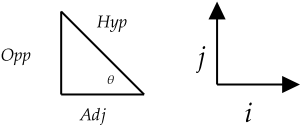
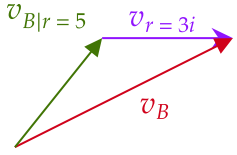
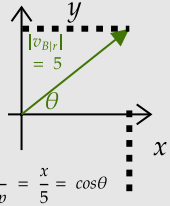


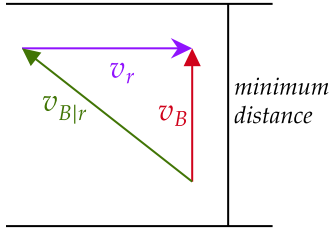




$$\frac{x}{hyp} = \frac{x}{5} = cos\theta$$

$$x = 5\cos\theta$$
$$y = 5\sin\theta$$

$$v_{B|r} = 5\cos\theta\,\hat{i} + 5\sin\theta\,\hat{j}$$

$$v_{B|r} = v_B - v_r$$
$$v_B = v_{B|r} + v_r$$
$$v_B = 5\cos\theta\, i + 5\sin\theta\, j + 3i$$
$$v_B = (3 + 5\cos\theta)\, i + 5\sin\theta\, j$$




*Assuming the boat attempts to traverse over a miinimum distance (takes a straight line)*
- *Take θ = to be in the j direction*
- *Boat is travlling vertical*
- *i component = 0*

---

$$3 + 5\cos\theta = 0$$

$$5\cos\theta = -3$$

$$\cos\theta = \frac{-3}{5}$$

$$\theta = \cos^{-1}\left(\frac{-3}{5}\right) = 127°$$

$$sin\,127 = \sqrt{1 - cos^2\,127} \cong 4/5$$

$$v_B = 5\sin\theta = 5 \cdot \frac{4}{5}$$
$$v_B = 4j$$
$$|v_B = 4\ m/s$$

*Thus it takes :*

$$\frac{500}{4} = 125 \text{ seconds to cross}$$

## Part A

$$Recall\ sin^2\theta + cos^2\theta = 1$$
$$= sin^2\theta = 1 - cos^2\theta$$
$$= sin\,\theta = \sqrt{1 - cos^2\,\theta}$$

$$v_B = 3 + 5cos\theta\, i + 5\,sin\,\theta\, j$$
$$r_B = t\, v_B$$
$$r_B = v_B = (3 + 5cos\theta)t\, i + 5\,sin\,\theta\, tj$$

*We want to cross a vertical distance of 500m and have y velocity of 5sin θ t j*

$$500 = 5\sin\theta\, t$$

$$t = \frac{500}{5\sin\theta} = \frac{100}{\sin\theta}$$

*If we cross vertically (optimal)*

$$t = \frac{100}{\sin 90} = \frac{100}{1} = 100\ s$$

*Finding how much we drifted optimally – sub in 100 s for t in i component*

$$(3 + 5cos(90)t = (3 + 5(0)(100)$$
$$= (3)(100) = 300m \text{ horizontally}$$

## Part B