4-6 Related Rates

- Compare two or more variables with respect to time.

$$\frac{dr}{dt} = \frac{\Delta r}{\Delta t}$$

$$\frac{dV}{dt} = \frac{\Delta V}{\Delta t}$$

$$\frac{dh}{dt} = \frac{\Delta h}{\Delta t}$$

How fast is the radius changing?

How fast is the volume changing?

How fast is the height changing?

Ex 1)
$$y = x^2 + 3x$$

Find dy/dt when x = 3 and dx/dt = 2.

Ex 2)
$$x^2 + y^2 = 25$$

Find dy/dt when x = 3, y = 4 and dx/dt = 8.

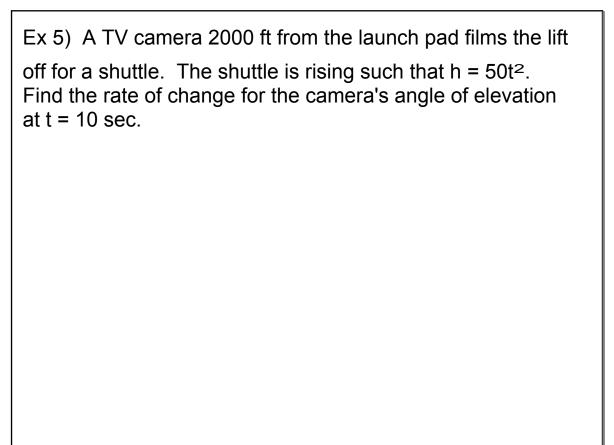
Ex 3) Air is being released from a spherical balloon at $3 \text{ in}^3/\text{min}$. What is the rate of a change for the radius, when r = 2 in?

1. Label all variables.

P. 246-247

- 2. Write an equation relating the variables.
- 3. Differentiate explicitly with respect to t.
- 4. Substitute into the derivative equation.
- 5. Solve

Ex 4) An airplane is flying at an altitude of 2 mi. If the distance, s, from the plane to a person on the ground is decreasing at 300 mph, what is the speed of the plane when s is 3 miles?



Ex 6) A water tank in the shape of a cone with radius = 6 ft and height = 18 ft, is leaking water at 2 ft³/hr. How fast is the height changing when the radius = 4 ft?