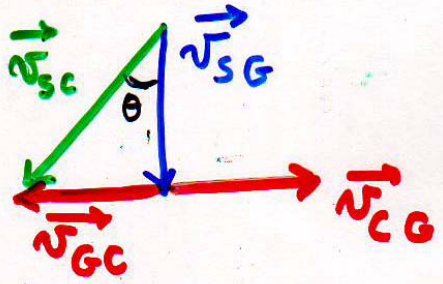
•59 Snow is falling vertically at a constant speed of 8.0 m/s. At what angle from the vertical do the snowflakes appear to be falling as viewed by the driver of a car traveling on a straight, level road with a speed of 50 km/h? SSM

$v_{SG} = 8$ m/s

$v_{CG} = 50$ km/h $= 14$ m/s



$\vec{v}_{SC} = \vec{v}_{SG} + \vec{v}_{GC}$

$\vec{v}_{SC} = \vec{v}_{SG} - \vec{v}_{CG}$

Be carful: $\vec{v}_{AB} = -\vec{v}_{BA}$

From the figure:

$$\tan\theta = \frac{v_{SGC}}{v_{SG}} = \frac{14}{8} = 1.75$$

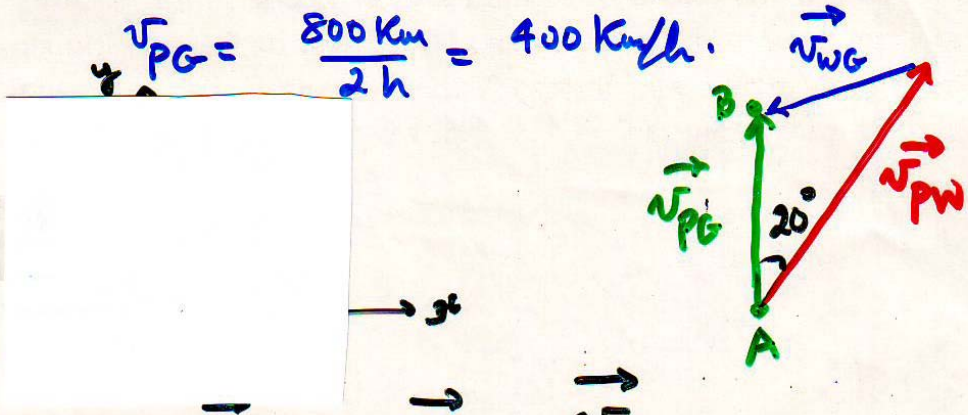
$$\boxed{\theta = 60^\circ}$$

$$v_{SC} = \sqrt{(8)^2 + (14)^2} = 16.1 \text{ m/s.}$$

••60 A light plane attains an airspeed of 500 km/h. The pilot sets out for a destination 800 km due north but discovers that the plane must be headed 20.0° east of due north to fly there directly. The plane arrives in 2.00 h. What were the (a) magnitude and (b) direction of the wind velocity?

$v_{PW} = 500$ km/h.

$v_{PG} = \frac{800\text{ km}}{2\text{ h}} = 400$ km/h.



$$\vec{v}_{PG} = \vec{v}_{PW} + \vec{v}_{WG}$$

x-axis: $0 = 500\cos 70^\circ + v_{WG,x}$

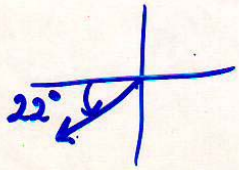
y-axis: $400 = 500\sin 70^\circ + v_{WG,y}$

$v_{WG,x} = -500\cos 70^\circ = -171$ m/s.

$v_{WG,y} = 400 - 500\sin 70^\circ = -70$ m/s.

$\vec{v}_{WG} = -171\,\hat{i} - 70\,\hat{j}$ m/s.

$\theta = \tan^{-1}\left(\frac{70}{171}\right) = 22^\circ$



86. Two highways intersect as shown in Fig. 4-55. At the instant shown, a police car P is distance $d_P = 800$ m from the intersection and moving at speed $v_P = 80$ km/h. Motorist M is distance $d_M = 600$ m from the intersection and moving at speed $v_M = 60$ km/h. (a) In unit-vector notation, what is the velocity of the motorist with respect to the police car? (b) For the instant shown in Fig. 4-55, what is the angle between the velocity found in (a) and the line of sight between the two cars? (c) If the cars maintain their velocities, do the answers to (a) and (b) change as the cars move nearer the intersection?

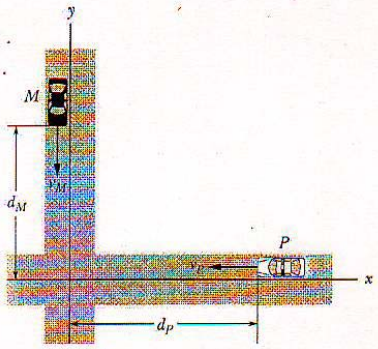


Fig. 4-55 Problem 86.

a) $\vec{v}_{PG} = -80\hat{i}$

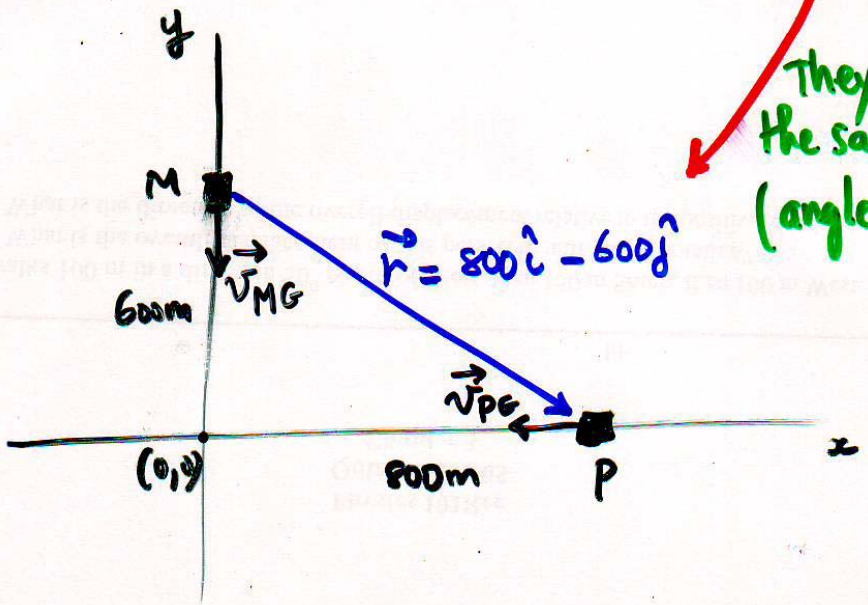
$\vec{v}_{MG} = -60\hat{j}$

$\vec{v}_{MP} = \vec{v}_{MG} + \vec{v}_{GP}$

$\vec{v}_{GP} = -\vec{v}_{PG} = 80\hat{i}$

$\vec{v}_{MP} = -60\hat{j} + 80\hat{i} = 80\hat{i} - 60\hat{j}\ (km/h)$

b)



They are in the same direction (angle is zero).