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Right Triangles

A *ladder 20 feet long* leans against a vertical house. If the bottom of the ladder slides away from the house *horizontally at a rate of 4 ft/sec*, how *fast is the ladder sliding down* the house when the *top of the ladder is 8 feet from the ground.*

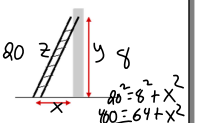
(a) How are these variables related?

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

(b) What is the given information?

$z=20$

$dx/dt=4$ $y=8$



$20^2=8^2+x^2$

$400=64+x^2$

$\sqrt{336}=\sqrt{x^2}$

$x=\sqrt{336}$

(c) What are you looking for?

dy/dt

(e) What is $\frac{dz}{dt}$? 0

(d) What is the derivative of this equation?

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

$2x\,dx/dt+2y\,dy/dt=2z\,dz/dt$

$2(\sqrt{336})(4)+2(8)dy/dt=2(20)(0)$

$8\sqrt{336}+16\,dy/dt=0$

$\frac{16\,dy/dt}{16}=\frac{-8\sqrt{336}}{16}$

$dy/dt=\frac{-\sqrt{336}}{2}$ ft/sec.

(f) What is x at this time?

$x=\sqrt{336}$

Advice from Mr. C:

1) Since the length of z does not change, $\frac{dz}{dt}=0$

2) Remember, not to plug the variables until you find the derivative

3) Then go back to the original $x^2+y^2=z^2$, to find the missing side of the right triangle

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Cylinder

The **volume** of a right circular cylinder is $V=\pi r^2 h$

If the cylinder does not changes dimensions and water is poured in what happens to

(a) $\frac{dh}{dt}$ of the water	(b) $\frac{dr}{dt}$ of the water

1) A right cylindrical tank is filled with water. The tank stands upright has *radius 20 cm*. How *fast does the height of water* in the tank drop when the water is being *drained at 25 cm³/sec?*

1. Given Information:

$r=20$

$dv/dt=-25$

2. Looking for:

dh/dt

3. Equation that relates the variables:

$V=\pi r^2 h$

4. The derivative of the equation:

$V=\pi r^2 h$

We don't know h, but $dr/dt=0$

$dV/dt=\pi r^2\,dh/dt+\cancel{2\pi r\,dr/dt\,h}$ 0

$-25=\pi(20)^2\,dh/dt$

$\frac{-25}{400\pi}=\frac{\cancel{400\pi}\,dh/dt}{\cancel{400\pi}}$

$-1/16\pi$ cm/sec $\frac{-1}{16\pi}=dh/dt$

Advice from Mr. C:

1. When taking the derivative of the volume equation use the product rule and think of the equation as is $V=(\pi r^2)(h)$

2. Remember, if the cylinder does not change dimensions, the radius of the substance inside will not change, hence $\frac{dr}{dt}=$

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