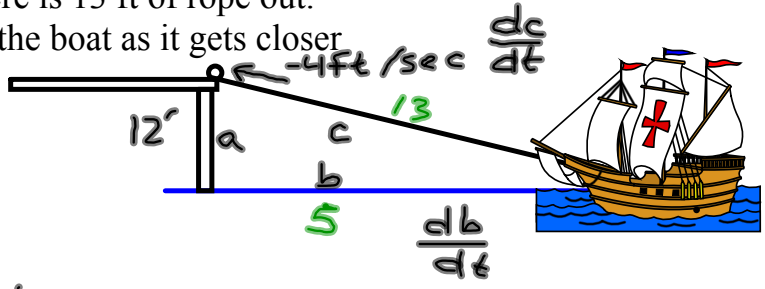
30) A boat is pulled into a dock by means of a winch 12 ft above the deck of the boat.

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?



$a^2 + b^2 = c^2$

$144 + b^2 = c^2$

$0 + 2b\frac{db}{dt} = 2c\frac{dc}{dt}$ $\quad 5\frac{db}{dt} = 13(-4)$ $\quad \frac{db}{dt} = -\frac{52}{5}\ ft/sec$

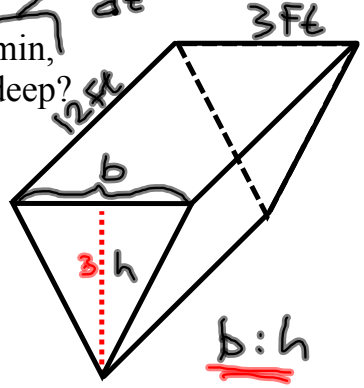
b) Suppose the boat is moving at a constant rate of 4 ft/sec. Determine the speed at which the winch pulls in rope when there is a total of 13 ft of rope out. What happens to tthe speed at which the winch pulls in rope as the boat gets closer to the dock?

$b\frac{db}{dt} = c\frac{dc}{dt} \rightarrow 5(4) = 13\frac{dc}{dt} \Rightarrow \frac{20}{13}\frac{ft}{sec} = \frac{dc}{dt}$

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 ft^3/min, how fast is the water level rising when it is 1 ft deep?

$\frac{dV}{dt}$



$\frac{dh}{dt}$

Bad

$V = \frac{1}{2}(b)(h)(12)$

$V = 6h^2 \rightarrow \frac{dV}{dt} = 12h\frac{dh}{dt}$

$2 = 12(1)\frac{dh}{dt} = \frac{1}{6}$ Ft/min

b : h

h

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.

$\frac{dV}{dt} = 12h\frac{dh}{dt}$

$\frac{3}{8}\frac{in}{min} \times \frac{1Ft}{12in} = \frac{1}{32}\frac{Ft}{min}$

$= 12(2)\left(\frac{1}{32}\right) = \frac{3}{4}\frac{Ft^3}{min}$