

## Related Rates

**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

**Solve the problem.**

- 1) Suppose that the radius  $r$  and the circumference  $C = 2\pi r$  of a circle are differentiable functions of  $t$ . Write an equation that relates  $dC/dt$  to  $dr/dt$ . 1) \_\_\_\_\_

A)  $\frac{dC}{dt} = 2\pi \frac{dr}{dt}$       B)  $\frac{dr}{dt} = 2\pi \frac{dC}{dt}$       C)  $\frac{dC}{dt} = 2\pi r \frac{dr}{dt}$       D)  $\frac{dC}{dt} = \frac{dr}{dt}$

- 2) Suppose that the radius  $r$  and volume  $V = \frac{4}{3}\pi r^3$  of a sphere are differentiable functions of  $t$ . 2) \_\_\_\_\_

Write an equation that relates  $dV/dt$  to  $dr/dt$ .

A)  $\frac{dV}{dt} = 4\pi \frac{dr}{dt}$       B)  $\frac{dV}{dt} = 4\pi r^2 \frac{dr}{dt}$   
C)  $\frac{dV}{dt} = 3r^2 \frac{dr}{dt}$       D)  $\frac{dV}{dt} = \frac{4}{3}\pi r^2 \frac{dr}{dt}$

**Provide an appropriate response.**

- 3) If  $x^3 + y^3 = 9$  and  $dx/dt = -3$ , then what is  $dy/dt$  when  $x = 1$  and  $y = 2$ ? 3) \_\_\_\_\_

A)  $-\frac{4}{3}$       B)  $\frac{3}{4}$       C)  $-\frac{3}{4}$       D)  $\frac{4}{3}$

**Solve the problem. Round your answer, if appropriate.**

- 4) A spherical balloon is inflated with helium at a rate of  $110\pi$  ft<sup>3</sup>/min. How fast is the balloon's radius increasing when the radius is 5 ft? 4) \_\_\_\_\_

A) 1.10 ft/min      B) 0.22 ft/min      C) 3.30 ft/min      D) 2.75 ft/min

- 5) A ladder is slipping down a vertical wall. If the ladder is 20 ft long and the top of it is slipping at the constant rate of 4 ft/s, how fast is the bottom of the ladder moving along the ground when the bottom is 16 ft from the wall? 5) \_\_\_\_\_

A) 5.0 ft/s      B) 0.25 ft/s      C) 0.8 ft/s      D) 3.0 ft/s

**Solve the problem.**

- 6) Water is falling on a surface, wetting a circular area that is expanding at a rate of 2 mm<sup>2</sup>/s. How fast is the radius of the wetted area expanding when the radius is 152 mm? (Round your answer to four decimal places.) 6) \_\_\_\_\_

A) 0.0132 mm/s      B) 0.0042 mm/s  
C) 0.0021 mm/s      D) 477.5217 mm/s

- 7) Water is falling on a surface, wetting a circular area that is expanding at a rate of 7 mm<sup>2</sup>/s. How fast is the radius of the wetted area expanding when the radius is 101 mm? (Round your answer to four decimal places.) 7) \_\_\_\_\_

A) 90.6573 mm/s      B) 0.0110 mm/s      C) 0.0221 mm/s      D) 0.0693 mm/s

**Solve the problem. Round your answer, if appropriate.**

- 8) A man 6 ft tall walks at a rate of 5 ft/sec away from a lamppost that is 12 ft high. At what rate is the length of his shadow changing when he is 25 ft away from the lamppost? (Do not round your answer) 8) \_\_\_\_\_  
A)  $\frac{5}{6}$  ft/sec      B) 5 ft/sec      C)  $\frac{125}{6}$  ft/sec      D)  $\frac{5}{3}$  ft/sec
- 9) A man 6 ft tall walks at a rate of 5 ft/sec away from a lamppost that is 14 ft high. At what rate is the length of his shadow changing when he is 65 ft away from the lamppost? (Do not round your answer) 9) \_\_\_\_\_  
A)  $\frac{325}{6}$  ft/sec      B)  $\frac{15}{4}$  ft/sec      C)  $\frac{3}{4}$  ft/sec      D)  $\frac{3}{2}$  ft/sec
- 10) A man flies a kite at a height of 120 m. The wind carries the kite horizontally away from him at a rate of 10 m/sec. How fast is the distance between the man and the kite changing when the kite is 130 m away from him? 10) \_\_\_\_\_  
A) 10 m/sec      B) 120.4 m/sec      C) 4.5 m/sec      D) 7.3 m/sec
- 11) A man flies a kite at a height of 120 m. The wind carries the kite horizontally away from him at a rate of 6 m/sec. How fast is the distance between the man and the kite changing when the kite is 130 m away from him? 11) \_\_\_\_\_  
A) 120.1 m/sec      B) 6 m/sec      C) 2.7 m/sec      D) 4.4 m/sec
- 12) One airplane is approaching an airport from the north at 182 km/hr. A second airplane approaches from the east at 294 km/hr. Find the rate at which the distance between the planes changes when the southbound plane is 31 km away from the airport and the westbound plane is 25 km from the airport. 12) \_\_\_\_\_  
A) -489 km/hr      B) -652 km/hr      C) -163 km/hr      D) -326 km/hr
- 13) One airplane is approaching an airport from the north at 184 km/hr. A second airplane approaches from the east at 210 km/hr. Find the rate at which the distance between the planes changes when the southbound plane is 33 km away from the airport and the westbound plane is 22 km from the airport. 13) \_\_\_\_\_  
A) -135 km/hr      B) -405 km/hr      C) -270 km/hr      D) -540 km/hr

**Solve the problem.**

- 14) Assume that the profit generated by a product is given by  $P(x) = 4\sqrt{x}$ , where  $x$  is the number of units sold. If the profit keeps changing at a rate of \$700 per month, then how fast are the sales changing when the number of units sold is 1500? (Round your answer to the nearest dollar per month.) 14) \_\_\_\_\_  
A) \$13,555/month      B) \$216,887/month  
C) \$6778/month      D) \$9/month
- 15) Assume that the profit generated by a product is given by  $P(x) = 2\sqrt{x}$ , where  $x$  is the number of units sold. If the profit keeps changing at a rate of \$700 per month, then how fast are the sales changing when the number of units sold is 1200? (Round your answer to the nearest dollar per month.) 15) \_\_\_\_\_  
A) \$24,249/month      B) \$20/month  
C) \$96,995/month      D) \$12,124/month

Answer Key

Testname: RELATED RATES

- 1) A
- 2) B
- 3) B
- 4) A
- 5) D
- 6) C
- 7) B
- 8) B
- 9) B
- 10) D
- 11) D
- 12) D
- 13) C
- 14) A
- 15) A