

Exercise 4B, P73

① (a) $x = 8 \cos 30 = 4\sqrt{3} \text{ N}$

$$y = 8 \sin 30 = 4 \text{ N}$$

(b) $x = 0 \text{ N}$ (OR $x = 10 \cos 90$)

$$y = 10 \text{ N}$$

(c) $x = -10 \cos 40 = -7.66 \text{ N}$ (-ve because cos is -ve in quadrant II)

OR do $x = 10 \cos 140$ measured from +ve x-axis anticlockwise.
 $= -7.66 \text{ N}$

$$y = 10 \sin 40 = 6.43 \text{ N}$$

(d) $x = 4 \cos 45 = 2.83 \text{ N}$

$$y = -4 \sin 45 = -2.83 \text{ N}$$
 (-ve because sin is -ve in quad IV)

OR $y = 4 \sin 135$ measured anticlockwise from +ve x-axis
 $= -2.83 \text{ N}$

(e) $x = 2\sqrt{3} \cdot \cos 60 = \sqrt{3} \text{ N}$

$$y = 2\sqrt{3} \sin 60 = 3 \text{ N}$$

(f) $x = P \cos \theta ; y = P \sin \theta$

$$\textcircled{2} \textcircled{a} \quad a\underline{i} + b\underline{j} = (16 \cos 60)\underline{i} + (16 \sin 60)\underline{j}$$

$$= (8\underline{i} + 8\sqrt{3}\underline{j}) N$$

$$\textcircled{b} \quad a\underline{i} + b\underline{j} = (3\sqrt{2} \cos 45)\underline{i} + (3\sqrt{2} \sin 45)\underline{j}$$

$$= (3\underline{i} + 3\underline{j}) N$$

$$\textcircled{c} \quad a\underline{i} + b\underline{j} = (-3\sqrt{2} \cos 45)\underline{i} + (3\sqrt{2} \sin 45)\underline{j}$$

$$= (-3\underline{i} + 3\underline{j}) N \quad \text{(-ve on } \underline{i} \text{ because}$$

cos is -ve in
quadrant II)

$$\textcircled{d} \quad a\underline{i} + b\underline{j} = (-10 \cos 60)\underline{i} - (10 \sin 60)\underline{j}$$

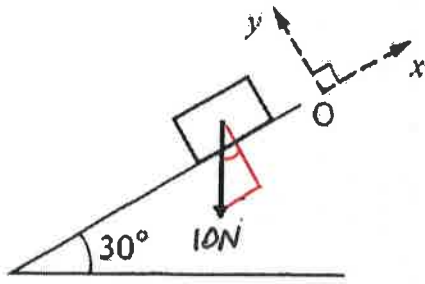
$$= (-5\underline{i} - 5\sqrt{3}\underline{j}) N$$

(-ve because cos & sin are -ve in quad III)

$$\textcircled{e} \quad a\underline{i} + b\underline{j} = (P \cos \alpha)\underline{i} + (P \sin \alpha)\underline{j}$$

$$\textcircled{f} \quad a\underline{i} + b\underline{j} = (-Q \cos \phi)\underline{i} + (-Q \sin \phi)\underline{j}$$

(3) (a)



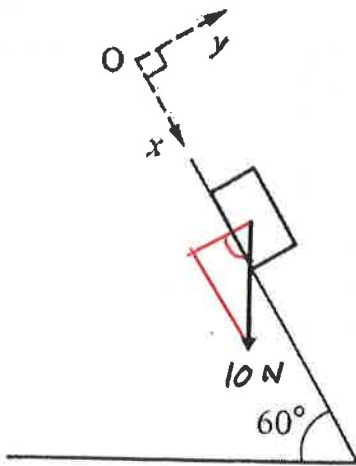
Red angle = 30°

$$\text{So } O_x = -10 \sin 30 = -5 \text{ N}$$

$$O_y = -10 \cos 30 = -5\sqrt{3} \text{ N}$$

(Why -ve? See (b) for Reason)

(b)



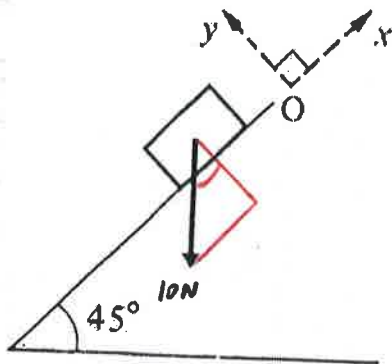
Red angle = 60°

$$\text{So } O_x = 10 \cos 60 = 5 \text{ N}$$

$$O_y = -10 \sin 60 = -5\sqrt{3} \text{ N}$$

-ve O_y because 10 N in the O_y direction is in opposite direction to specified axes.

(c)

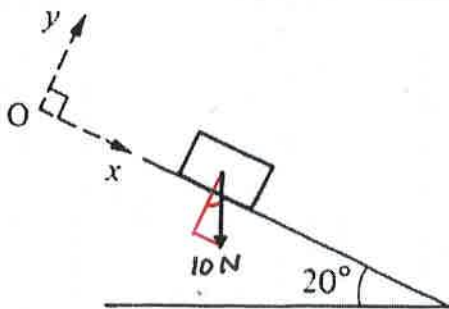


Red angle = 45°

$$\text{So } O_x = -10 \sin 45 = -5\sqrt{2} \text{ N}$$

$$O_y = -10 \cos 45 = -5\sqrt{2} \text{ N}$$

(d)

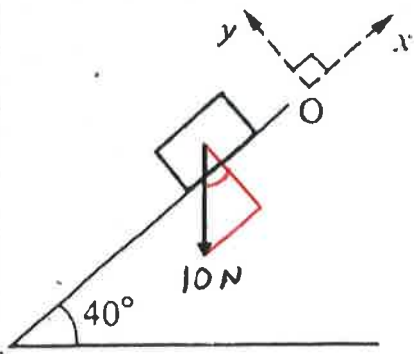


Red angle = 20°

$$\text{So } O_x = 10 \sin 20 = 3.42 \text{ N}$$

$$O_y = -10 \cos 20 = -9.39 \text{ N}$$

(e)

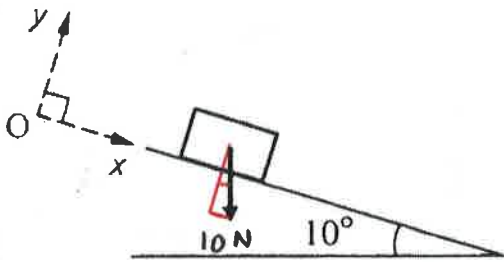


Red angle = 40°

$$\text{So } O_x = -10 \sin 40 = -6.43 \text{ N}$$

$$O_y = -10 \cos 40 = -7.66 \text{ N}$$

(f)



Red angle = 10°

So

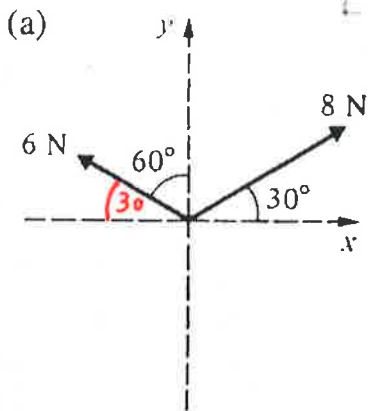
$$O_x = 10 \sin 10^\circ$$

$$O_y = -10 \cos 10$$

$$\therefore O_x = 1.74 \text{ N}$$

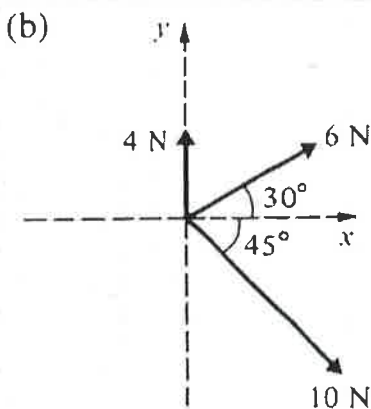
$$\text{So } O_y = -9.85 \text{ N}$$

(4)



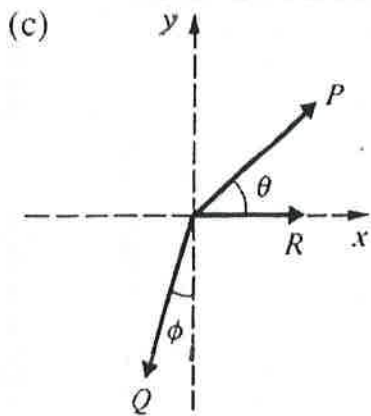
$$O_x = 8 \cos 30 - 6 \cos 30 = \sqrt{3} \text{ N}$$

$$O_y = 8 \sin 30 + 6 \sin 30 = 7 \text{ N}$$



$$O_x = 6 \cos 30 + 10 \cos 45 = 3\sqrt{3} + 5\sqrt{2} = 12.27 \text{ N}$$

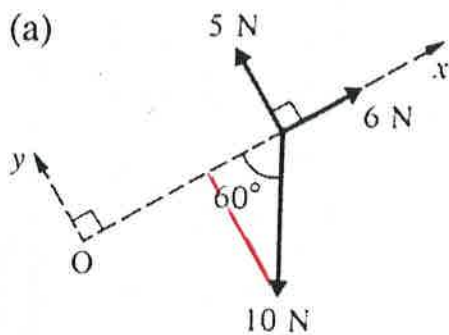
$$O_y = 4 + 6 \sin 30 - 10 \sin 45 = 4 + 3 - 5\sqrt{2} = -0.071 \text{ N}$$



$$O_x = R + P \cos \theta - Q \sin \phi$$

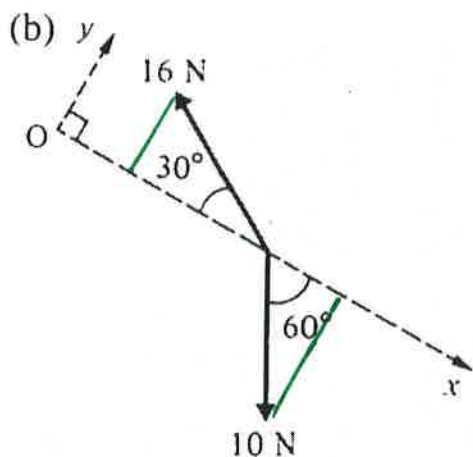
$$O_y = P \sin \theta - Q \cos \phi$$

(5)



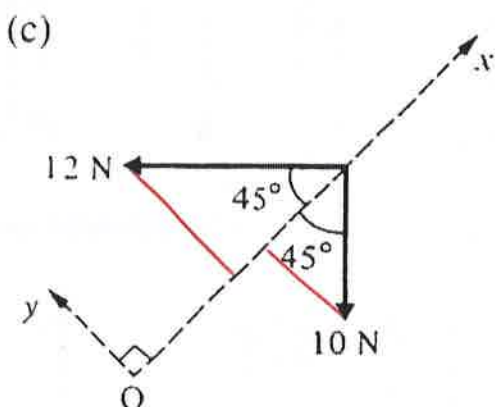
$$O_x = 6 - 10 \cos 60 = 1 \text{ N}$$

$$O_y = 5 - 10 \sin 60 = -3.66 \text{ N}$$



$$O_y = -10 \sin 60 + 16 \sin 30 = -0.66 \text{ N}$$

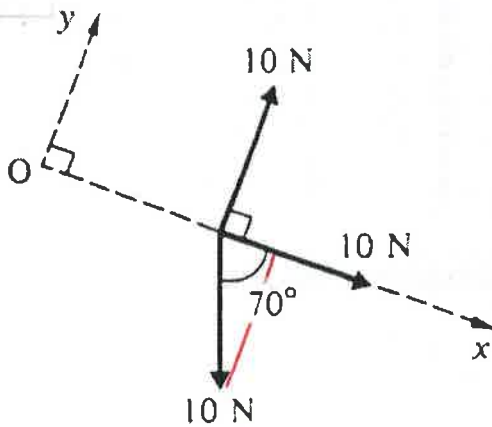
$$O_x = 10 \cos 60 - 16 \cos 30 = -8.86 \text{ N}$$



$$O_x = -10 \cos 45 - 12 \cos 45 = -11\sqrt{2} = -15.56 \text{ N}$$

$$O_y = -10 \sin 45 + 12 \sin 45 = \sqrt{2} = 1.41 \text{ N}$$

(d)



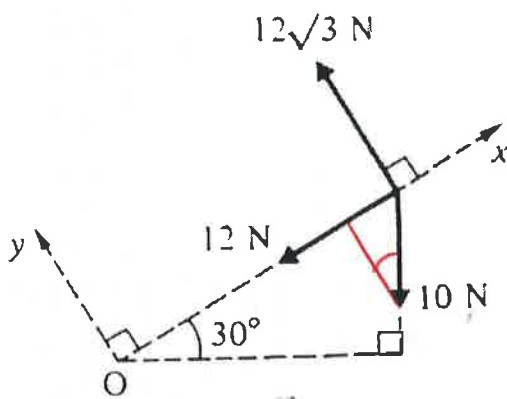
$$O_x = 10 + 10 \cos 70$$

$$= 13.42 \text{ N}$$

$$O_y = 10 - 10 \sin 70$$

$$= 1.94 \text{ N}$$

(e)



Red angle = 30°

$$O_x = -12 + 10 \sin 30$$

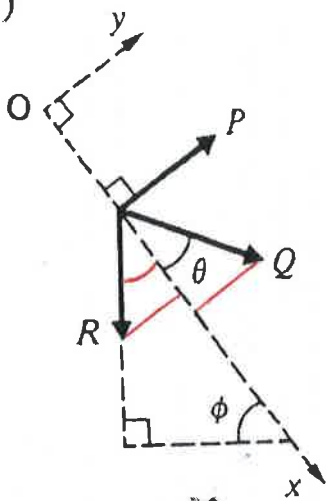
$$= -17 \text{ N}$$

$$O_y = 12\sqrt{3} - 10 \cos 30$$

$$= 12\sqrt{3} - 5\sqrt{3}$$

$$= 7\sqrt{3} \text{ N.}$$

(f)



Red angle = 90 - phi

$$O_x = Q \cos \theta + R \cos (90 - \phi)$$

$$= Q \cos \theta + R \sin \phi$$

$$O_y = P + Q \sin \theta - R \sin (90 - \phi)$$

$$= P + Q \sin \theta - R \cos \phi$$