Name _____ Quiz 5

Choose ONE of the following problems to complete. The quiz will be graded out of 10 points, regardless of which problem you choose. Choose wisely.

(8 points) 1) The radius r of a circle is increasing at a rate of 3cm/s. Find the rate of change of the area when $r = 6$cm.

Key Formula:
$$A = \pi r^2$$

Relevant information:
$A = ??$
$A' = ??$
$r = 6$
$r' = 3$

$$A' = 2\pi r r'$$

$$A' = 2\pi \cdot 6 \cdot 3 = 36\pi$$

The area is increasing at a rate of 36π cm/s.

(10 points) 2) At a sand and gravel plant, sand is falling off of a conveyor and onto a conical pile at a rate of 10 cubic feet per minute. The diameter of the base of the cone is three times the altitude. At what rate is the height of the pile changing when the pile is 15 feet high?

Key Formula:

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

Relevant information:

$$V = ??$$
$$V' = 10$$
$$r = ??$$
$$h = 15$$
$$2r = 3h$$

Formula expressed in terms of h:

$$V = \frac{1}{3}\pi \left(\frac{3}{2}h\right)^2 \cdot h = \frac{1}{3}\pi \frac{9}{4}h^3 = \frac{3}{4}\pi h^3$$
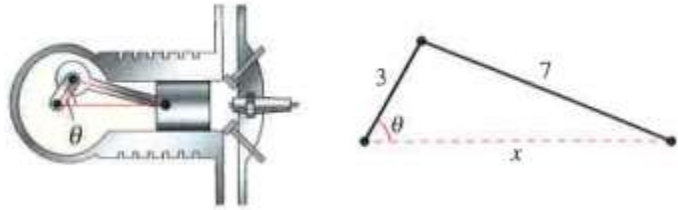
$$V' = \frac{9}{4}\pi h^2 h'$$

$$10 = \frac{9}{4}\pi \cdot 15^2 \cdot h'$$

$$h' = \frac{10 \cdot 4}{9\pi \cdot 15^2} = \frac{40}{9 \cdot 225\pi}$$

The pile is increasing by $\frac{40}{9 \cdot 225\pi}$ feet per minute.

(12 points) **3)** In the engine shown below, a 7-inch connecting rod is fastened to a crank of radius 3 inches. The crankshaft rotates counterclockwise at a constant rate of 200rpm. Find the velocity of the piston when $\theta = \frac{\pi}{3}$

(Nobody attempted this problem)