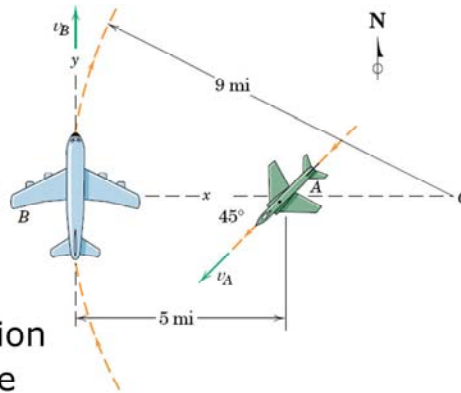


Relative Velocity: Exercise

Aircraft **B** has a constant **speed** of 480 mph along an arc with a **radius** of 9 miles. Aircraft **A** flies **southwest** at a constant **speed** of 360 mph.



Write the **vector** expression (x - y attached to **B**) for the **velocity** of **A relative to B**.

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$$v_B = 480 \frac{44}{30} = 704 \text{ ft/sec}$$

$$v_A = 360 \frac{44}{30} = 528 \text{ ft/sec}$$

$$\underline{v}_A = \underline{v}_B + \underline{\omega} \times \underline{r} + \underline{v}_{rel}$$

$$\begin{aligned} \text{Angular vel. of axes} = \underline{\omega} &= \frac{v_B}{r} (-\underline{k}) \\ &= \frac{-704}{9 \times 5280} \underline{k} = -0.01481 \underline{k} \text{ rad/sec} \end{aligned}$$

v_{rel} = vel. of A rel. to B

$$\underline{r} = 5(5280) \underline{i} = 26,400 \underline{i} \text{ ft}$$

$$\text{Thus } 528(-0.707 \underline{i} - 0.707 \underline{j}) = 704 \underline{j} - 0.01481 \underline{k} \times 26,400 \underline{i} + \underline{v}_{rel}$$

$$\underline{v}_{rel} = -373 \underline{i} - 686 \underline{j} \text{ ft/sec with } v_{rel} = 781 \text{ ft/sec} \\ \text{or } \underline{533 \text{ mi/hr}}$$

