

Name: _____ Section: _____

Clear your desk of everything excepts pens, pencils and erasers. **Show all your work.**

If you have a question raise your hand and I will come to you.

1. (2 points) **Fill-in-the-Blank. No partial credit available**

A stone dropped into a pond sends out a circular ripple whose radius increases at a constant rate of 3 ft/sec .

- (a) How rapidly is the area enclosed by the ripple increasing when the radius is 2 feet?

12π _____ ft^2/sec

- (b) How rapidly is the area enclosed by the ripple increasing after 2 seconds?

36π _____ ft^2/sec

Extra Work Space.

2. (4 points) Gravel is being dumped from a conveyor belt at a rate of 10 cubic feet per minute. It forms a pile in the shape of a right circular cone whose height and base diameter are always the same. How fast is the height of the pile increasing when the pile is 7 feet high?

(**Recall:** Volume of a right circular cone with height h and radius of the base r is given by $V = \frac{\pi}{3}r^2h$)

Solution: With the words above we can get the equations

$$V'(t) = 10 \text{ and } h(t) = 2r(t) \implies r(t) = \frac{h(t)}{2}.$$

Take t_0 to be the special time when $h(t_0) = 7$.

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

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

$$V(t) = \frac{\pi}{12}h(t)^3$$

$$V'(t) = \frac{\pi}{4}h(t)^2h'(t)$$

$$10 = \frac{\pi}{4}h(t_0)^2h'(t_0)$$

$$10 = \frac{\pi}{4}(7)^2h'(t_0)$$

$$\frac{40}{49\pi} = h'(t_0)$$