Warm Up

At 9 A.M. ship A is situated 80 *km* due east of ship B. Ship A is traveling north at 40 *km/h* and ship B is sailing south at 60 *km/h*. How fast is the distance between the ships changing at noon ?

A building is illuminated by a floodlight that is 15 m away and at ground level a man 2 m tall walks away from the light directly towards the building at 2 m/s. Determine the rate of change of the length of his shadow when he is 4 m from the light ? [5]

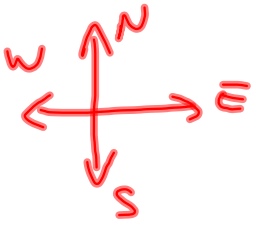
$-3.75 m/s$

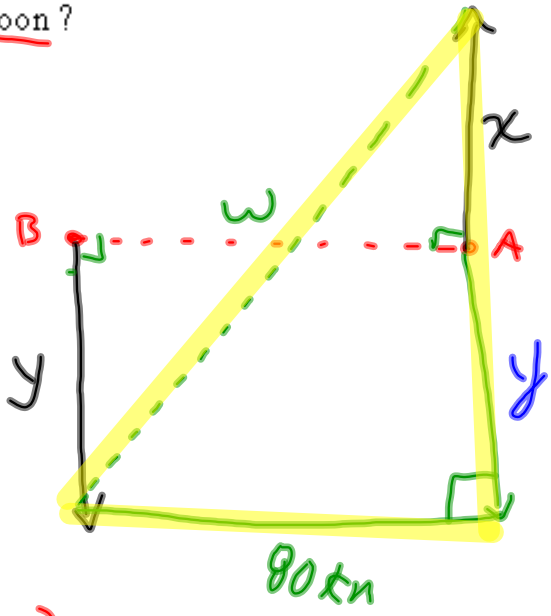
The trough down the centre of a cattle barn is 40 cm wide at the top and 20 cm at the bottom. It is 30 cm deep and 8 m long. The trough is being filled at the rate of 0.25 m^3/min. How fast is the water level in the trough rising when the water is 20 cm deep in the trough?

$0.09 m/min.$

Pg. 145/146 #3-17 Practice Problems

At 9 A.M. ship A is situated 80 *km* due east of ship B. Ship A is traveling north at 40 *km/h* and ship B is sailing south at 60 *km/h*. How fast is the distance between the ships changing at noon ?





$\frac{dx}{dt} = 40 km/h$

$\frac{dy}{dt} = 60 km/h$

$$(x+y)^2 + 80^2 = w^2$$

$$2(x+y)^1\left(\frac{dx}{dt} + \frac{dy}{dt}\right) + 0 = 2w\frac{dw}{dt}$$

$$2(300)(40+60) = 2\sqrt{80^2+300^2}\frac{dw}{dt}$$

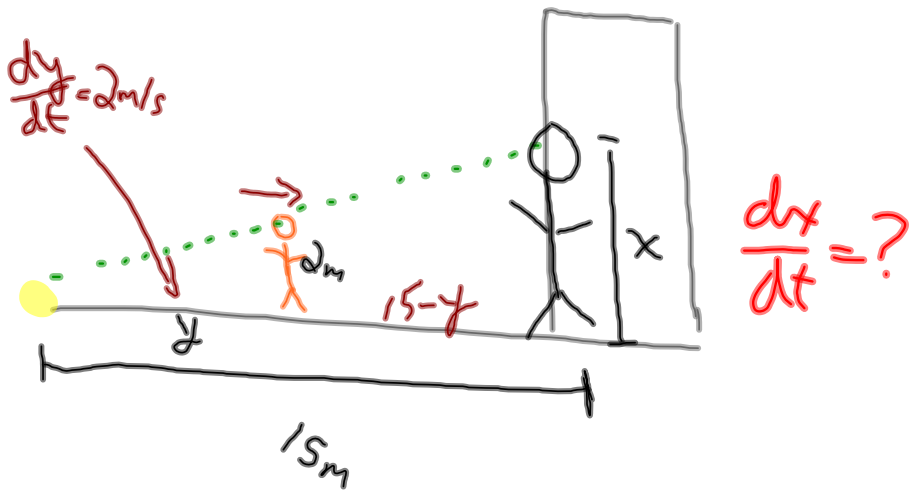
$$\frac{dw}{dt} = \frac{6000}{2\sqrt{80^2+300^2}}$$

$$= 96.6 km/h$$

At Noon :

$w = \sqrt{80^2+300^2}$

A building is illuminated by a floodlight that is 15 m away and at ground level a man 2 m tall walks away from the light directly towards the building at 2 m/s. Determine the rate of change of the length of his shadow when he is 4 m from the light ? [5]



$$\frac{2}{x} = \frac{y}{15} \Longrightarrow \frac{2}{x} = \frac{4}{15}$$

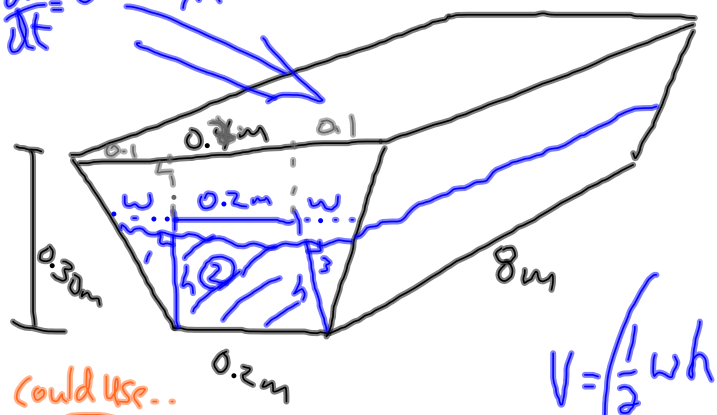
$$30 = xy$$

$$0 = \frac{dx}{dt}y + x\frac{dy}{dt}$$

The trough down the centre of a cattle barn is 40 cm wide at the top and 20 cm at the bottom. It is 30 cm deep and 8 m long. The trough is being filled at the rate of 0.25 m^3/min. How fast is the water level in the trough rising when the water is 20 cm deep in the trough?

$\frac{dV}{dt} = 0.25 m^3/min.$

$V_{PRISM} = \text{Area of Face} \times \text{Length}$



$V = \left(\frac{1}{2}wh + 0.2h + \frac{1}{2}wh\right)8$

$V = (wh + 0.2h)8$

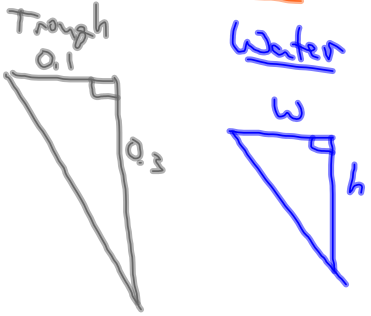
$V = 8wh + 1.6h$ ← 3 variables

Could use..

Area of a Trapezoid

$A = \frac{1}{2}(a+b)h$

Similar Shapes



$\frac{0.1}{w} = \frac{0.3}{h}$

$\frac{0.3w}{0.3} = \frac{0.1h}{0.3}$

$w = \frac{1}{3}h$

$V = 8\left(\frac{1}{3}h\right)h + 1.6h$

$V = \frac{8}{3}h^2 + 1.6h$

$\frac{dV}{dt} = \frac{16}{3}h\frac{dh}{dt} + 1.6\frac{dh}{dt}$

$0.25 = \frac{16}{3}(0.2)\frac{dh}{dt} + 1.6\frac{dh}{dt}$

$0.25 = 2.667\frac{dh}{dt}$

$\frac{dh}{dt} = \frac{0.25}{2.667} = 0.09375 \text{ m/min.}$