RECITATION 2

Ch 3

•6 In Fig. 3-27, a heavy piece of machinery is raised by sliding it a distance $d = 12.5$ m along a plank oriented at angle $\theta = 20.0°$ to the horizontal. How far is it moved (a) vertically and (b) horizontally?

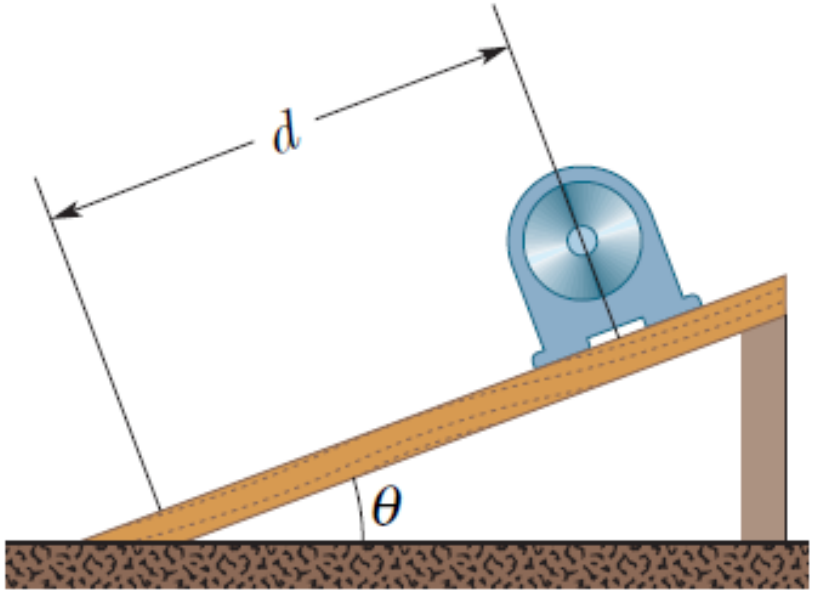


Fig. 3-27 Problem 6.

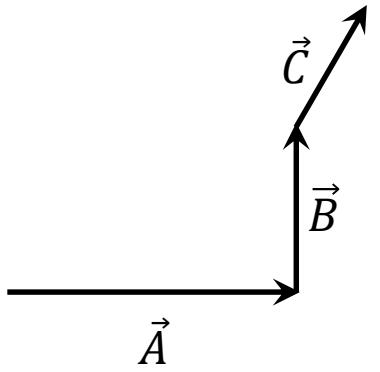
a)

$$d_y = d \sin\theta = (12.5 \text{ m}) \sin 20.0° = 4.28 \text{ m}.$$

b)

$$d_x = d \cos\theta = (12.5 \text{ m}) \cos 20.0° = 11.7 \text{ m}.$$

•12 A car is driven east for a distance of 50 km, then north for 30 km, and then in a direction 30° east of north for 25 km. Sketch the vector diagram and determine (a) the magnitude and (b) the angle of the car's total displacement from its starting point.



$$\vec{A} = (50\ \text{km})\hat{\imath}.$$

$$\vec{B} = (30\ \text{km})\hat{\jmath}.$$

$$\vec{C} = (25\cos 60)\hat{\imath} + (25\sin 60)\hat{\jmath}$$

$$= (13\ \text{km})\hat{\imath} + (22\ \text{km})\hat{\jmath}$$

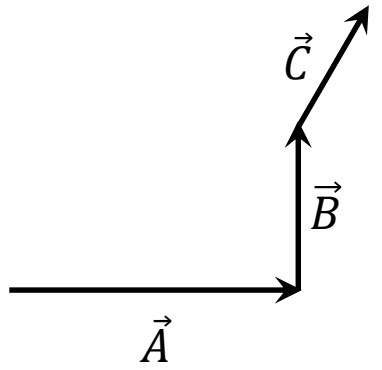
$$\vec{d} = (50\ \text{km} + 0 + 13\ \text{km})\hat{\imath} + (0 + 30\ \text{km} + 22\ \text{km})\hat{\jmath}$$

$$= (63\ \text{km})\hat{\imath} + (52\ \text{km})\hat{\jmath}$$

•12 A car is driven east for a distance of 50 km, then north for 30 km, and then in a direction 30° east of north for 25 km. Sketch the vector diagram and determine (a) the magnitude and (b) the angle of the car's total displacement from its starting point.

$$d = \sqrt{62.5^2 + 51.7^2} = 81 \text{ km}.$$

$$\theta = \tan^{-1}\frac{51.7}{62.5} = 40°.$$



••38 GO For the following three vectors, what is $3\vec{C} \cdot (2\vec{A} \times \vec{B})$?

$$\vec{A} = 2.00\hat{i} + 3.00\hat{j} - 4.00\hat{k}$$

$$\vec{B} = -3.00\hat{i} + 4.00\hat{j} + 2.00\hat{k} \qquad \vec{C} = 7.00\hat{i} - 8.00\hat{j}$$

$$2\vec{A} \times \vec{B} = 2\begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & -4 \\ -3 & 4 & 2 \end{vmatrix} = 2\{[(3)(2) - (-4)(4)]\,\hat{i} - [(2)(2) - (-4)(-3)]\,\hat{j}$$

$$+[(2)(4) - (3)(-3)]\,\hat{k}\} = 44\,\hat{i} + 16\,\hat{j} + 34\,\hat{k}.$$

$$3\vec{C} \cdot (2\vec{A} \times \vec{B}) = 3(7\,\hat{i} - 8\,\hat{j}) \cdot (44\,\hat{i} + 16\,\hat{j} + 34\,\hat{k}) = 924 - 384 = 540.$$

••41 SSM ILW WWW Use the definition of scalar product, $\vec{a} \cdot \vec{b} = ab \cos\theta$, and the fact that $\vec{a} \cdot \vec{b} = a_x b_x + a_y b_y + a_z b_z$ to calculate the angle between the two vectors given by $\vec{a} = 3.0\hat{i} + 3.0\hat{j} + 3.0\hat{k}$ and $\vec{b} = 2.0\hat{i} + 1.0\hat{j} + 3.0\hat{k}$.

$$\vec{a} \cdot \vec{b} = (3)(2) + (3)(1) + (3)(3) = 18.$$

$$a = \sqrt{3^2 + 3^2 + 3^2} = \sqrt{27} = 5.20.$$

$$b = \sqrt{2^2 + 1^2 + 3^2} = \sqrt{14}. = 3.74.$$

$$\theta = \cos^{-1}\frac{\vec{a} \cdot \vec{b}}{ab} = \cos^{-1}\frac{18}{(5.20)(3.74)} = 22°.$$