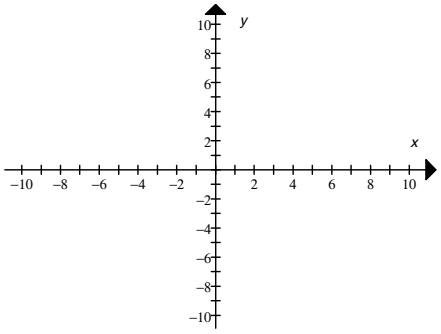
CALCULUS FOR THE LIFE SCIENCES

Name: _____

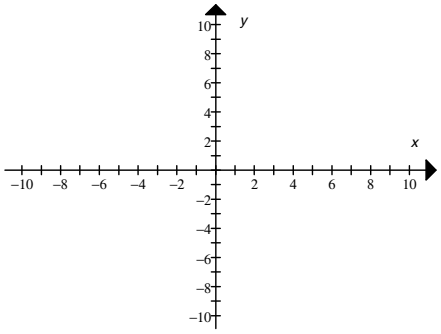
Chapter 3, Form A

Find the relative extrema and points of inflection of the function. List your answers in terms of ordered pairs. Then sketch a graph of the function.

1. $f(x) = x^2 - 2x - 8$



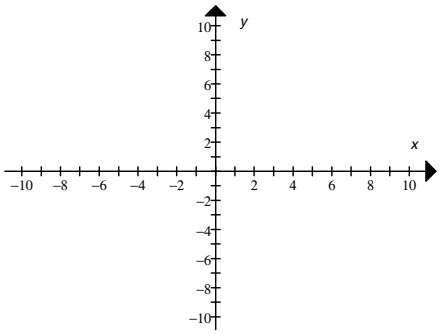
2. $f(x) = 4x^4 - 12x^2 + 9$



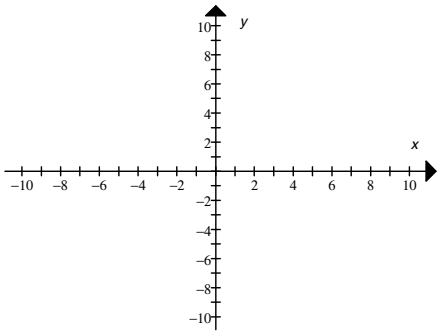
1. _____

2. _____

3. $f(x) = (x-2)^{2/3} + 1$



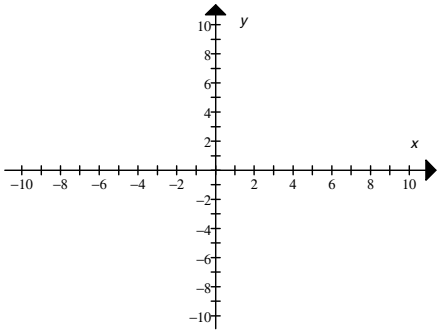
4. $f(x) = \dfrac{40}{x^2 + 5}$



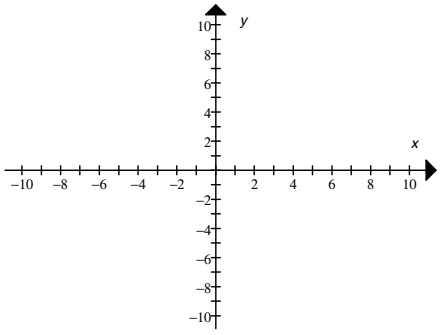
3. _____

4. _____

5. $f(x) = (x+1)^3 + 3$



6. $f(x) = x\sqrt{16 - x^2}$

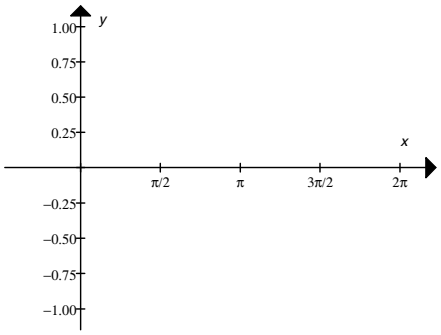


5. _____

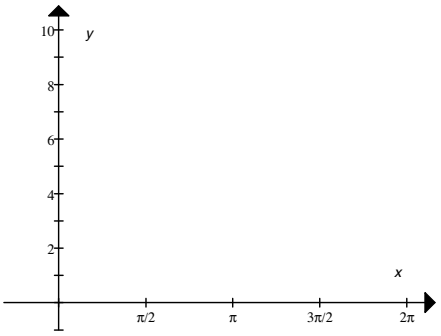
6. _____

Find the relative extrema of the function on $[0, 2\pi]$. List your answers in terms of ordered pairs. Then sketch a graph of the function.

7. $f(x) = \dfrac{\cos x}{4 + 3\cos x}$



8. $f(x) = \sin(2x) + 2x$

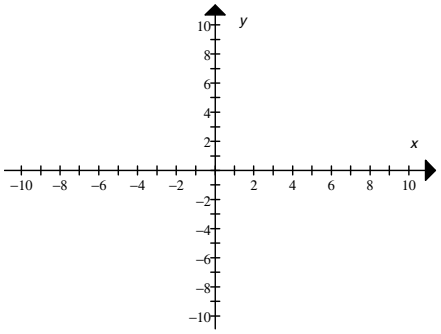


1. _____

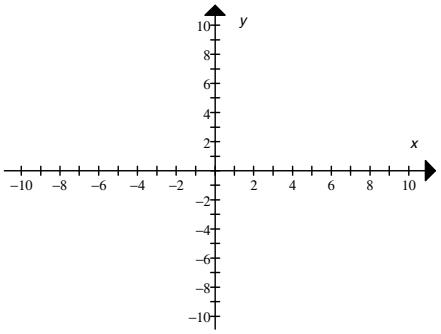
2. _____

Sketch a graph of the function.

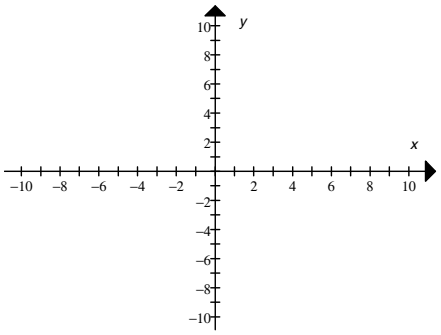
9. $f(x) = \dfrac{3}{x + 2}$



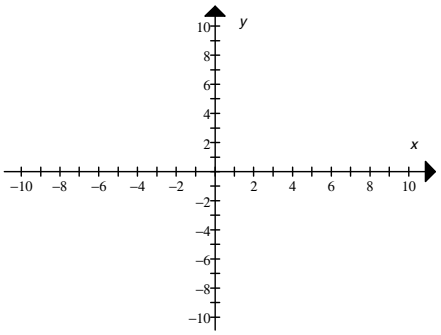
10. $f(x) = \dfrac{-4}{x^2 - 1}$



11. $f(x) = \dfrac{x^2 - 9}{x}$



12. $f(x) = \dfrac{x + 4}{x - 5}$



Find absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line. List your answers in terms of ordered pairs.

13. $f(x) = x(x-3)$ **13.** _____

14. $f(x) = 4x^3 + 3x^2 - 6x - 5;\ [-2, 1]$ **14.** _____

15. $f(x) = 2x^2 + 5.4x - 6$ **15.** _____

16. $f(x) = \sin^2 x + 2\sin x;\ [0, 2\pi]$ **16.** _____

17. $f(x) = \sqrt{3}\tan^2 x + 2\tan x;\ (-\pi/2, \pi/2)$ **17.** _____

18. $f(x) = \cos^2 x + \tan^2 x;\ (-\pi/2, \pi/2)$ **18.** _____

19. $f(x) = x^2 + \dfrac{54}{x};\ (0, \infty)$ **19.** _____

20. Of all numbers whose difference is 12, find the two that have the minimum product. **20.** _____

21. Minimize $Q = x^2 + y^2$, where $x + y = 4$. **21.** _____

22. From a thin piece of cardboard 48 in. by 48 in., square corners are cut out so that the sides can be folded up to make a box. What dimensions will yield a box of maximum volume? What is the maximum volume? **22.** _____

23. Find the linearization to $f(x) = \dfrac{x}{x+1}$ at $a = 3$. **23.** _____

24. Find the linearization to $f(x) = 1 + \cos x$ at $a = \pi/2$. **24.** _____

25. Use linearization to approximate $\sqrt{48}$. **25.** _____

26. Use Newton's method and $x_1 = 1$ to find an approximate solution of $3x^3 + 2x = 7$. **26.** _____

27. Use Newton's method and $x_1 = 1$ to find an approximate solution of $\sin x = x - \cos x$. **27.** _____

28. Differentiate the following implicitly to find dy/dx. Then find the slope of the curve at the given point.

$$x^2 + y^3 = 17;\ (4, 1)$$ **28.** _____

29. A board 10 ft long leans against a vertical wall. If the lower end is being moved away from the wall at a rate of 0.3 ft/sec, how fast is the upper end coming down when the lower end is 8 ft from the wall? **29.** _____

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30. Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval.

$$f(x) = \frac{x^2}{4 + x^3};\ [0, \infty)$$ **30.** _____

---

31. Use a grapher to estimate the relative extrema of the function.

$$f(x) = 4x^3 - 30x^2 + 40x + 3\sqrt{x}$$ **31.** _____

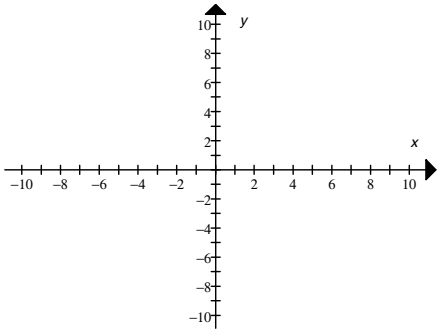
CALCULUS FOR THE LIFE SCIENCES

Name: _____

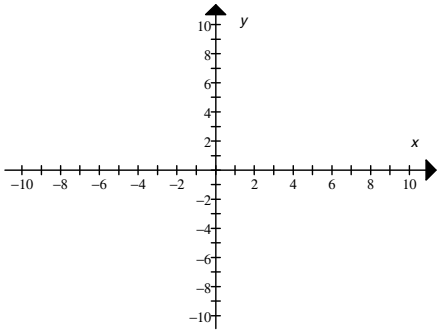
Chapter 3, Form B

Find the relative extrema of the function. List your answers in terms of ordered pairs. Then sketch a graph of the function.

1. $f(x) = x^2 + 4x - 5$



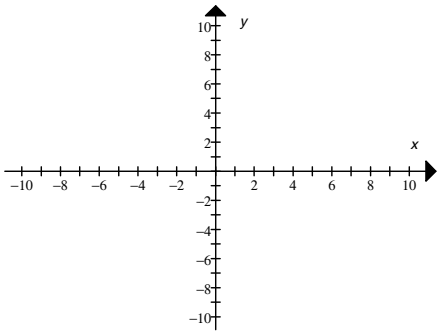
2. $f(x) = 3x^4 - 12^2 + 4$



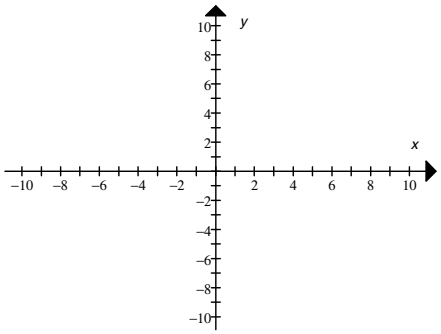
1. _____

2. _____

3. $f(x) = (x-2)^{2/3} + 4$



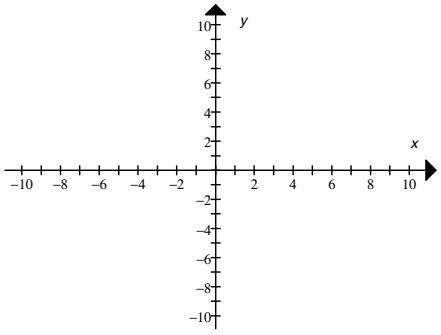
4. $f(x) = \dfrac{-3}{x^2 + 1}$



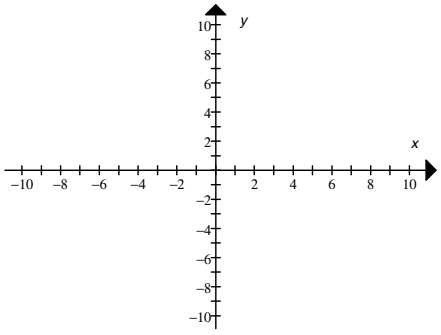
3. _____

4. _____

5. $f(x) = (x+3)^3 - 4$



6. $f(x) = x\sqrt{16 - x^2}$

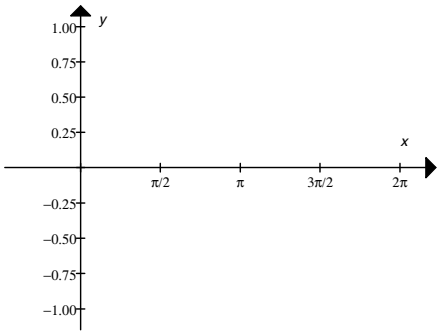


5. _____

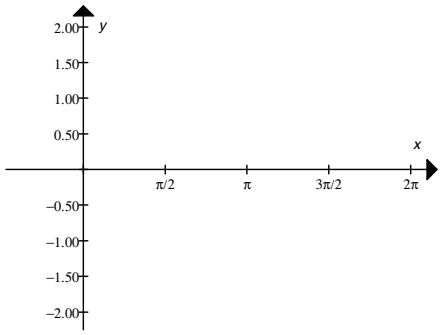
6. _____

Find the relative extrema and points of inflection of the function on $[0, 2\pi]$.
List your answers in terms of ordered pairs. Then sketch a graph of the function.

7. $f(x) = \dfrac{1}{4 + 3\cos x}$



8. $f(x) = \sin^2 x - 2\cos x$

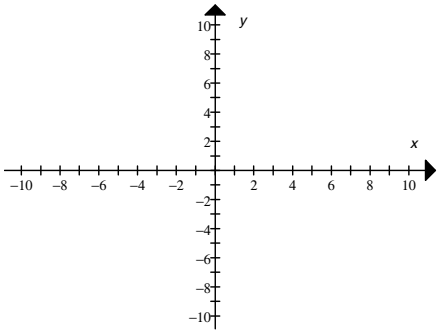


1. _____

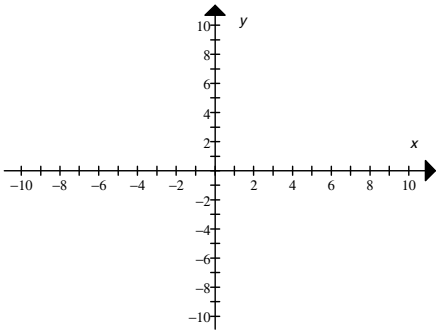
2. _____

Sketch a graph of the function.

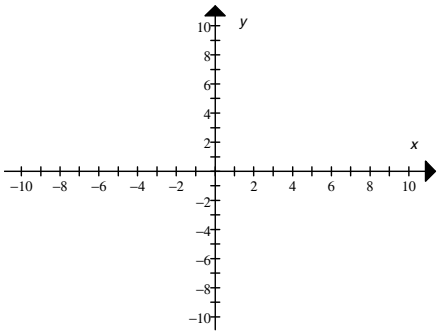
9. $f(x) = \dfrac{5}{x - 3}$



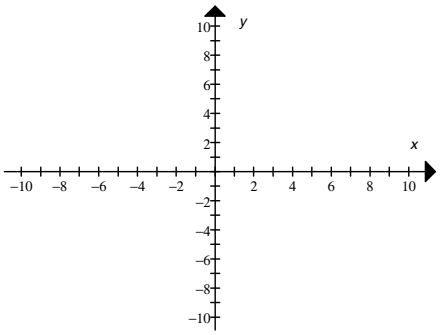
10. $f(x) = \dfrac{-2}{x^2 - 4}$



11. $f(x) = \dfrac{x^2 - 1}{x}$



12. $f(x) = \dfrac{x - 1}{x + 4}$



Find absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line. List your answers in terms of ordered pairs.

13. $f(x) = x(6-x)$ **13.** _____

14. $f(x) = 2x^3 - 5x^2 - 4x + 3;\ [-2, 1]$ **14.** _____

15. $f(x) = -3x^2 + 6.6x + 4$ **15.** _____

16. $f(x) = \cos^2 x + 2\cos x;\ [0, 2\pi]$ **16.** _____

17. $f(x) = \sqrt{3}\cot^2 x - 2\cot x;\ (0, \pi)$ **17.** _____

18. $f(x) = \sin^2 x - \cot^2 x;\ (0, \pi)$ **18.** _____

19. $f(x) = x^2 + \dfrac{2}{x};\ (0, \infty)$ **19.** _____

20. Of all numbers whose difference is 9, find the two that have the minimum product. **20.** _____

21. Minimize $Q = x^2 + 2y^2$, where $x + y = 6$. **21.** _____

22. From a thin piece of cardboard 72 in. by 72 in., square corners are cut out so that the sides can be folded up to make a box. What dimensions will yield a box of maximum volume? What is the maximum volume? **22.** _____

23. Find the linearization to $f(x) = x\sqrt{x-1}$ at $a = 5$. **23.** _____

24. Find the linearization to $f(x) = (1 - \sin x)^2$ at $a = \pi$. **24.** _____

25. Use linearization to approximate $\sqrt[3]{26}$. **25.** _____

26. Use Newton's method and $x_1 = -1$ to find an approximate solution of $x - 2x^3 = 5$. **26.** _____

27. Use Newton's method and $x_1 = 1$ to find an approximate solution of $\cos x = x - \sin x$. **27.** _____

28. Differentiate the following implicitly to find dy/dx. Then find the slope of the curve at the given point.

$$2x^2 + y^3 = 6;\ (-1,\ 2)$$ **28.** _____

29. A board 26 ft long leans against a vertical wall. If the lower end is being moved away from the wall at a rate of 0.1 ft/sec, how fast is the upper end coming down when the lower end is 24 ft from the wall? **29.** _____

---

30. Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval.

$$f(x) = \frac{2x^2}{8 + x^3};\ [0,\ \infty)$$ **30.** _____

---

31. Use a grapher to estimate the relative extrema of the function.

$$f(x) = 4x^3 - 28x^2 + 40x + 2\sqrt{x}$$ **31.** _____

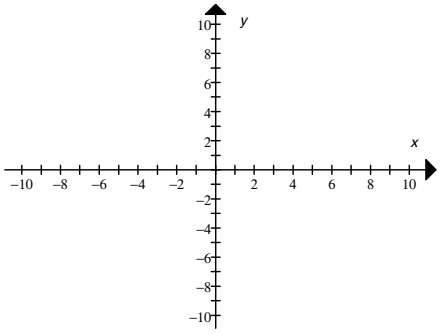
CALCULUS FOR THE LIFE SCIENCES

Name: _____

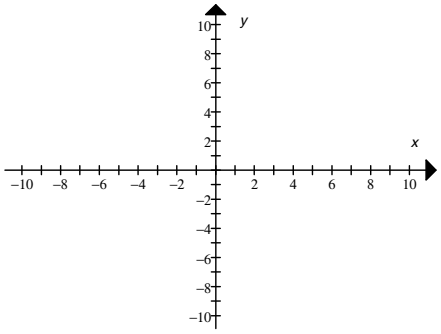
Chapter 3, Form C

Find the relative extrema of the function. List your answers in terms of ordered pairs. Then sketch a graph of the function.

1. $f(x) = x^2 - 2x - 3$



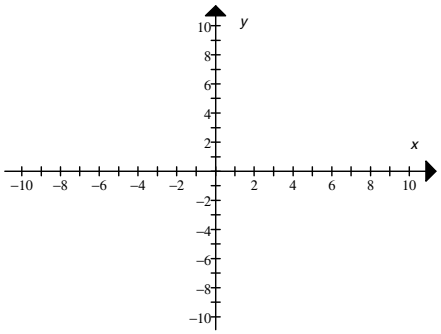
2. $f(x) = 4x^4 - 4x^2 + 1$



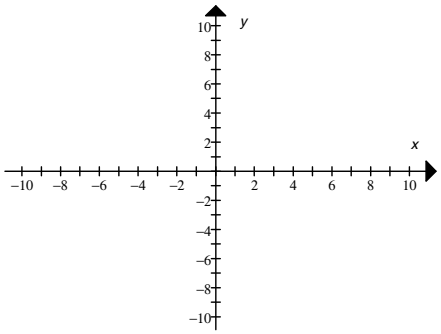
1. _____

2. _____

3. $f(x) = (x-4)^{2/3} + 1$



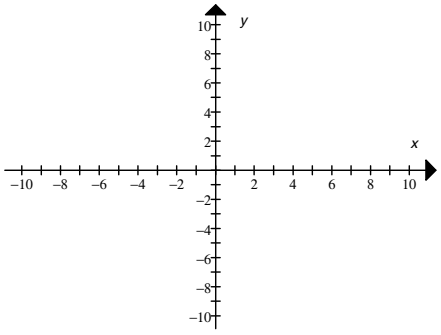
4. $f(x) = \dfrac{8}{x^2 + 4}$



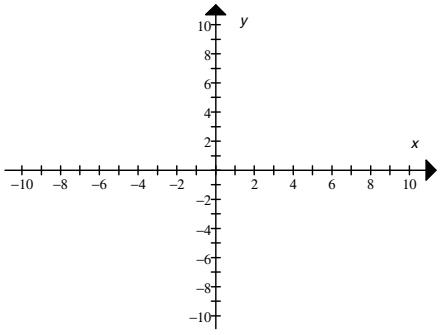
3. _____

4. _____

5. $f(x) = (x-1)^3$



6. $f(x) = x\sqrt{49 - 9x^2}$

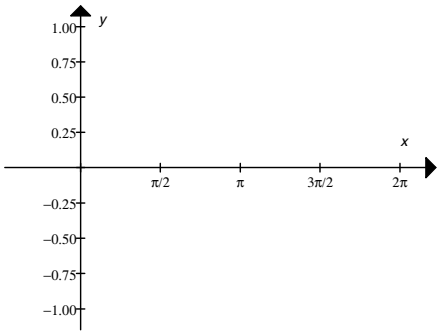


5. _____

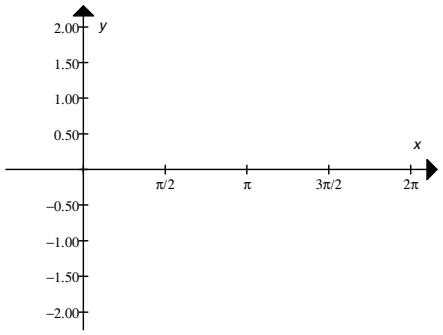
6. _____

Find the relative extrema and points of inflection of the function on $[0, 2\pi]$.
List your answers in terms of ordered pairs. Then sketch a graph of the function.

7. $f(x) = \dfrac{\sin x}{-6 + 2\sin x}$



8. $f(x) = \sin^2 x + \cos x$

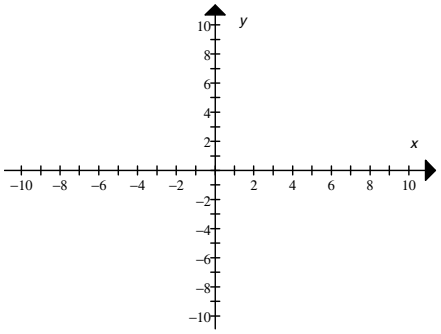


1. _____

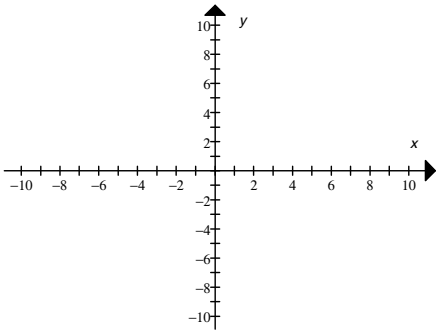
2. _____

Sketch a graph of the function.

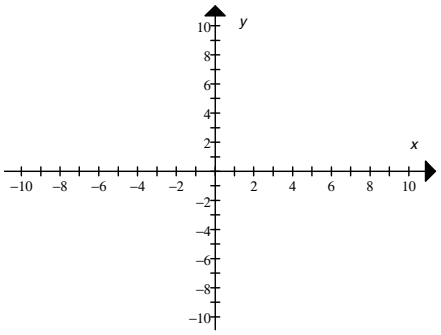
9. $f(x) = \dfrac{3}{x - 6}$



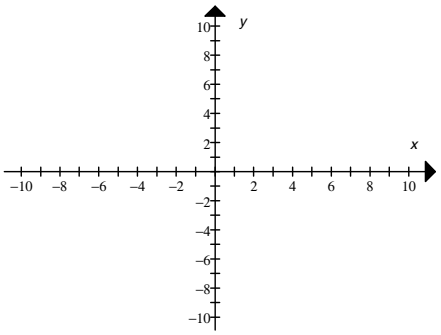
10. $f(x) = \dfrac{-6}{x^2 + 2x - 3}$



11. $f(x) = \dfrac{2x^2 - 1}{x}$



12. $f(x) = \dfrac{x - 1}{x + 3}$



Find absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line. List your answers in terms of ordered pairs.

13. $f(x) = x(5-x)$ **13.** _____

14. $f(x) = x^3 + \frac{3}{2}x^2 - 6x - 2; [-4, 2]$ **14.** _____

15. $f(x) = -x^2 + 3.6x + 12$ **15.** _____

16. $f(x) = \cos x - \sin^2 x; [0, 2\pi]$ **16.** _____

17. $f(x) = \sec^2 x + 9\csc^2 x; (0, \pi/2)$ **17.** _____

18. $f(x) = \sin^2 x + \tan^2 x; (-\pi/2, \pi/2)$ **18.** _____

19. $f(x) = x^2 + \frac{250}{x}; (0, \infty)$ **19.** _____

20. Of all numbers whose difference is 8, find the two that have the minimum product. **20.** _____

21. Minimize $Q = 3x^2 + y^2$, where $x + y = 4$. **21.** _____

22. From a thin piece of cardboard 84 in. by 84 in., square corners are cut out so that the sides can be folded up to make a box. What dimensions will yield a box of maximum volume? What is the maximum volume? **22.** _____

23. Find the linearization to $f(x) = \frac{1}{x-1}$ at $a = -2$. **23.** _____

24. Find the linearization to $f(x) = \frac{\cos x}{1 - \sin x}$ at $a = 0$. **24.** _____

25. Use linearization to approximate $\sqrt{17}$. **25.** _____

26. Use Newton's method and $x_1 = 2$ to find an approximate solution of $x^3 - 7x = -3$. **26.** _____

27. Use Newton's method and $x_1 = -1$ to find an approximate solution of $\cos^2 x = \sin x - x$. **27.** _____

28. Differentiate the following implicitly to find dy/dx . Then find the slope of the curve at the given point.

$$2x^2 + y^3 = -15;\ (-2, 1)$$ **28.** _____

29. A board 13 ft long leans against a vertical wall. If the lower end is being moved away from the wall at a rate of 0.25 ft/sec, how fast is the upper end coming down when the lower end is 12 ft from the wall? **29.** _____

---

30. Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval.

$$f(x) = \frac{-2x^2}{4 + x^3};\ [0, \infty)$$ **30.** _____

---

31. Use a grapher to estimate the relative extrema of the function.

$$f(x) = 3x^3 - 25x^2 + 30x + \sqrt{x}$$ **31.** _____

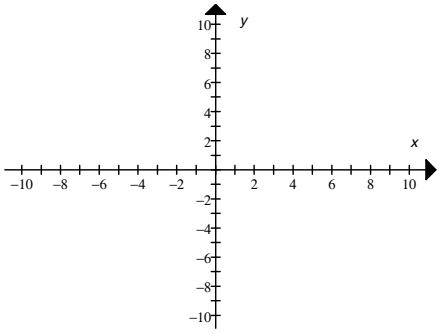
CALCULUS FOR THE LIFE SCIENCES

Name: _____

Chapter 3, Form D

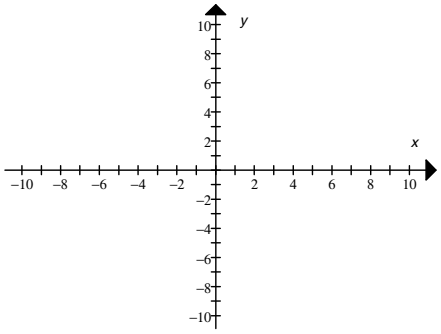
Find the relative extrema and points of inflection of the function. List your answers in terms of ordered pairs. Then sketch a graph of the function.

1. $f(x) = x^2 - 7x + 6$



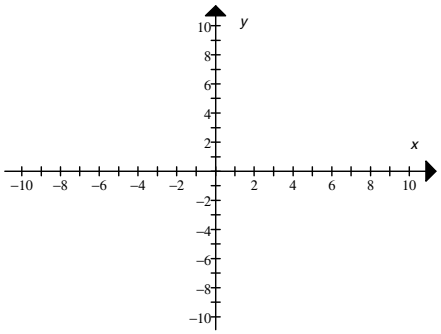
1. _____

2. $f(x) = x^4 - 4x^2 + 4$



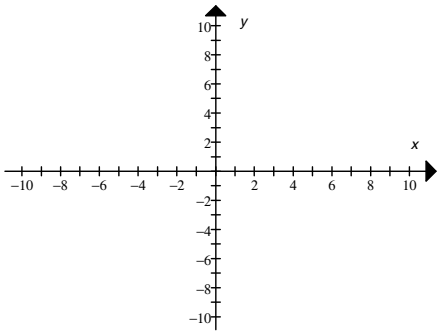
2. _____

3. $f(x) = (x-4)^{2/3} - 1$



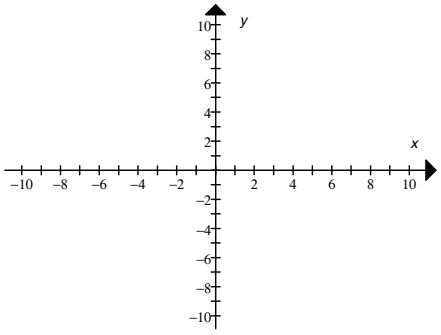
3. _____

4. $f(x) = \dfrac{36}{x^2 + 36}$



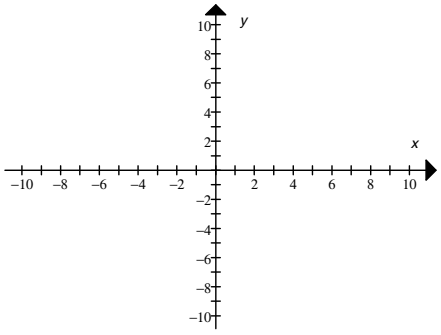
4. _____

5. $f(x) = (x-4)^3$



5. _____

6. $f(x) = x\sqrt{25 - 4x^2}$

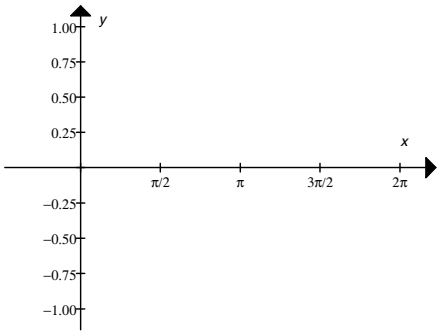


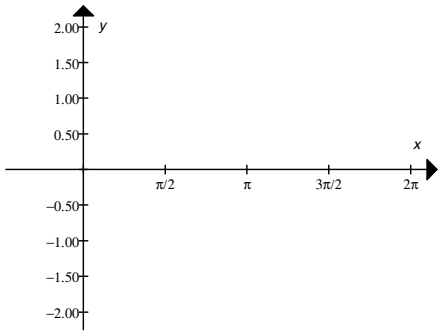
6. _____

Find the relative extrema of the function on $[0, 2\pi]$. List your answers in terms of ordered pairs. Then sketch a graph of the function.

7. $f(x) = \dfrac{1}{2\sin x - 6}$

8. $f(x) = \cos^2 x + 2\sin x$



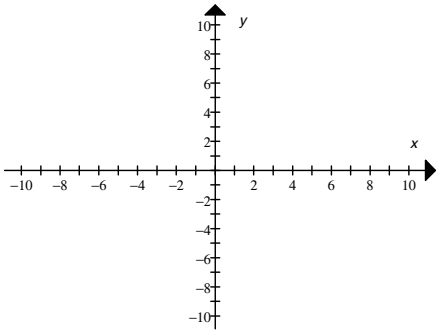


1. _____

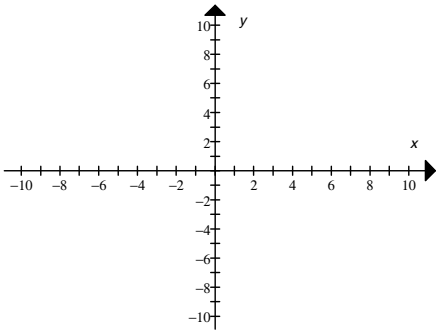
2. _____

Sketch a graph of the function.

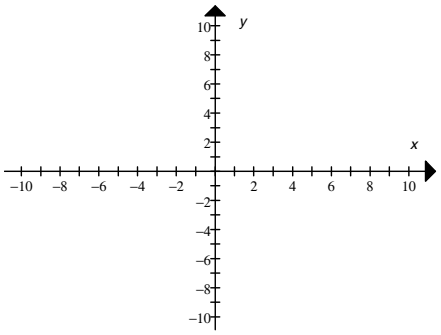
9. $f(x) = \dfrac{2}{x-3}$



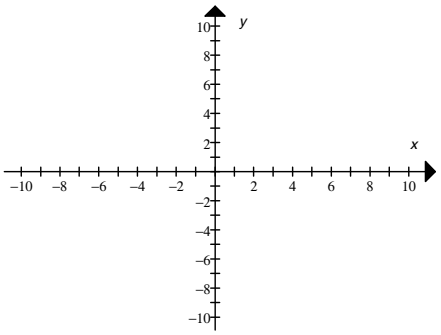
10. $f(x) = \dfrac{-2}{x^2 + 2x + 1}$



11. $f(x) = \dfrac{x^2 - 9}{x}$



12. $f(x) = \dfrac{x-2}{x+3}$



Find absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line. List your answers in terms of ordered pairs.

13. $f(x) = x(3-x)$ **13.** _____

14. $f(x) = -8x^3 + 9x^2 + 6x - 2; [-1, 1]$ **14.** _____

15. $f(x) = -x^2 + 4.2x + 6$ **15.** _____

16. $f(x) = \sin x - \cos^2 x; [0, 2\pi]$ **16.** _____

17. $f(x) = \sec^2 x + \tan^2 x; (-\pi/2, \pi/2)$ **17.** _____

18. $f(x) = \cos^2 x + \cot x; (0, \pi)$ **18.** _____

19. $f(x) = x^2 - \dfrac{250}{x}; (-\infty, 0)$ **19.** _____

20. Of all numbers whose difference is 18, find the two that have the minimum product. **20.** _____

21. Minimize $Q = x^2 + 2y^2$, where $x - y = 4$. **21.** _____

22. From a thin piece of cardboard 100 in. by 100 in., square corners are cut out so that the sides can be folded up to make a box. What dimensions will yield a box of maximum volume? What is the maximum volume? **22.** _____

23. Find the linearization to $f(x) = \dfrac{1}{\sqrt{x+2}}$ at $a = 2$. **23.** _____

24. Find the linearization to $f(x) = \dfrac{\cos x}{2 + \sin x}$ at $a = \pi$. **24.** _____

25. Use linearization to approximate $\sqrt[3]{123}$. **25.** _____

26. Use Newton's method and $x_1 = 1$ to find an approximate solution of $2x + x^3 = 4$ **26.** _____

27. Use Newton's method and $x_1 = 1$ to find an approximate solution of $\cos x + \sin x = 2x$ **27.** _____

28. Differentiate the following implicitly to find dy/dx. Then find the slope of the curve at the given point.

$$2x^3 - y^3 = -11;\ (2, 3)$$ **28.** _____

29. A board 26 ft long leans against a vertical wall. If the lower end is being moved away from the wall at a rate of 0.4 ft/sec, how fast is the upper end coming down when the lower end is 10 ft from the wall? **29.** _____

---

30. Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval.

$$f(x) = \frac{-5x^2}{1+x^3};\ [0, \infty)$$ **30.** _____

---

31. Use a grapher to estimate the relative extrema of the function.

$$f(x) = 2x^3 - 15x^2 + 10x + 10\sqrt{x}$$ **31.** _____

CALCULUS FOR THE LIFE SCIENCES

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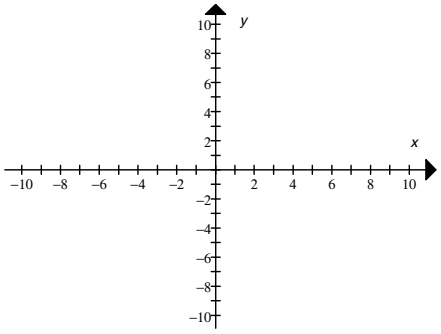
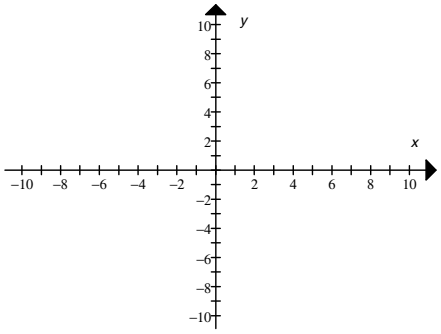
Chapter 3, Form E

Find the relative extrema and points of inflection of the function. List your answers in terms of ordered pairs. Then sketch a graph of the function.

1. $f(x) = x^2 + 7x + 12$



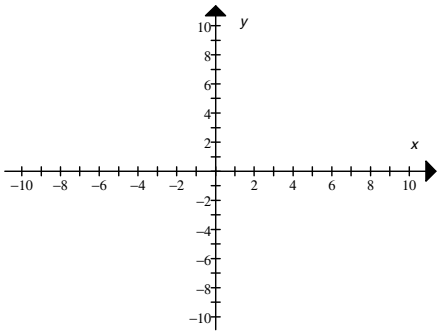
2. $f(x) = x^4 - 6x^2 + 9$



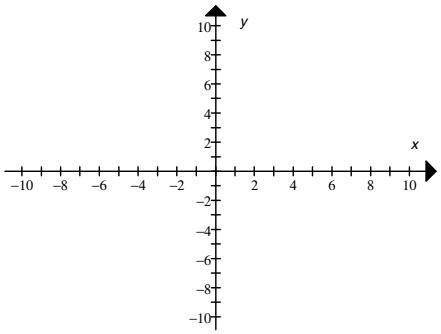
1. _____

2. _____

3. $f(x) = (x-1)^{2/3} + 2$



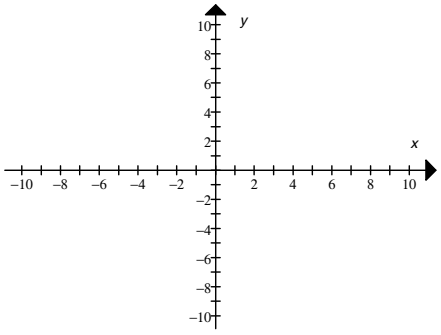
4. $f(x) = \dfrac{-6}{x^2 + 2}$



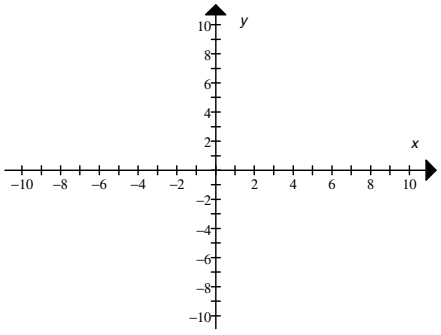
3. _____

4. _____

5. $f(x) = (x+3)^3$



6. $f(x) = x\sqrt{49 - 16x^2}$



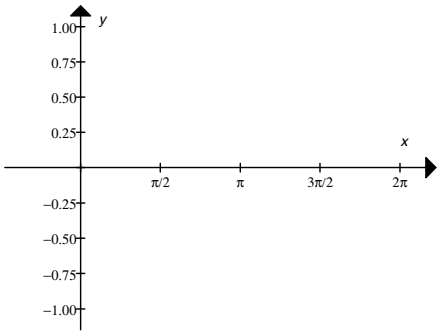
5. _____

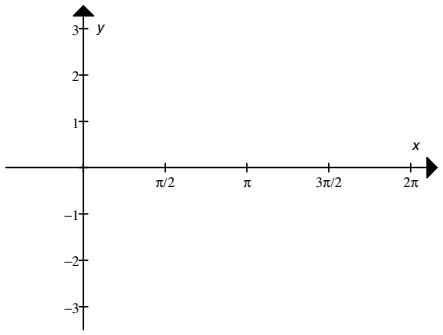
6. _____

Find the relative extrema of the function on $[0, 2\pi]$. List your answers in terms of ordered pairs. Then sketch a graph of the function.

7. $f(x) = \dfrac{\sin x}{2\cos x - 4}$

8. $f(x) = 2\sin x + \cos x$



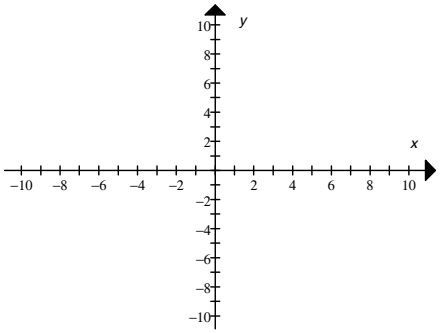


1. _____

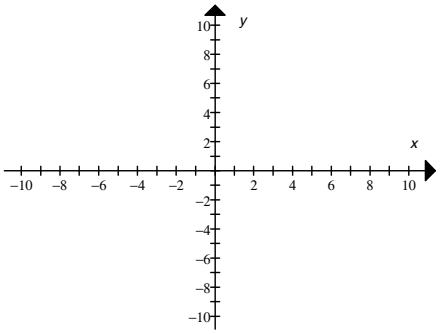
2. _____

Sketch a graph of the function.

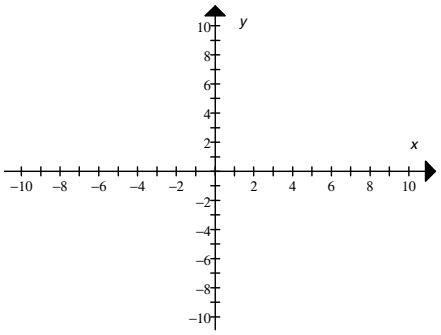
9. $f(x) = \dfrac{8}{x+5}$



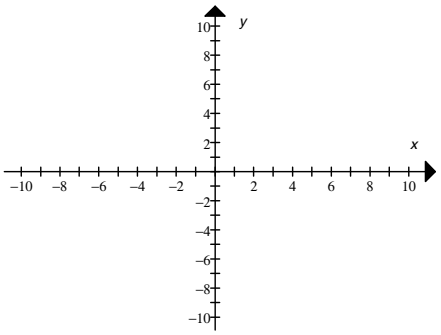
10. $f(x) = \dfrac{-8}{x^2 + 6x + 9}$



11. $f(x) = \dfrac{x^2 - 16}{x}$



12. $f(x) = \dfrac{x+3}{x-2}$



Find absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line. List your answers in terms of ordered pairs.

13. $f(x) = x(10 - x)$ **13.** _____

14. $f(x) = \frac{x^3}{3} + x^2 - 3x + 1; [0, 4]$ **14.** _____

15. $f(x) = -x^2 + 2.6x - 5$ **15.** _____

16. $f(x) = \cos x - \cos^2 x; [0, 2\pi]$ **16.** _____

17. $f(x) = \tan x + 2\sec x; (-\pi/2, \pi/2)$ **17.** _____

18. $f(x) = \cos^2 x + \cot^2 x; (0, \pi)$ **18.** _____

19. $f(x) = x^2 + \frac{1024}{x}; (0, \infty)$ **19.** _____

20. Of all numbers whose difference is 8, find the two that have the minimum product. **20.** _____

21. Minimize $Q = 2x^2 + 2y^2$, where $x + y = 10$. **21.** _____

22. From a thin piece of cardboard 108 in. by 108 in., square corners are cut out so that the sides can be folded up to make a box. What dimensions will yield a box of maximum volume? What is the maximum volume? **22.** _____

23. Find the linearization to $f(x) = 5\sqrt{2 - x}$ at $a = -7$. **23.** _____

24. Find the linearization to $f(x) = \cos x + \sin x$ at $a = \pi/2$. **24.** _____

25. Use linearization to approximate $\sqrt{80}$. **25.** _____

26. Use Newton's method and $x_1 = 4$ to find an approximate solution of $x^3 - 3x^2 = 8$. **26.** _____

27. Use Newton's method and $x_1 = 2$ to find an approximate solution of $2\sin x = x - \cos x$. **27.** _____

28. Differentiate the following implicitly to find dy/dx. Then find the slope of the curve at the given point.

$$3x^3 + y^3 = 3;\ (-2,\ 3)$$ **28.** _____

29. A board 17 ft long leans against a vertical wall. If the lower end is being moved away from the wall at a rate of 0.1 ft/sec, how fast is the upper end coming down when the lower end is 8 ft from the wall? **29.** _____

---

30. Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval.

$$f(x) = \frac{4x^2}{1 - x^3};\ (-\infty,\ 0]$$ **30.** _____

---

31. Use a grapher to estimate the relative extrema of the function.

$$f(x) = 3x^3 - 20x^2 + 25x + \sqrt{x}$$ **31.** _____

CALCULUS FOR THE LIFE SCIENCES

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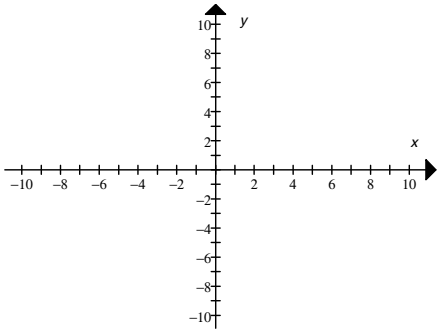
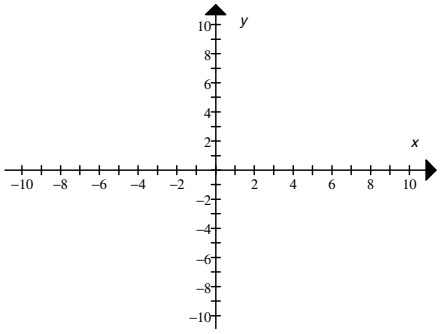
Chapter 3, Form F

Find the relative extrema and points of inflection of the function. List your answers in terms of ordered pairs. Then sketch a graph of the function.

1. $f(x) = x^2 + 2x - 8$



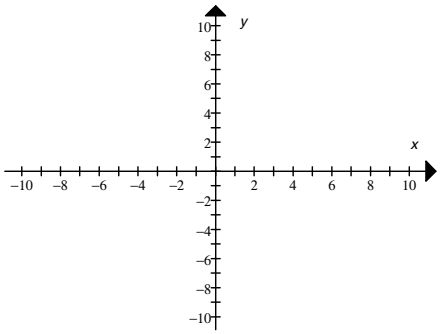
2. $f(x) = x^4 - 2x^2 + 3$



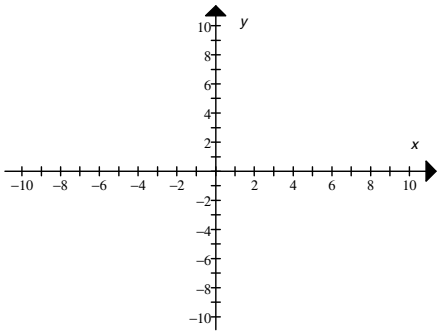
1. _____

2. _____

3. $f(x) = (x-3)^{2/3} - 1$



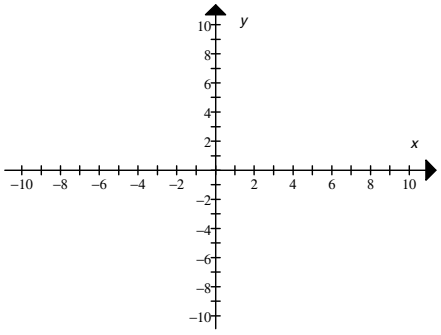
4. $f(x) = \dfrac{10}{x^2 + 4}$



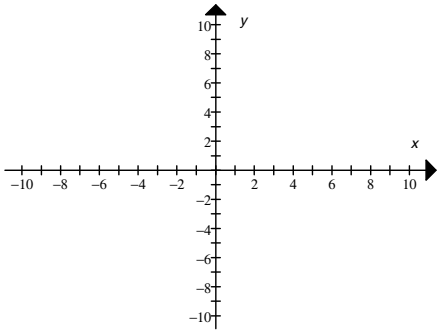
3. _____

4. _____

5. $f(x) = (x-2)^3$



6. $f(x) = x\sqrt{25 - 16x^2}$



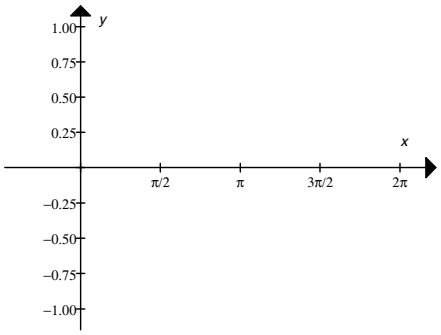
5. _____

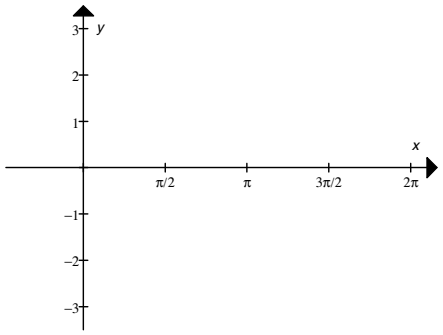
6. _____

Find the relative extrema of the function on $[0, 2\pi]$. List your answers in terms of ordered pairs. Then sketch a graph of the function.

7. $f(x) = \dfrac{\cos x}{6 + 3\cos x}$

8. $f(x) = \sqrt{3}\cos x - \sin x$



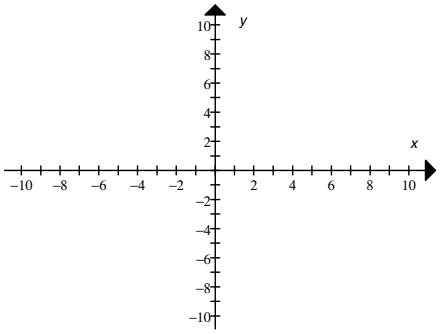


1. _____

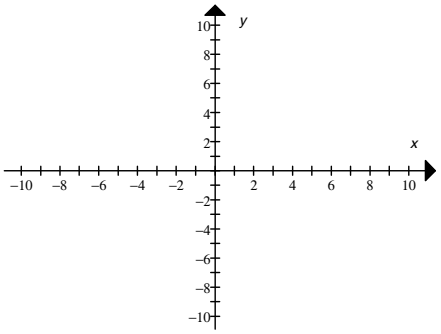
2. _____

Sketch a graph of the function.

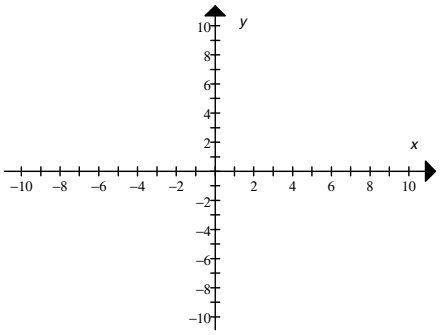
9. $f(x) = \dfrac{3}{x - 5}$



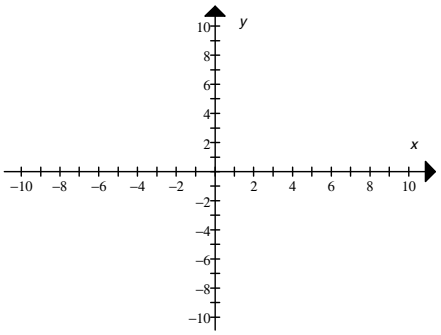
10. $f(x) = \dfrac{-6}{x^2 - 25}$



11. $f(x) = \dfrac{x^2 - 16}{x}$



12. $f(x) = \dfrac{x + 1}{x - 2}$



Find absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line. List your answers in terms of ordered pairs.

13. $f(x) = x(2-x)$ **13.** _____

14. $f(x) = -8x^3 + 9x^2 + 6x - 5; [-2, 0]$ **14.** _____

15. $f(x) = -x^2 + 5.4x + 9$ **15.** _____

16. $f(x) = \sin^2 x + 2\cos x; [0, 2\pi]$ **16.** _____

17. $f(x) = \tan^2 x - \cos^2 x; [0, \pi]$ **17.** _____

18. $f(x) = \sin^2 x - \cot^2 x; (0, \pi)$ **18.** _____

19. $f(x) = x^2 + \dfrac{16}{x}; (0, \infty)$ **19.** _____

20. Of all numbers whose difference is 16, find the two that have the minimum product. **20.** _____

21. Minimize $Q = x^2 + 3y^2$ where $x - y = 6$. **21.** _____

22. From a thin piece of cardboard 81 in. by 81 in., square corners are cut out so that the sides can be folded up to make a box. What dimensions will yield a box of maximum volume? What is the maximum volume? **22.** _____

23. Find the linearization to $f(x) = \dfrac{x}{x+4}$ at $a = -1$. **23.** _____

24. Find the linearization to $f(x) = (1 + \cos x)^2$ at $a = 0$. **24.** _____

25. Use linearization to approximate $\sqrt[3]{7}$. **25.** _____

26. Use Newton's method and $x_1 = 3$ to find an approximate solution of $x^3 - 3x^2 = 2$. **26.** _____

27. Use Newton's method and $x_1 = -1$ to find an approximate solution of $-2\cos x = x + \sin x$. **27.** _____

28. Differentiate the following implicitly to find dy/dx . Then find the slope of the curve at the given point.

$$-2x^3 + y^3 = -17;\ (2, -1)$$ **28.** _____

29. A board 13 ft long leans against a vertical wall. If the lower end is being moved away from the wall at a rate of 0.1 ft/sec, how fast is the upper end coming down when the lower end is 12 ft from the wall? **29.** _____

---

30. Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval.

$$f(x) = \frac{x^2}{4 - x^3};\ (-\infty, 0]$$ **30.** _____

---

31. Use a grapher to estimate the relative extrema of the function.

$$f(x) = 4x^3 - 22x^2 + 30x + 4\sqrt{x}$$ **31.** _____