30) A boat is pulled into a dock by means of a winch 12 ft above the deck of the boat.

a) The winch pulls in rope at a rate of 4 ft/sec. Determine the speed of the boat when there is 13 ft of rope out. What happens to the speed of the boat as it gets closer to the dock?

\[ a^2 + b^2 = c^2 \]
\[ 144 + b^2 = c^2 \]
\[ \frac{db}{dt} = 2c \frac{dc}{dt} \]
\[ 5 \frac{db}{dt} = 13 \frac{dc}{dt} \]
\[ \frac{db}{dt} = -\frac{52}{5} \text{ ft/sec} \]

b) Suppose the boat is moving at a constant rate of 4 ft/sec. Determine the speed at which the winch pulls in rope when there is a total of 13 ft of rope out. What happens to the speed at which the winch pulls in rope as the boat gets closer to the dock?

\[ b \frac{db}{dt} = c \frac{dc}{dt} \rightarrow 5(4) = 13 \frac{dc}{dt} \Rightarrow \frac{20}{13} \text{ ft/sec} = \frac{dc}{dt} \]
26) A trough is 12 ft long and 3 feet across the top. Its ends are isosceles triangles with altitudes of 3 ft.
   a) If water is being pumped into the trough at 2 ft³/min, how fast is the water level rising when it is 1 ft deep?

   \[ V = \frac{1}{2} (b \times h) \times (12) \]
   \[ V = 6h^2 \rightarrow \frac{dV}{dt} = 12h \frac{dh}{dt} \]
   \[ 2 = 12(1) \frac{dh}{dt} = \frac{1}{6} \text{ ft/min} \]

   b) If the water level is rising at a rate of \( \frac{3}{8} \) in/min when \( h = 2 \), determine the rate at which water is being pumped into the trough.

   \[ \frac{dV}{dt} = 12h \frac{dh}{dt} \]
   \[ = 12 (2) \left( \frac{1}{32} \right) = \frac{3}{4} \text{ ft}^3/\text{min} \]