Name________________________________

1) A plane flying horizontally at an altitude of 1.0 mi and a speed of 200 mi/h passes directly over a radar station. Find the rate at which the distance from the plane to the station is increasing when it is 2.6 mi away from the station.

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

$$x^2 + 1^2 = 2.6^2$$
$$x^2 = 5.76$$
$$x = \sqrt{5.76}$$
$$x = 2.4$$

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 2z\frac{dz}{dt}$$

$$2(2.4)(200) + 2(1)(0) = 2(2.6)\frac{dz}{dt}$$

$$960 = 5.2\frac{dz}{dt}$$

$$\boxed{\frac{dz}{dt} = \frac{960}{5.2} \approx 184.62 \text{ m/hr}}$$

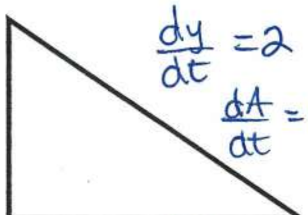
z $\frac{dz}{dt} = ?$

(2.6 miles)

1.0 miles $y = 1$

$\frac{dx}{dt} = 200$ x (2.4)

2) The altitude of a triangle is increasing at a rate of 2 cm/min while the area of the triangle remains constant. At what rate is the base of the triangle changing when the altitude is 5 cm and the area is 10 cm^2?



$\frac{dy}{dt} = 2$ $\frac{dA}{dt} = 0$

(5) y

x (4)

$$A = \frac{1}{2}xy$$
$$10 = \frac{1}{2}\cdot x\cdot 5$$
$$20 = 5x$$
$$4 = x$$

$$A = \frac{1}{2}xy$$

$$\frac{dA}{dt} = \frac{1}{2}\frac{dx}{dt}y + \frac{dy}{dt}\cdot\frac{1}{2}x$$

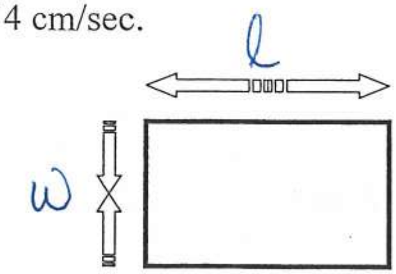
$$0 = \frac{1}{2}\frac{dx}{dt}\cdot 5 + 2\cdot\frac{1}{2}\cdot 4$$

$$\frac{2}{5}\cdot -4 = \frac{5}{2}\frac{dx}{dt}\cdot\frac{2}{5}$$

$$\boxed{-\frac{8}{5} = \frac{dx}{dt} \text{ or } -1.6 \text{ cm/min}}$$

3) The length of a rectangle is increasing at a rate of 3 cm/sec while the width is decreasing at a rate of 4 cm/sec.

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



$\frac{dw}{dt} = -4$

a) How fast is the **area** of the rectangle changing when the length is 12 cm long and the width is 10 cm long?

$$A = lw$$

$$\frac{dA}{dt} = \frac{dl}{dt} w + \frac{dw}{dt} l$$

$$\frac{dA}{dt} = (3)(10) + (-4)(12)$$

$$\boxed{\frac{dA}{dt} = -18 \text{ cm}^2/\text{sec}}$$

b) How fast is the **perimeter** of the rectangle changing when the length is 12 cm long and the width is 10 cm long?

$$P = 2l + 2w$$

$$\frac{dP}{dt} = 2\frac{dl}{dt} + 2\frac{dw}{dt}$$

$$= 2(3) + 2(-4)$$

$$\boxed{\frac{dP}{dt} = -2 \text{ cm/sec}}$$