14) Find the rate of change $\frac{dd}{dt}$ of the distance between the origin and a moving point on the graph of y = sinx if *dx/dt* = 2 cm/sec.

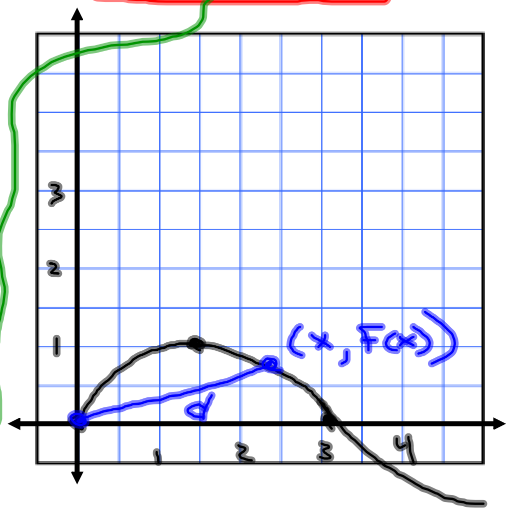
$$d = \sqrt{x^2 + f^2(x)}$$

$$d = \sqrt{x^2 + \sin^2 x}$$

$$\frac{dd}{dt} = \frac{\cancel{2}x\frac{dx}{dt} + \cancel{2}\sin x\cos x\frac{dx}{dt}}{\cancel{2}\sqrt{x^2 + \sin^2 x}}$$

$$\frac{dd}{dt} = \frac{x + \sin x\cos x}{\sqrt{x^2 + \sin^2 x}}\,\frac{dx}{dt}$$

$$\frac{dd}{dt} = \boxed{\frac{2x + 2\sin x\cos x}{\sqrt{x^2 + \sin^2 x}}}$$



15) The radius r of a circle is increasing at a rate of 3 cm/min. $\frac{dr}{dt}$

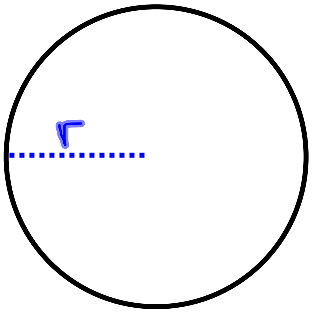
Find the rate of change of the area when: $\frac{dA}{dt}$

a) r = 6 cm

$$A = \pi r^2$$

$$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$$

$$\frac{dA}{dt} = 2\pi(6)(3) = 36\pi \ \frac{cm^2}{min}$$



b) r = 24 cm

$$\frac{dA}{dt} = 2\pi(24)(3) = 144\pi \ \frac{cm^2}{min}$$

16) Let A be the area of a circle of radius r that is changing with respect to time. If dr/dt is constant, is dA/dt constant? Explain.

$$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$$

Not constant

still variable

17) The included angle of the two sides of constant equal length *s* of an isosceles triangle is θ.

not changing

a) $A = \frac{1}{2}s^2 \sin\theta$

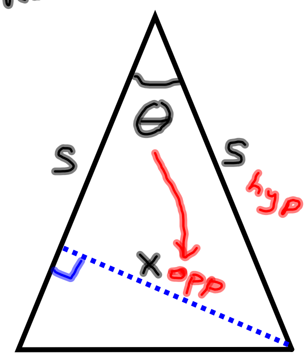
b) $\frac{d\theta}{dt} = \frac{1}{2}\ \frac{\text{rad}}{\text{min}}$

Find $\frac{dA}{dt}$

$$\frac{dA}{dt} = \frac{1}{2}s^2 \cos\theta \frac{d\theta}{dt}$$

$\theta = \frac{\pi}{6}$ $\quad \frac{dA}{dt} = \frac{1}{2}s^2\left(\overset{\frac{\sqrt{3}}{2}}{\cos\frac{\pi}{6}}\right)\frac{1}{2}$

$$\frac{dA}{dt} = \frac{s^2\sqrt{3}}{8}\ \frac{\text{units}^2}{\text{min}}$$



$\frac{x}{s} = \sin\theta$

$x = s \cdot \sin\theta$

$A = \frac{1}{2}b \cdot h$

$A = \frac{1}{2}s \cdot x$

$A = \frac{1}{2}s \cdot s \cdot \sin\theta$

$= \frac{1}{2}s^2 \sin\theta$

24. A conical tank (with vertex tank) 10 feet across the top and 12 feet across the top and 12 feet deep. If water is flowing into the tank at a rate of 10 cubic feet per minute, find the rate of change of the depth of the water when the water is 8 feet deep.

$\frac{dV}{dt} = 10$

$\frac{dh}{dt}$

problem

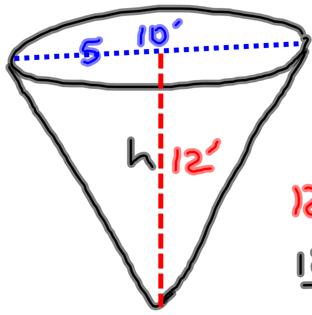
$$V = \frac{1}{3}\pi r^2 h$$

$$V = \frac{1}{3}\pi \left(\frac{12h}{5}\right)^2 h$$

$$V = \frac{144\pi}{75} h^3 \rightarrow \frac{dV}{dt} = \frac{144\pi}{25} h^2 \frac{dh}{dt}$$

$$\frac{25}{144\pi\, 8^2} \quad 10 = \cancel{\frac{144\pi}{25}}(8)^2 \frac{dh}{dt}$$

$$\frac{250}{144 \cdot 64\pi} = \frac{dh}{dt}$$



$12h : 5r$

$\frac{12h}{5} = r$