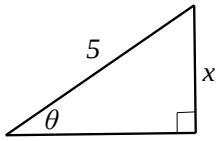
AP Calculus Related Rates Multiple Choice

1. A railroad track and a road cross at right angles. An observer stands on the road 70 meters south of the crossing and watches an eastbound train traveling at 60 meters per second. At how many meters per second is the train moving away from the observer 4 seconds after it passes through the intersection?

   a) 57.60 b) 57.88 c) 59.20 d) 60.00 e) 67.40



2. In the triangle shown above, if θ increases at a constant rate of 3 radians per minute, at what rate is x increasing in units per minute when $x = 3$ units?

   a) 3 b) $\frac{15}{4}$ c) 4 d) 9 e) 12

3. If the base *b* of a triangle is increasing at a rate of 3 inches per minute while its height *h* is decreasing at a rate of 3 inches per minute, which of the following must be true about the area *A* of the triangle?

   a) *A* is always increasing
   b) *A* is always decreasing
   c) *A* is decreasing only when $b < h$
   d) *A* is decreasing only when $b > h$
   e) *A* remains constant

4. The radius of a circle is increasing at a constant rate of 0.2 meters per second. What is the rate of increase in the area of the circle at the instant when the circumference of the circle is 20π meters?

   a) 0.04π m^2 / sec b) 0.4π m^2 / sec c) 4π m^2 / sec

   d) 20π m^2 / sec e) 100π m^2 / sec

5. The radius of a sphere is decreasing at a rate of 2 centimeters per second. At the instant when the radius of the sphere is 3 centimeters, what is the rate of change, in square centimeters per second, of the surface area of the sphere? (The surface area of a sphere is $S = 4\pi r^2$)

a) -108π b) -72π c) -48π d) -24π e) -16π

6. An isosceles right triangle with legs of length s has an area $A = \frac{1}{2}s^2$. At the instant when $s = \sqrt{32}$ centimeters, the area of the triangle is increasing at a rate of 12 square centimeters per second. At what rate is the length of the hypotenuse of the triangle increasing, in centimeters per second, at that instant?

a) $\frac{3}{4}$ b) 3 c) $\sqrt{32}$ d) 48

7. A cup has the shape of a right circular cone. The height of the cup is 12 cm, and the radius of the opening is 3 cm. Water is poured into the cup at a constant rate of 2 cm^3 / sec. What is the rate at which the water level is rising when the depth of the water in the cup is 5 cm?
(The volume of a cone is $V = \frac{1}{3}\pi r^2 h$)

a) $\frac{32}{25\pi}$ cm / sec b) $\frac{96}{125\pi}$ cm / sec c) $\frac{2}{3\pi}$ cm / sec

d) $\frac{2}{9\pi}$ cm / sec e) $\frac{1}{200\pi}$ cm / sec