Name: _____ Date: _____ Period: _____ 2016

AP Calculus – QUIZ – Related Rates – **NO CALCULATOR ALLOWED**

1. The radius r of a sphere is increasing at the uniform rate of 0.3 inches per second. At the instant when the surface area S becomes 100π square inches, what is the rate of increase, in cubic inches per second, in the volume V ?

$$\left(S = 4\pi r^2 \text{ and } V = \frac{4}{3}\pi r^3\right)$$

(A) 10π **(B)** 12π **(C)** 22.5π **(D)** 25π **(E)** 30π

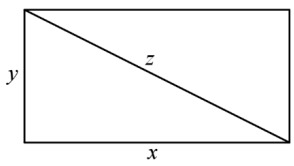
2. The volume of a cone of radius r and height h is given by $V = \frac{1}{3}\pi r^2 h$. If the radius and the height both increase at a constant rate of $\frac{1}{2}$ centimeter per second, at what rate, in cubic centimeters per second, is the volume increasing when the height is 9 centimeters and the radius is 6 centimeters?

(A) $\frac{1}{2}\pi$ **(B)** 10π **(C)** 24π **(D)** 54π **(E)** 108π

3. The area of a circular region is increasing at a rate of 96π square meters per second. When the area of the region is 64π square meters, how fast, in meters per second, is the radius of the region increasing?

(A) 6 **(B)** 8 **(C)** 16 **(D)** $4\sqrt{3}$ **(E)** $12\sqrt{3}$

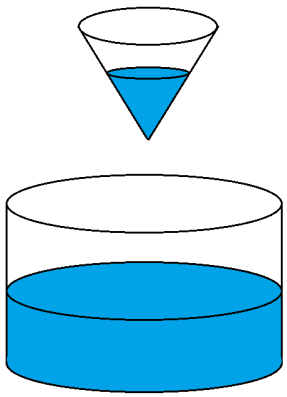
4. The sides of the rectangle below increase in such a way that $\frac{dz}{dt} = 1$ and $\frac{dx}{dt} = 3\frac{dy}{dt}$. At the instant when $x = 4$ and $y = 3$, what is the value of $\frac{dx}{dt}$?



(A) $\frac{1}{3}$ **(B)** 1 **(C)** 2 **(D)** $\sqrt{5}$ **(E)** 5

5. As shown in the figure below, water is draining from a conical tank with height 12 feet and diameter 8 feet into a cylindrical tank that has a base with area 400π square feet. The depth, h, in feet, of the water in the conical tank is changing at a rate of $(h - 12)$ feet per minute.

$$\left(V = \pi r^2 h \quad \text{and} \quad V = \frac{1}{3}\pi r^2 h \right)$$



(part a) Write an equation for the volume of the water in the conical tank as a function of h.

(part b) At what rate is the volume of the water in the conical tank changing when $h = 3$? Indicate units of measure.

(part c) Let y be the depth, in feet, of the water in the cylindrical tank. At what rate is y changing when $h = 3$? Indicate units of measure.