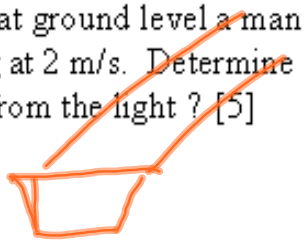
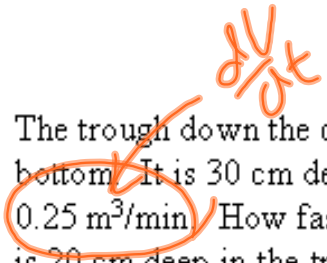
Warm Up

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]





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?

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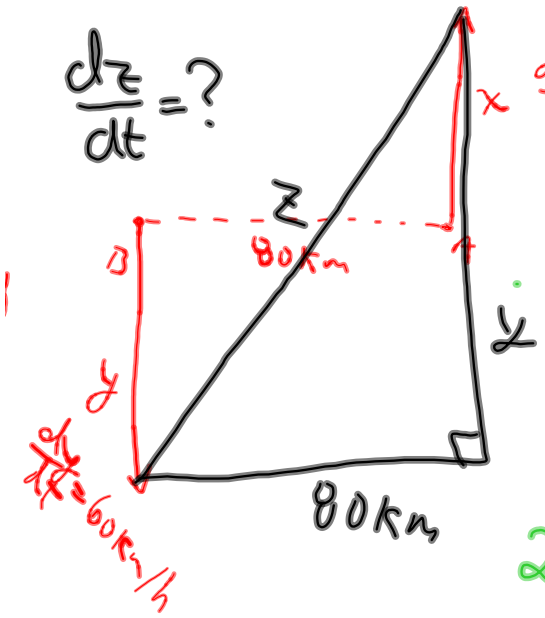


$(x+y)^2 + 80^2 = z^2$

$2(x+y)^1\left(\frac{dx}{dt} + \frac{dy}{dt}\right) = 2z\frac{dz}{dt}$

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

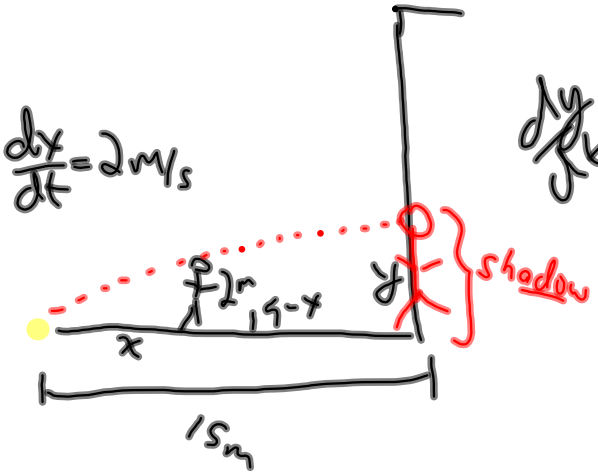
3 hours later . . .

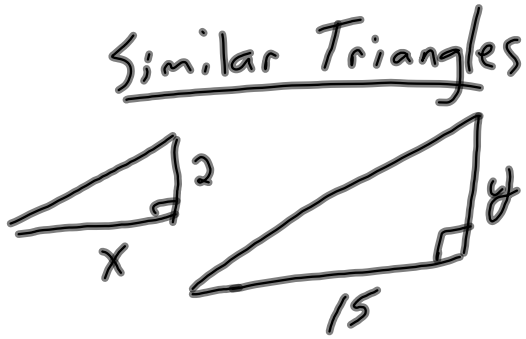
$\frac{60000}{2\sqrt{300^2+80^2}} = \frac{dz}{dt}$

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

$96.6\ \text{km/h} = \frac{dz}{dt}$

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]





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

$$xy = 30$$

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

$$(2)\left(\frac{15}{2}\right) + (4)\frac{dy}{dt} = 0$$

$$4\frac{dy}{dt} = -15$$

$$\frac{dy}{dt} = -\frac{15}{4}\ m/s$$

$$= -3.75\ m/s$$

when $x = 4m$

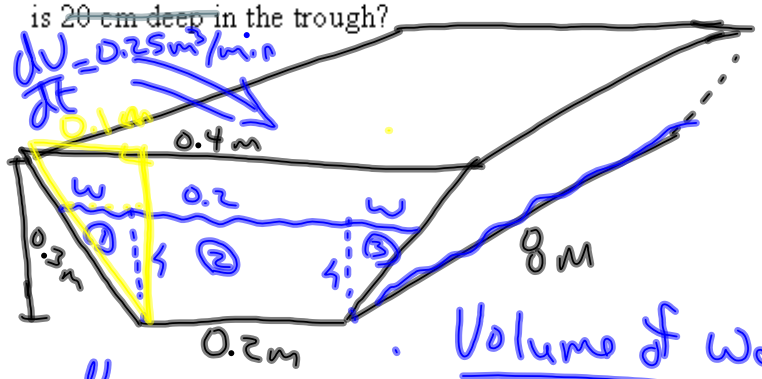
$$\frac{2}{y} = \frac{4}{15}$$

$$4y = 30$$

$$y = \frac{30}{4}$$

$$y = \frac{15}{2}m$$

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?



$\frac{dh}{dt} = ?$

Volume of Water

$V = (\text{Area of face}) \times \text{length}$

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

$V = (wh + 0.2h)\,8$

$V = 8wh + 1.6h$

Trough

Water

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

$0.1h = 0.3w$

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

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

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

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

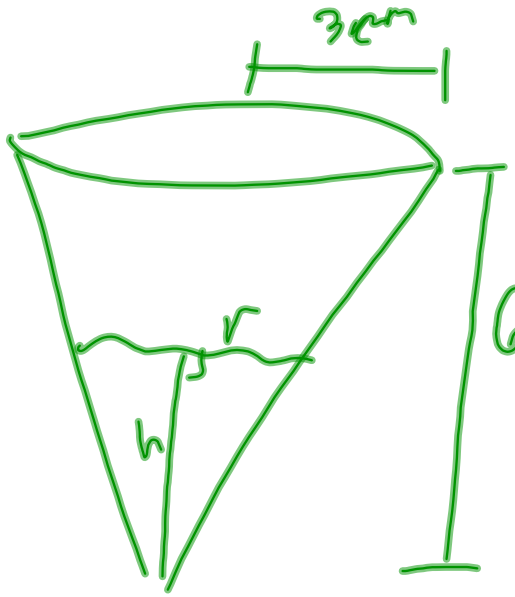
$\frac{dV}{dt} = \frac{8}{3}(2h)\frac{dh}{dt} + 1.6\left(\frac{dh}{dt}\right)$

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

$0.25 = \left(\frac{3.2}{3} + 1.6\right)\frac{dh}{dt}$

$\frac{dh}{dt} = \frac{0.25}{\left(\frac{3.2}{3} + 1.6\right)}$

$= 0.09\ m/$

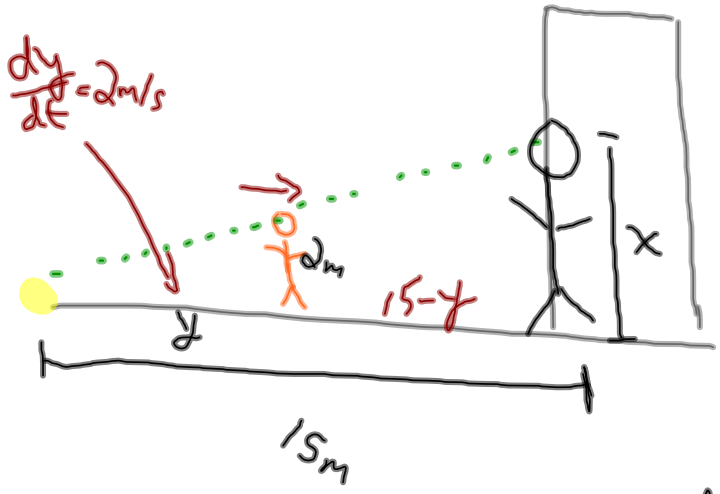


$$\frac{3}{r} = \frac{6}{h}$$

$$3h = 6r$$

$$\frac{1}{2}h = r$$

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]



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

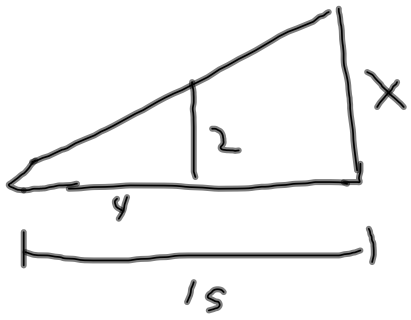
$$xy = 30$$

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

$$\frac{dx}{dt}(4) + \left(\frac{15}{x}\right)(x) = 0$$

$$4\frac{dx}{dt} = -15$$

$$\frac{dx}{dt} = -\frac{15}{4} = -3.75\ m/s$$



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

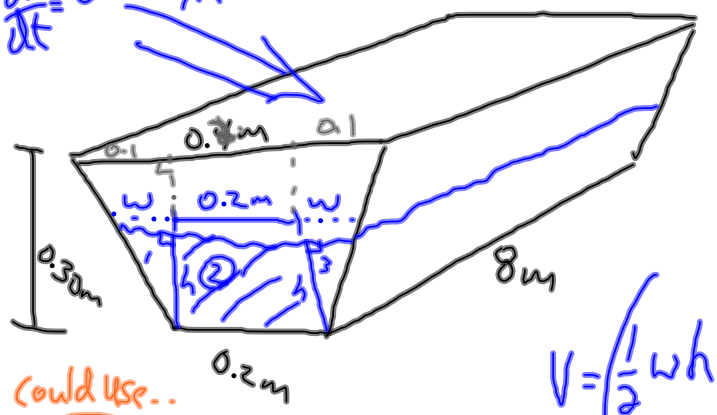
$$4y = 30$$

$$y = \frac{15}{2}$$

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?

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

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



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

$V = (wh + 0.2h)8$

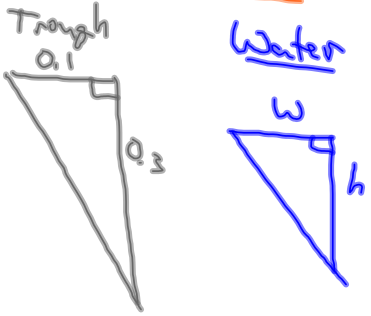
$V = 8wh + 1.6h$ ← 3 variables

Could use..

Area of a Trapezoid

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

Similar Shapes



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

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

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

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

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

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

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

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

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

① Finish Pg. 145/146

② Worksheet