

PROB. 11-120

$$|\vec{v}|_{C/A} = 235 \frac{\text{m}}{\text{h}}, \theta_{C/A} = 75^\circ \swarrow, |\vec{v}|_{C/B} = 260 \frac{\text{m}}{\text{h}}, \theta_{C/B} = 40^\circ \searrow$$

FIND $\vec{v}_{B/A}$, FIND \vec{v}_A IF $\vec{v}_C = (24)\hat{j} \frac{\text{m}}{\text{h}}$

FIND $\Delta x_{C/B}$ OVER $t = 15 \text{ min}$

$$\theta_{C/A} = 180 + 75 = 255^\circ, \theta_{C/B} = 360 - 40 = 320^\circ$$

$$\vec{v}_{C/A} = (235 \cos 255)\hat{i} + (235 \sin 255)\hat{j} = (-60.82)\hat{i} + (-227)\hat{j} \frac{\text{m}}{\text{h}}$$

$$\vec{v}_{C/B} = (260 \cos 320)\hat{i} + (260 \sin 320)\hat{j} = (199.2)\hat{i} + (-167.1)\hat{j} \frac{\text{m}}{\text{h}}$$

FIND $\vec{v}_{B/A}$:

$$\vec{v}_B = \vec{v}_A + \vec{v}_{B/A}, \vec{v}_{B/A} = \vec{v}_B - \vec{v}_A$$

$$\vec{v}_C = \vec{v}_A + \vec{v}_{C/A}, \vec{v}_A = \vec{v}_C - \vec{v}_{C/A}$$

$$\vec{v}_C = \vec{v}_B + \vec{v}_{C/B}, \vec{v}_B = \vec{v}_C - \vec{v}_{C/B}$$

$$\vec{v}_{B/A} = (\vec{v}_C - \vec{v}_{C/B}) - (\vec{v}_C - \vec{v}_{C/A}) = \vec{v}_{C/A} - \vec{v}_{C/B}$$

$$\vec{v}_{B/A} = (-60.82)\hat{i} + (-227)\hat{j} - [(199.2)\hat{i} + (-167.1)\hat{j}]$$

$$\vec{v}_{B/A} = (-260)\hat{i} + (-59.9)\hat{j} \frac{\text{m}}{\text{h}}$$

$$\boxed{|\vec{v}_{B/A}| = 266.7 \frac{\text{m}}{\text{h}}}, \theta = \tan^{-1}\left(\frac{-59.9}{-260}\right) = 12.97^\circ + 180^\circ = \boxed{193^\circ}$$

FIND \vec{v}_A IF $\vec{v}_C = (24)\hat{j} \frac{\text{m}}{\text{h}}$

$$\vec{v}_A = \vec{v}_C - \vec{v}_{C/A}$$

PROB. 11-120 CONT.

$$\vec{v}_A = (24)\hat{j} - [(-60.82)\hat{i} + (-227)\hat{j}]$$

$$\vec{v}_A = (60.82)\hat{i} + (251)\hat{j} \frac{\text{m}}{\text{H}}$$

$$|\vec{v}_A| = 258.3 \frac{\text{m}}{\text{H}}, \theta = 76.38^\circ$$

FIND $\Delta x_{C/B}$ OVER $t = 15 \text{ min}$:

$$x = x_0 + v_0 t + \frac{1}{2} a t^2 \quad \text{ASSUME } a = 0$$

$$x - x_0 = v_0 t$$

X-DIRECTION:

$$\Delta x = (v_x)_{C/B} t = (199.2 \frac{\text{m}}{\text{H}}) (15 \text{ min}) (\frac{\text{H}}{60 \text{ min}}) = 49.8 \text{ m}$$

Y-DIRECTION:

$$\Delta y = (v_y)_{C/B} t = (-167.1) (15 \text{ min}) (\frac{\text{H}}{60 \text{ min}}) = -41.77 \text{ m}$$

$$(\Delta \vec{r})_{C/B} = (49.8)\hat{i} + (-41.77)\hat{j} \text{ m}$$

$$|\Delta \vec{r}_{C/B}| = 65.0 \text{ m}, \theta = -40 + 360 = 320^\circ$$