

1. If  $y = 3x^3 + 5x$  and  $\frac{dx}{dt} = 5$ , find  $\frac{dy}{dt}$  when  $x = 3$ .
- 425
  - 431
  - 422
  - 440
  - 430
2. If a snowball melts so that its surface area  $S = 4\pi r^2$  decreases at a rate of  $1 \text{ cm}^2/\text{min}$ , find the rate at which the diameter decreases when the diameter is 35 cm.
- $\frac{1}{35\pi} \text{ cm/min}$
  - $\frac{1}{69}\pi \text{ cm/min}$
  - $\frac{1}{72\pi} \text{ cm/min}$
  - $\frac{1}{70\pi} \text{ cm/min}$
  - $\frac{1}{36\pi} \text{ cm/min}$
3. Find the linearization  $L(x)$  of  $f(x) = \sqrt[3]{x}$  at  $a = -8$ .
- $L(x) = \frac{1}{12}x + \frac{8}{3}$
  - $L(x) = \frac{1}{12}x - \frac{4}{3}$
  - $L(x) = 2x - 8$
  - $L(x) = 2x + 8$
  - $L(x) = -\frac{1}{12}x + \frac{4}{3}$
4. Compute  $\Delta y$  and  $dy$  for  $y = \frac{16}{x}$ ,  $x = 4$  and  $\Delta x = -1$ .
- $\Delta y = \frac{3}{4}, dy = -1$
  - $\Delta y = 4, dy = -1$
  - $\Delta y = \frac{1}{3}, dy = 1$
  - $\Delta y = \frac{4}{3}, dy = 1$
  - $\Delta y = 3, dy = 1$
5. Find the critical numbers of the function  $y = \frac{x}{x^2 + 9}$ .
- 3, -3
  - 0, -3
  - 9, -9
  - 3, 0
  - 9, 0, 9
6. Find the absolute maximum of the function  $f(x) = \sin(2x) + \cos(2x)$  on the interval  $\left[0, \frac{\pi}{4}\right]$ .
- 2
  - 1
  - $\sqrt{2}$
  - $-\sqrt{2}$
  - 1
7. Find the number  $c$  that satisfies the conclusion of the Mean Value Theorem for  $f(x) = \frac{x}{x+6}$  in the interval  $[0, 1]$ .
- $c = \sqrt{42}$
  - $c = -42 + \sqrt{6}$
  - $c = \sqrt{6}$
  - $c = -6 + \sqrt{42}$
  - $c = \frac{1}{2}$
8. How many real roots does the equation  $x^5 + 5x + 3 = 0$  have?
- exactly three real roots
  - no real roots
  - exactly one real root
  - exactly two real roots
  - exactly five real roots
9. Find the intervals on which the function  $f(x) = x^3 - 27x + 2$  is increasing.
- $(-3, \infty)$
  - $(-3, 3)$
  - $(-\infty, -3), (3, \infty)$
  - $(-\infty, 3)$
  - $(-\infty, -9), (9, \infty)$

10. How many points of inflection are on the graph of the function  $f(x) = -13x^3 + 18x^2 - 9x - 7$ ? 15. Find  $f(x)$  where  $f'(x) = 6 \cos(x) + 5 \sin(x)$  and  $f(0) = 7$ .

- a) 3  
b) 1  
c) 2  
d) 4  
e) 0

- a)  $f(x) = 6 \sin(x) - 5 \cos(x) + 12$   
b)  $f(x) = -6 \sin(x) - 5 \cos(x) + 7$   
c)  $f(x) = 6 \sin(x) + 5 \cos(x) + 12$   
d)  $f(x) = -6 \sin(x) + 5 \cos(x) + 2$   
e)  $f(x) = 6 \cos(x) + 5 \sin(x) + 1$

11. Find  $\lim_{x \rightarrow \infty} x \sin \frac{1}{x}$ .

- a)  $\infty$   
b) 1  
c) 0  
d)  $-\infty$   
e)  $\sin(1)$

12. Find the horizontal asymptote of the curve  $y = \frac{5 - 8x}{1 + x}$ .

- a)  $y = -8$   
b)  $y = -5$   
c)  $y = 5$   
d)  $y = 0$   
e)  $y = 8$

16. Find the length of the base  $AB$  of the rectangle of largest area that has its base on the  $x$ -axis and its other two vertices above the  $x$ -axis and lying on the parabola  $y = 38 - x^2$ .

- a)  $2\sqrt{38}$   
b)  $2\sqrt{\frac{35}{3}}$   
c)  $2\sqrt{\frac{38}{5}}$   
d)  $2\sqrt{\frac{38}{3}}$   
e)  $2\sqrt{\frac{39}{5}}$

17. (10 pts.) A man starts walking north at 3 ft/s from a point  $P$ . At the same time, a woman starts walking west at 4 ft/s from the same point  $P$ . At what rate are the people moving apart 10 minutes later?

18. (10 pts.) Find the absolute maximum and absolute minimum values of  $f(t) = t\sqrt{64 - t^2}$  on the interval  $[-5, 8]$ .

13. Which of the following statements is incorrect?

- a) The graph of  $y = \frac{x}{x^2 + 4}$  has a horizontal asymptote at  $y = 0$ .  
b) The graph of  $y = \frac{x^2}{x + 4}$  has no horizontal asymptote.  
c) The graph of  $y = \frac{x}{x^2 - 4}$  has two vertical asymptotes.  
d) The graph of  $y = \frac{x}{x^2 - 4}$  has a vertical asymptote at  $x = 4$ .  
e) The graph of  $y = x^3$  is symmetric about the origin.

14. Find the curve  $y = \frac{x^3}{x^2 - 4}$ .