

Review - Unit 3

PM - Calculus

1. Let  $f(x) = x^3 - x^2 + 3$ . Determine the critical numbers.
  2. Find all critical numbers of  $f(x) = 3x^4 - 4x^3$ .
  3. Given that  $f(x) = -x^2 + 12x - 28$  has a relative maximum at  $x = 6$ , choose the correct statement.
  4. Which of the following gives the relative extrema for the function  $f(x) = 3x^5 - 5x^3$ ?
  5. Given  $f(x) - 20 = x^3 - 3x^2 - 9x$  find the local maximum point on the closed interval  $[-3, 5]$ .
  6. Given  $f(x) = x^3 - 3x^2 - 9x$  find the absolute maximum value on the closed interval  $[0, 6]$ .
  7. Find the maximum value of  $f(x) = x^2 - 2x + 1$  on the interval  $[0, 3]$ .
  8. The radius of a circle is increasing at the rate of 5 inches per minute. At what rate is the area increasing when the radius is 10 inches?
  9. The radius of a sphere is increasing at a constant rate of 0.05 cm per second. At the time when the radius of the sphere is 10 cm, what is the rate of increase of the volume?
10. As a balloon in the shape of a sphere is being blown up, the volume is increasing at the rate  $4 \text{ in}^3/\text{sec}$ . At what rate is the radius increasing when the radius is 1 in?
  11. A balloon rises vertically at the rate of 10 ft/s. A person on the ground 100 ft away from the spot below the rising balloon watches the balloon ascend; at what rate is the distance between balloon and observer changing when the balloon is 100 ft above ground?
  12. In a right triangle the hypotenuse is of fixed length of 20 units, one side is increasing in length by 6 units per second while the third side is decreasing in size. At a certain instant the increasing side is of length 12 units. Find the rate of change of the third side at the same instant.
  13. A balloon rises vertically at the rate of 10 ft/sec. A person watches the balloon ascend from a point on the ground 100 ft away from the spot below the rising balloon. At what rate (radians per second) is the observer's eye rotating upward to follow the balloon when the balloon is 50 ft above the level of the observer's eye?
  14. A ladder 12 ft in length leans against a vertical wall, with the bottom of the ladder 3 ft from the wall on a horizontal floor. If at that time the bottom end of the ladder is being pulled away at the rate of 0.5 ft/s, at what rate does the top of the ladder slip down the wall?

Note: The volume of a sphere with radius  $r$  is  $V = \frac{4}{3}\pi r^3$ .

1.  
Answer:  $0, \frac{2}{3}$   
CodePath: EAS.APC.E.A.3
2.  
Answer: 0 and 1  
CodePath: EAS.APC.E.A.5
3.  
Answer:  $f'$  is negative on the interval  $(6, \infty)$   
CodePath: EAS.APC.E.A.15
4.  
Answer: Rel max:  $x = -1$ ; Rel min:  $x = 1$   
CodePath: EAS.APC.E.A.33
5.  
Answer:  $(-1, 25)$   
CodePath: EAS.APC.E.A.41
6.  
Answer: 54  
CodePath: EAS.APC.E.A.43
7.  
Answer: 4  
CodePath: EAS.APC.E.A.45
8.  
Answer:  $100\pi \text{ in}^2/\text{min}$   
CodePath: EAS.APC.E.J.3
9.  
Answer:  $20\pi \text{ cm}^3/\text{s}$   
CodePath: EAS.APC.E.J.7
10.  
Answer:  $\frac{1}{\pi} \text{ in}/\text{sec}$   
CodePath: EAS.APC.E.J.9
11.  
Answer:  $5\sqrt{2} \text{ ft}/\text{s}$   
CodePath: EAS.APC.E.J.15
12.  
Answer:  $-\frac{9}{2} \text{ units}/\text{sec}$   
CodePath: EAS.APC.E.J.22
13.  
Answer:  $\frac{2}{25} \text{ rad}/\text{s}$   
CodePath: EAS.APC.E.J.31
14.  
Answer:  $\frac{\sqrt{15}}{30} \text{ ft}/\text{s}$   
CodePath: EAS.APC.E.J.38