

RELATED RATES AND OPTIMIZATION MC Practice

1. The radius r of a sphere is increasing at a 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 ?

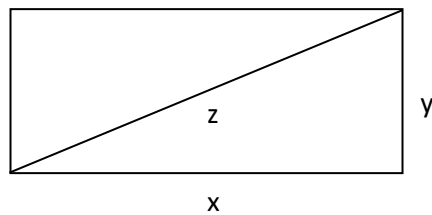
$$A = 4\pi r^2 \quad V = \frac{4}{3}\pi r^3$$

- a) 10π b) 12π c) 22.5π d) 25π e) 30π
2. If $y = 2x - 8$, what is the minimum value of the product xy ?
- a) -16 b) -8 c) -4 d) 0 e) 2
3. The volume of a cylindrical tin can with a top and a bottom is to be 16π cubic inches. If a minimum amount of tin is to be used to construct the can, what must be the height, in inches, of the can?

$$A = 2\pi r^2 + 2\pi r h \quad V = \pi r^2 h$$

- a) $2\sqrt[3]{2}$ b) $2\sqrt{2}$ c) $2\sqrt[3]{4}$ d) 4 e) 8
4. The radius of a circle is increasing at a nonzero rate, and at a certain instant, the rate of increase in the area of the circle is numerically equal to the rate of increase in its circumference. At this instant, the radius of the circle is

- a) $\frac{1}{\pi}$ b) $\frac{1}{2}$ c) $\frac{2}{\pi}$ d) 1 e) 2



5. The sides of the rectangle above 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

6. The top of a 25-foot ladder is sliding down a vertical wall at a constant rate of 3 feet per minute. When the top of the ladder is 7 feet from the ground, what is the rate of change of the distance between the bottom of the ladder and the wall?
- a) $-\frac{7}{8}$ ft/min b) $-\frac{7}{24}$ ft/min c) $\frac{7}{8}$ ft/min d) $\frac{7}{24}$ ft/min e) $\frac{21}{25}$ ft/min
7. 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
8. The point on the curve $2y = x^2$ nearest to $(4,1)$ is
- a) $(0,0)$ b) $(2,2)$ c) $(\sqrt{2},1)$ d) $(2\sqrt{2},4)$ e) $(4,8)$
9. 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 away from the observer 4 seconds after it passes through the intersection? (Calculator Active)
- a) 57.60 b) 57.88 c) 59.20 d) 60.00 e) 67.40
10. Let $f(x) = \sqrt{x}$. If the rate of change of f at $x = c$ is twice its rate of change at $x = 1$, then $c =$
- a) $\frac{1}{4}$ b) 1 c) 4 d) $\frac{1}{\sqrt{2}}$ e) $\frac{1}{2\sqrt{2}}$

Answers

1. E

2. B

3. D

4. D

5. B

6. C

7. D

8. B

9. A

10. A