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What is the process for solving Related Rates problems?

Identify

From Problem {
- Know: > Rates $\frac{d(\text{something})}{dt}$
- Find:
- When: most of time length/sometimes time

Equation: must have same variables as Know & Find

Derivative: always with Respect to time!!

Substitute: Sub in and solve for find

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Solve

Water pours into a conical tank of height 10 feet and radius 4 feet at a rate of $10\frac{ft^3}{\min}$. How fast is the water level rising when it is 5 feet high?

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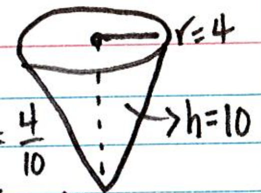

$\frac{r}{h} = \frac{4}{10}$

$\frac{\cancel{10}r}{\cancel{10}} = \frac{4h}{10}$

$r = \frac{2}{5}h$

K: $dV/dt = 10\ ft^3/min$

F: $dh/dt =$ ___

W: $h = 5\ ft$

Eqn: $V = \frac{1}{3}\pi R^2 h$

$V = \frac{1}{3}\pi\left(\frac{2}{5}h\right)^2 h$

$V = \frac{1}{3}\pi\left(\frac{4}{25}\right)h^2 h$

$\frac{d}{dt}\left[V = \frac{4}{75}\pi h^3\right]$

$\frac{dV}{dt} = \frac{4}{\cancel{75}\,25}\pi(\cancel{3}h^2)\frac{dh}{dt}$

$\frac{dV}{dt} = \frac{4\pi}{25}h^2\frac{dh}{dt}$

$10 = \frac{4\pi}{\cancel{25}}\cancel{(5)^2}\frac{dh}{dt}$

$\frac{dh}{dt} = \frac{5}{2\pi}\frac{ft}{min}$

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Solve

A stone is thrown into a pond creating ripples that are concentric circles. The rate of change of the radius of the circle is 2cm/sec. Find the rate of change of the area of the circle when the radius is 12cm.

A stone is thrown into a pond creating ripples that are concentric circles. The rate of change of the radius of the circle is 2cm/sec. Find the rate of change of the area of the circle when the radius is 12cm.

Know: $dR/dt = 2\ cm/s$

Find: $dA/dt =$ ___

When: $R = 12cm$

Equation: $[A = \pi R^2]\ d/dt$

Derivative: $\frac{dA}{dt} = 2\pi R\ dR/dt$

Substitute:

$\frac{dA}{dt} = 2\pi R\frac{dR}{dt}$

$\frac{dA}{dt} = 2\pi(12cm)\left(2\frac{cm}{s}\right)$

$\frac{dA}{dt} = 48\pi\frac{cm^2}{s}$

Solve

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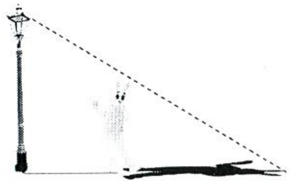
A man in a 7 foot tall bunny costume is walking away from a 10 foot tall street lamp at a rate of 3 feet per second. How fast is the man's showdown growing?



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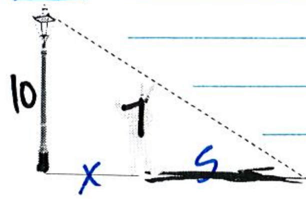

K: $dx/dt = 3\text{ft/sec}$

F: $ds/dt =$ ____

W: ?

Eqn: $\frac{\text{Small}}{\Delta} = \frac{\text{lg}}{\Delta}$

$$\frac{7}{s} = \frac{10}{x+s}$$

$$7x + 7s = 10s$$

D: $\left[7x = 3s\right]\frac{d}{dt}$

$$7\frac{dx}{dt} = 3\frac{ds}{dt}$$

$$\frac{7(\cancel{3})}{\cancel{3}} = \frac{\cancel{3}\frac{ds}{dt}}{\cancel{3}}$$

$$\frac{ds}{dt} = 7\frac{ft}{s}$$