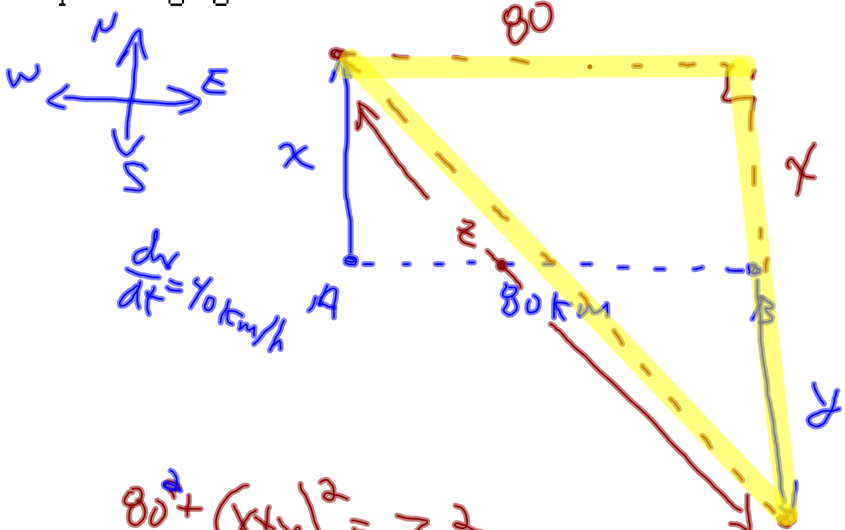
Warm Up

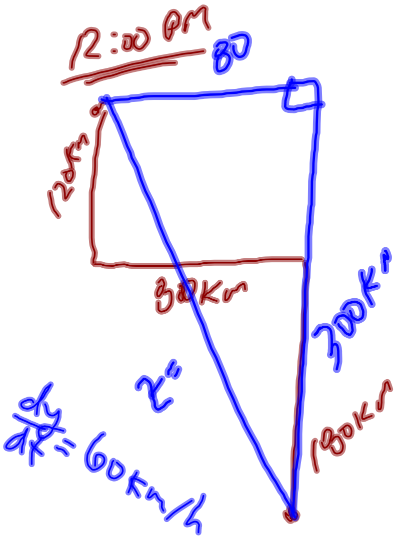
At 9 A.M. ship A is situated 80 *km* due east of ship B. Ship A is traveling north at 40 *km/h* and ship B is sailing south at 60 *km/h*. How fast is the distance between the ships changing at noon ?

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?

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 ?

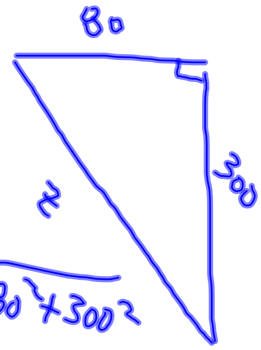




$$80^2+(x+y)^2=z^2$$

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

$$2(120+180)(40+60)=2\sqrt{80^2+300^2}\,\frac{dz}{dt}$$

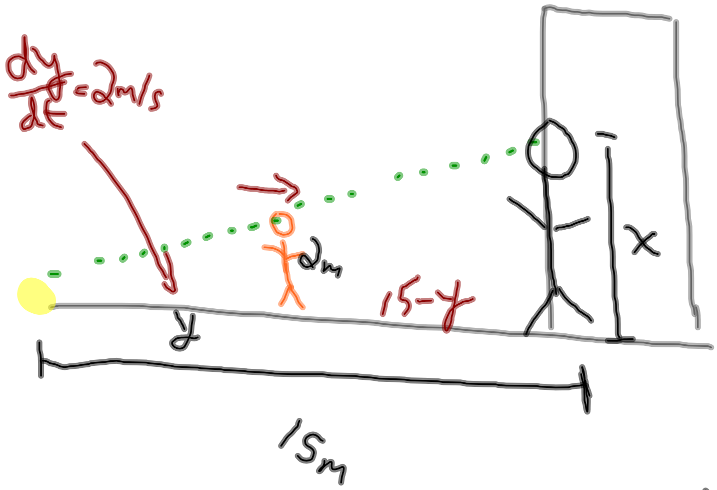


$$z=\sqrt{80^2+300^2}$$

$$\frac{dz}{dt}=\frac{2(300)(100)}{2\sqrt{80^2+300^2}}$$

$$\frac{dz}{dt}=96.62\text{ km/h}$$

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]



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

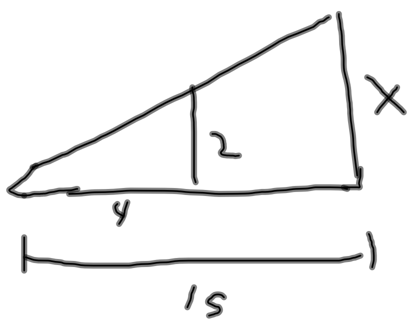
$$xy = 30$$

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

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

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

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



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

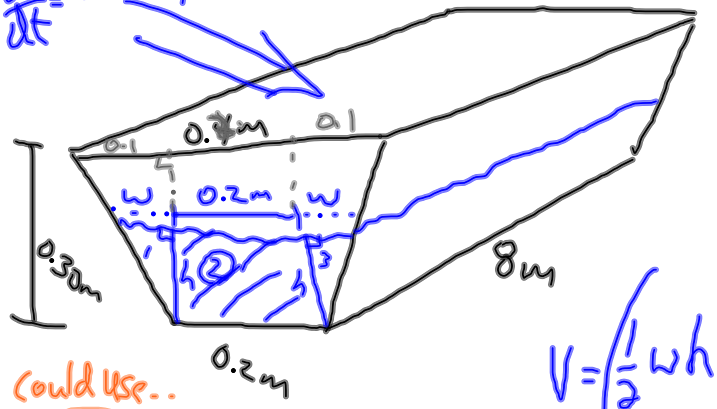
$$4x = 30$$

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

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?

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

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



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

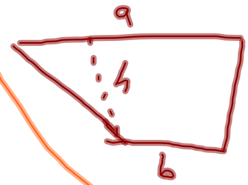
$V = (wh + 0.2h)8$

$V = 8wh + 1.6h \leftarrow$ 3 variables

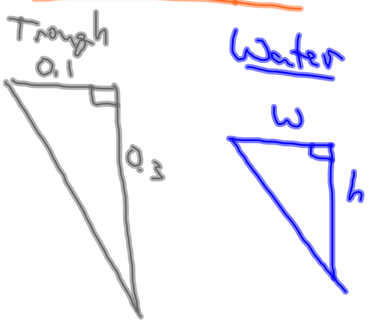
Could use..

Area of a Trapezoid

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



Similar Shapes



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

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

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

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

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

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

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

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

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

1. Finish Pg. 145/146

2. Worksheet

Warm Up

A spherical hailstone is increasing in size at the rate of 2 cm^3/min. as it falls from the clouds. Determine the rate at which the radius of the hailstone is increasing at the instant it has a surface area of $4\pi\ cm^2$. [5]

A rectangle is expanding so that its length is always twice its width. The perimeter of the rectangle is increasing at a rate of 6 *cm/min*. Find the rate of increase of the area of the rectangle when the perimeter is 40 *cm*. [5]

A dog running at 5 *m/s* is chasing a squirrel running at the rate of 4 *m/s*. The squirrel dashes up a telephone pole in attempt to get away from the canine. If the dog is 16 *m* behind the squirrel when it begins to climb the pole, what is the rate at which the distance between the two animals is increasing 2 seconds after the squirrel starts up the pole? [5]

A spherical hailstone is increasing in size at the rate of 2 cm^3/min. as it falls from the clouds. Determine the rate at which the radius of the hailstone is increasing at the instant it has a surface area of $4\pi\ cm^2$. [5]

$SA = 4\pi r^2$

$4\pi = 4\pi r^2$

$1 = r^2$

$r = 1\text{cm}$

$\frac{dV}{dt} = 2\text{cm}^3/\text{min.}$

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

$V = \frac{4}{3}\pi r^3$

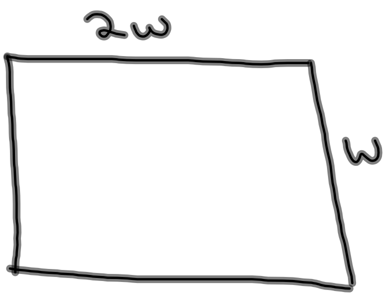
$\frac{dV}{dt} = \frac{4}{3}\pi(3r^2)\frac{dr}{dt}$

$2 = \frac{4}{\cancel{3}}\pi(\cancel{3})(1)^2\frac{dr}{dt}$

$\frac{2}{4\pi} = \frac{dr}{dt}$

$\frac{1}{2\pi} = 0.16\text{ cm/min}$

A rectangle is expanding so that its length is always twice its width. The perimeter of the rectangle is increasing at a rate of 6 *cm/min*. Find the rate of increase of the area of the rectangle when the perimeter is 40 *cm*. [5]



$$\frac{dP}{dt} = 6 \text{ cm/min}$$

$$A = 2w(w)$$
$$A = 2w^2$$

$$P = 6w$$
$$w = \frac{P}{6}$$

$$A = 2\left(\frac{P}{6}\right)^2 = \frac{2P^2}{36}$$
$$A = \frac{1}{18}P^2$$
$$\frac{dA}{dt} = \frac{1}{9}P\frac{dP}{dt}$$
$$= \frac{1}{9}(40)(6)$$
$$= \frac{80}{3} \text{ cm}^2/\text{min}.$$

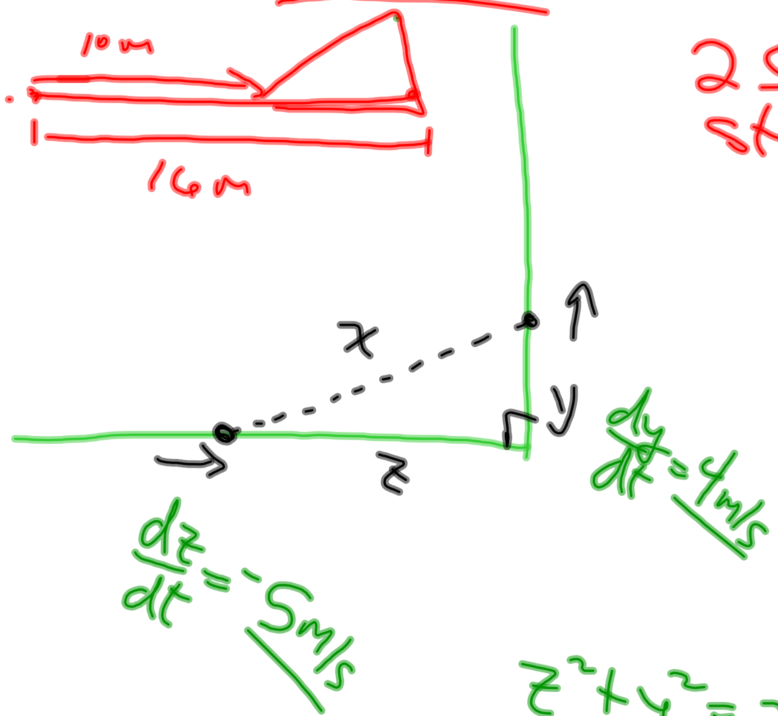
OR

$$A = 2w^2$$
$$\frac{dA}{dt} = 4w\frac{dw}{dt}$$

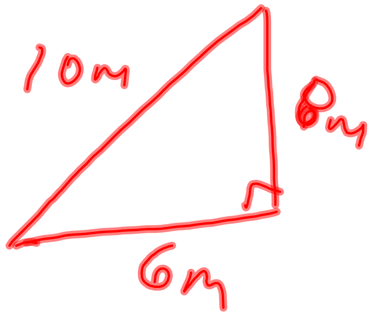
$$P = 6w$$
$$\frac{dP}{dt} = 6\frac{dw}{dt}$$
$$6 = 6\frac{dw}{dt}$$
$$1 = \frac{dw}{dt}$$

$$40 = 6w$$
$$\frac{40}{6} = w$$

A dog running at 5 *m/s* is chasing a squirrel running at the rate of 4 *m/s*. The squirrel dashes up a telephone pole in attempt to get away from the canine. If the dog is 16 *m* behind the squirrel when it begins to climb the pole, what is the rate at which the distance between the two animals is increasing 2 seconds after the squirrel starts up the pole? [5]



2 Seconds after squirrel starts up pole...



$$z^2 + y^2 = x^2$$

$$\cancel{2}z\frac{dz}{dt} + \cancel{2}y\frac{dy}{dt} = \cancel{2}x\frac{dx}{dt}$$

$$6(-5) + 8(4) = 10\frac{dx}{dt}$$

$$2 = 10\frac{dx}{dt}$$

$$\frac{1}{5} = \frac{dx}{dt}$$

$$(+)\ 0.2\ m/s = \frac{dx}{dt}$$

1/ Textbook:

Pg. 145
#3 - 17 (omit 14)

Pg. 159
#17, 18, 19

Pg. 346
#13

2/ Practice Test