

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

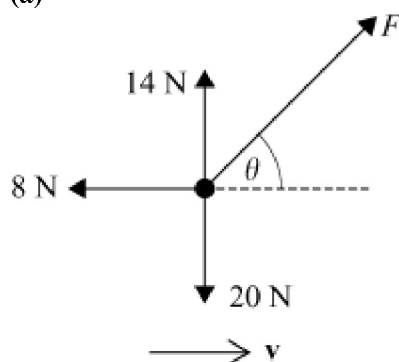
5 Newton's laws of motion

Exercise A, Question 2

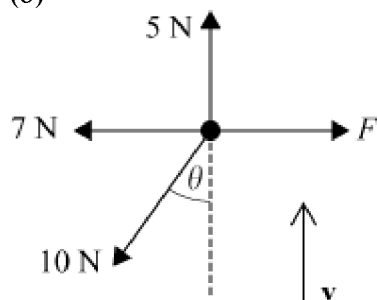
Question:

The following situations show a body moving with constant velocity in the direction shown, subject to an unknown force of magnitude F N acting an angle θ . Find F and θ .

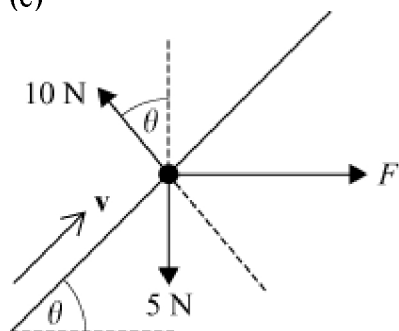
(a)



(b)



(c)



Solution:

(a) Let the applied force have components X and Y as shown

$$\text{Newton 1, } \rightarrow X - 8 = 0$$

$$\therefore X = 8$$

$$\text{Newton 1, } \uparrow Y + 14 - 20 = 0$$

$$\therefore Y = 6$$

$$\therefore F = \sqrt{8^2 + 6^2}$$

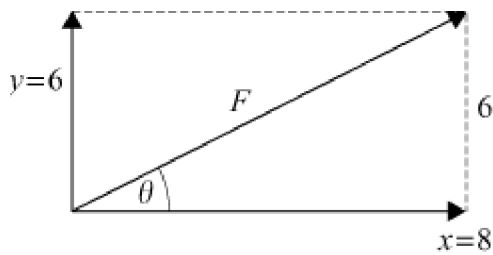
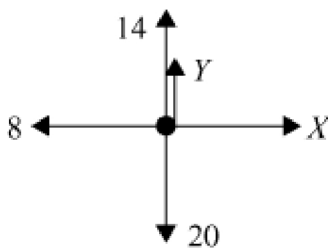
$$F = \sqrt{100}$$

$$\therefore F = 10 \text{ N}$$

$$\text{and } \tan \theta = \frac{6}{8}$$

$$\theta = 36.869\dots^\circ$$

$$\text{i.e. at } \theta = 36.9^\circ \text{ (3 s.f.)}$$



$$\text{Newton 1, } \uparrow 5 - 10 \cos \theta = 0$$

$$\therefore 5 = 10 \cos \theta$$

$$\text{so } \cos \theta = \frac{5}{10}$$

$$\text{(b) } \therefore \theta = 60^\circ$$

$$\text{Newton 1, } \rightarrow F - 7 - 10 \sin \theta = 0$$

$$\therefore F = 7 + 10 \sin 60^\circ$$

$$F = 15.660\dots$$

$$\therefore F = 15.7 \text{ N (3 s.f.)}$$

$$\text{Newton 1, } \uparrow 10 \cos \theta - 5 = 0$$

$$\therefore \cos \theta = \frac{5}{10}$$

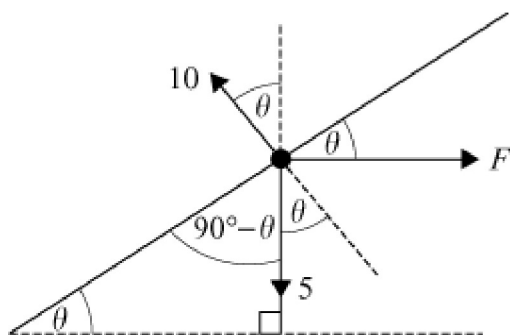
$$\theta = 60^\circ$$

$$\text{(c) Newton 1, } \rightarrow F = 10 \sin \theta$$

$$\therefore F = 10 \sin 60$$

$$F = 8.6602\dots$$

$$\therefore F = 8.66 \text{ N (3 s.f.)}$$



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