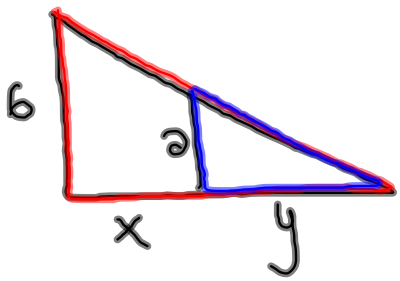
⑦



$$\frac{6}{x+y} = \frac{2}{y}$$

$$2x+2y = 6y$$

$$2x = 4y$$

Given:

$\frac{dx}{dt} = -1.5 m/s$

$x = 5m$

$$2\frac{dx}{dt} = 4\frac{dy}{dt}$$

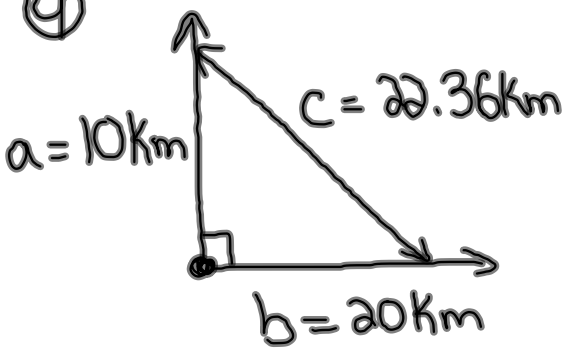
$$2(-1.5) = 4\frac{dy}{dt}$$

$$-3 = 4\frac{dy}{dt}$$

$$-0.75 m/s = \frac{dy}{dt}$$

∴ His shadow is decreasing at a rate of 0.75m/s

⑨



Given:

$\frac{da}{dt} = 5 km/h$ $\quad a = 10 km$

$\frac{db}{dt} = 10 km/h$ $\quad b = 20 km$

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

$c = \sqrt{a^2+b^2}$

$c = \sqrt{100+400}$

$c = 22.36$

$a^2+b^2 = c^2$

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

$2(10)(5) + 2(20)(10) = 2(22.36)\frac{dc}{dt}$

$100 + 400 = 44.72\frac{dc}{dt}$

$11.18 km/h = \frac{dc}{dt}$

∴ The distance between the two is increasing at a rate of 11.18 km/h.

⑥ Given:

$\frac{dV}{dt} = 6m^3/min$

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

$r = 2m$

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

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

$6 = 4\pi (2)^2 \frac{dr}{dt}$

$6 = 16\pi \frac{dr}{dt}$

$0.119 m/min = \frac{dr}{dt}$

Square: $A = l^2 \rightarrow \frac{dA}{dt} = 2l\frac{dl}{dt}$

Cube: $V = l^3 \rightarrow \frac{dV}{dt} = 3l^2\frac{dl}{dt}$

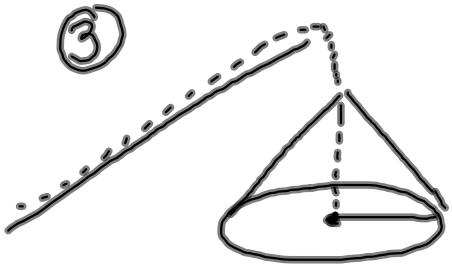
Circle: $A = \pi r^2 \rightarrow \frac{dA}{dt} = 2\pi r\frac{dr}{dt}$

Cone: $V = \frac{1}{3}\pi r^2 h$

Sphere: $V = \frac{4}{3}\pi r^3 \rightarrow \frac{dV}{dt} = 4\pi r^2\frac{dr}{dt}$

$A = 4\pi r^2 \rightarrow \frac{dA}{dt} = 8\pi r\frac{dr}{dt}$

③



$r = 2h$

Given:

$\frac{dV}{dt} = 2 m^3/min$

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

$h = 4m$

$V = \frac{1}{3}\pi r^2 h$

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

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

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

$2 = 4\pi (4)^2 \frac{dh}{dt}$

$2 = 64\pi \frac{dh}{dt}$

$\frac{1}{32\pi} m/min = \frac{dh}{dt}$

Related Rates Review #3

$x = y^3 + y$ * Use Implicit Diff.

$1 = 3y^2y' + y'$

$1 = y'(3y^2+1)$

$\frac{1}{3y^2+1} = y'$

$$\boxed{y' = \frac{1}{3y^2+1}}$$

$$y'' = \frac{(3y^2+1)(0) - 1(6yy')}{(3y^2+1)^2}$$

$$y'' = \frac{-6yy'}{(3y^2+1)^2}$$

$$y'' = \frac{-6y\left(\frac{1}{3y^2+1}\right)}{(3y^2+1)^2}$$

$$y'' = \frac{\frac{-6y}{3y^2+1}}{(3y^2+1)^2} = \frac{-6y}{3y^2+1} \times \frac{1}{(3y^2+1)^2} = \boxed{\frac{-6y}{(3y^2+1)^3}}$$