A Few More Related Rate Problems

(1) A 13 m ladder is sliding down a wall at a rate of 0.1 m/min. Determine the rate at which its base is moving away from the wall when the top of the ladder is 12 m from the ground.

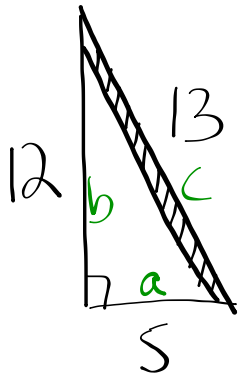
$\frac{dx}{dt} = 0.24 \text{ m/min}$

(2) A cylindrical tank has a leak in its base such that water is leaking out at a constant rate of 50 cm^3/min. The tank has a height of ~~2m~~ 200 cm and a diameter of ~~2m~~ 200 cm. Determine how quickly the height of the water is dropping when the tank is half full.

$\frac{dh}{dt} = -0.0016 \text{ cm/min}$

(3) A 2m tall man walks away from a 5m tall lamppost at a constant rate of 1 m/sec. Determine the rate at which the length of his shadow is increasing when he is 3 m from the lamp post.

$\frac{dl}{dt} = \frac{2}{3} \text{ m/sec}$



$$a^2 + b^2 = 13^2$$

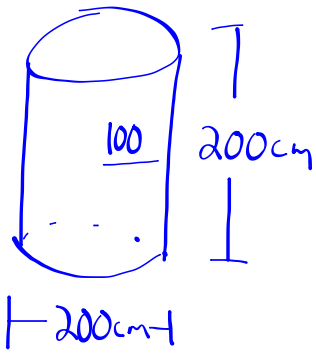
$$2a\frac{da}{dt} + 2b\frac{db}{dt} = 2c\frac{dc}{dt}$$

$$2(5)\frac{da}{dt} + 2(12)(-0.1) = 2(13)(0)$$

$$10\frac{da}{dt} = 24(0.1)$$

$$\frac{da}{dt} = 0.24 \text{ m/min}$$

2.



$V = \pi r^2 h$ Want $\frac{dh}{dt}$

$V = \pi 100^2 (h)$ Have $\frac{dV}{dt} = -50 \text{ cm}^3/\text{min}$

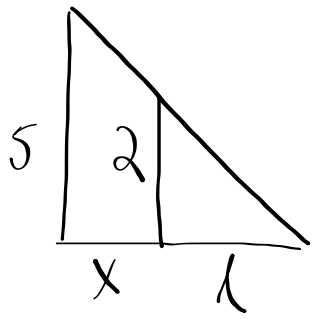
$V = 10000\pi h$

~~$h = 100\text{cm}$~~

$\frac{dV}{dt} = 10000\pi \frac{dh}{dt}$

$\frac{-50}{10000\pi} = \frac{dh}{dt} = -0.00159\ldots \text{cm/min}$

3.



$\frac{5}{x+l} = \frac{2}{l}$

Have $\frac{dx}{dt} = +1$ m/s

$5l = 2x + 2l$

$-2l \quad -2l$

$3l = 2x$

$3\frac{dl}{dt} = 2\frac{dx}{dt}$

Find $\frac{dl}{dx}$

when ~~$x=3$~~

$\frac{dl}{dt} = \frac{2}{3}(1) = \frac{2}{3}$ m/s