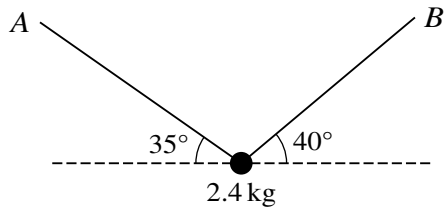

A particle of mass 2.4 kg is held in equilibrium by two light inextensible strings, one of which is attached to point *A* and the other attached to point *B*. The strings make angles of 35° and 40° with the horizontal (see diagram).

Find the tension in each of the two strings. [5]