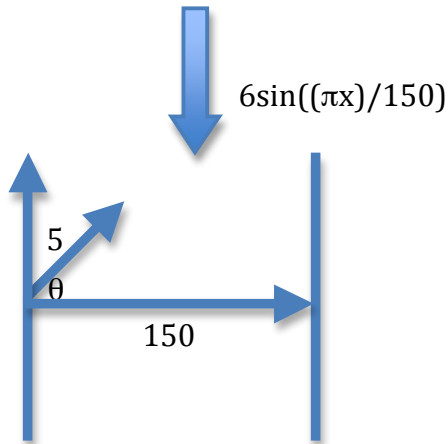
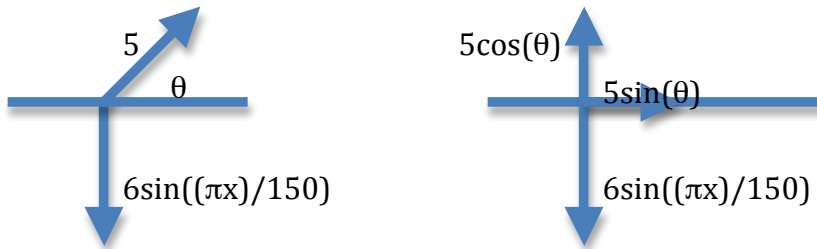


Problem Six:



The actual velocity of the boat is the sum of the velocity of the boat in still water and the velocity of the current. This results in the following free body diagrams, the first being the vectors and the second being the horizontal and vertical components:



If, averaged over the 150-foot river crossing, the vertical velocities add to zero, then the boat will not travel vertically. Integrating these velocities with respect to x over the width of the river and setting them equal allows the desired launch angle to be determined:

$$\begin{aligned} \int_0^{150} 5\sin(\theta) dx &= \int_0^{150} 6\sin((\pi x)/150) dx \\ 750\sin(\theta) &= (-900/\pi)\cos(\pi) + (900/\pi)\cos(0) \\ 750\sin(\theta) &= 1800/\pi \\ \sin(\theta) &= 12/5\pi \\ \theta &= \sin^{-1}(12/5\pi) \approx 49.81^\circ \end{aligned}$$

Therefore, to cross the river and not travel vertically at all, the boat should head 49.81° from the horizontal.