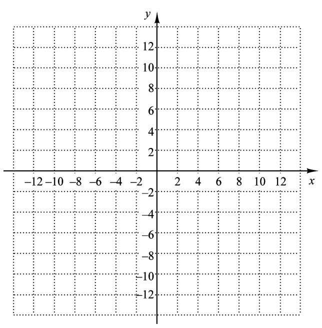
CALCULUS AND ITS APPLICATIONS

Name:

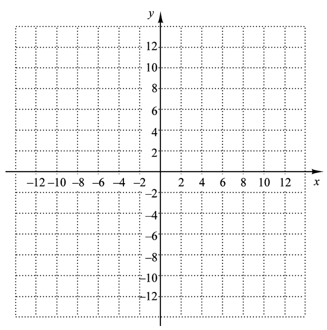
Chapter 2, Form A

Find all relative minimum or maximum values as well as the x-values at which they occur. State where each function is increasing or decreasing. Then sketch a graph of the function.

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



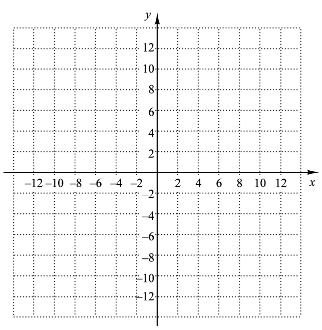
2. $f(x) = 1 - 6x + 2x^3$



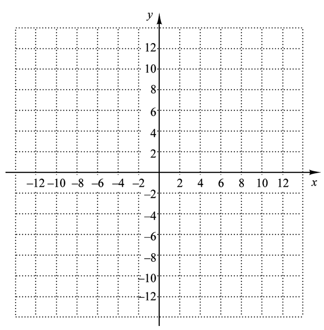
1. ______________________________

2. ______________________________

3. $f(x) = (x+1)^{4/5} - 2$



4. $f(x) = \dfrac{15}{x^2 + 3}$

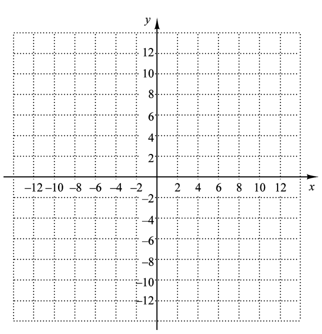


3. ______________________________

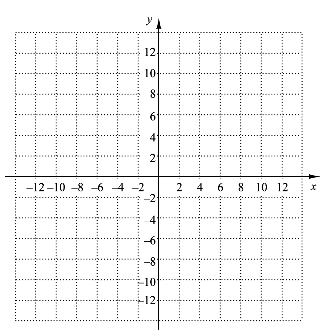
4. ______________________________

Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of inflection.

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



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

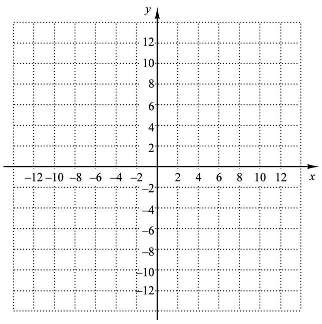


5. ______________________________

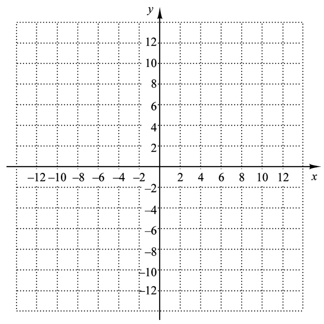
6. ______________________________

Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of inflection.

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



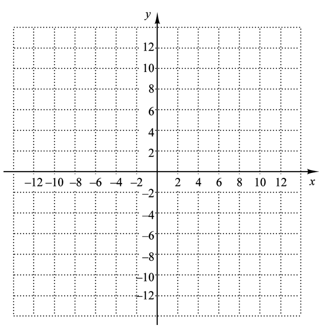
8. $f(x) = x\sqrt{25-4x^2}$



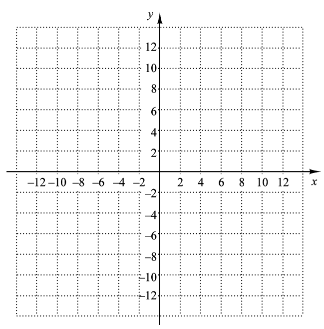
7. ______________________________

8. ______________________________

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



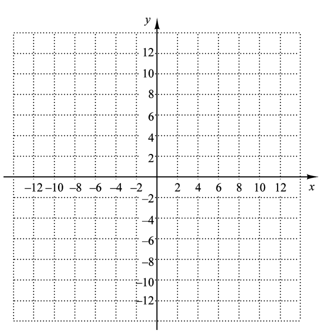
10. $f(x) = \dfrac{-5}{x^2-9}$



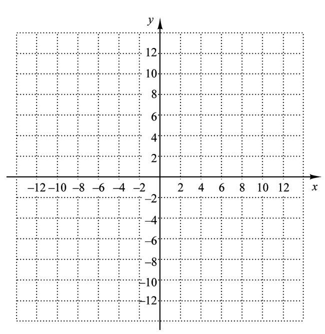
9. ______________________________

10. ______________________________

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



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



11. ______________________________

12. ______________________________

Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line.

13. $f(x)=x(11-x)$ **13.** ____________

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

15. $f(x)=-x^2+3.2x+8$ **15.** ____________

16. $f(x)=4x+1;\ [-2,2]$ **16.** ____________

17. $f(x)=4x+1$ **17.** ____________

18. $f(x)=8x^2-6x+1$ **18.** ____________

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

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

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

22. *Business: maximum profit.* Find the maximum profit and the number of units x that must be produced and sold in order to yield the maximum profit. Assume that $R(x)$ and $C(x)$ are the revenue and the cost, in dollars, when x units are produced. **22.** ____________

$$R(x)=0.8x^2+160x+50$$
$$C(x)=1.2x^2+20x+60\ .$$

23. 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 an open box. What dimensions will yield a box of maximum volume? What is the maximum volume? **23.** ____________

24. *Business: minimizing inventory costs.* An electronics store sells 100 digital video recorders (DVRs) per year. It costs \$18 to store one DVR for one year. To reorder, there is a fixed cost of \$36, plus \$11 for each DVR. How many times per year should the store order DVRs and in what lot size, in order to minimize inventory costs? **24.** ____________

25. For $y = f(x) = x^2 + 6,\ x = -2,$ and $\Delta x = 0.1,$ find Δy and $f'(x)\Delta x$.

25. ______________________

26. Approximate $\sqrt{45}$ using $\Delta y \approx f'(x)\Delta x$.

26. ______________________

27. For $y = \sqrt{x^2 + 5}$:

(a) Find dy.

(b) Find dy when $x = 3$ and $dx = 0.01$.

27. (a) ______________________

(b) ______________________

28. Differentiate the following implicitly to find *dy*/*dx*. Then find the slope of the curve at $(2,\ 3)$;

$$5x^2 - y^3 = -7\ .$$

28. ______________________

29. *Volume of sphere.* A spherical balloon has a radius of 12 cm. Use a differential to find the approximate change in the volume of the balloon if the radius is increased or decreased by 0.3cm. The volume of a sphere is $V = \frac{4}{3}\pi r^3$. Use 3.14 for π.

29. ______________________

30. 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?

30. ______________________

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31. Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval $[0, \infty)$:

$$f(x) = \frac{-5x^2}{1 + x^3}\ .$$

31. ______________________

32. *Business: minimizing average cost*. The total cost in dollars of producing *x* units of a product is given by

$$C(x) = 50x + 50\sqrt{x} + \frac{\sqrt{x^3}}{50}\ .$$

How many units should be produced to minimize the average cost?

32. ______________________

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33. Use a calculator to estimate any extrema of the function:

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

33. ______________________

34. *Business advertising*. The business of manufacturing and selling tennis racquets is one of frequent changes. Companies introduce new models to the market as innovations and advances in technology lead to improvements in racquets. Many factors contribute to a company's decision-making processes when deciding how to best use advertising dollars. One of the factors is to track the sales in relation to the amount spent on advertising. Suppose that a company has the following data from past sales.

Amount Spent on Advertising (in thousands)	Number of Tennis Racquets sold, *N*
\$ 0	75
\$ 50	9,235
\$100	13,987
\$150	15,318
\$200	14,650
\$250	8,762
\$300	98

(a) Use REGRESSION to fit linear quadratic, cubic and quartic functions to the data.

(b) Determine the domain of the function.

(c) Based on the quadratic fit, use a calculator to approximate the maximum value. Approximate also how much the company should spend on advertising the next new model in order to sell the maximum the number of tennis racquets.

34. (a) ______________________

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(b) ______________________

(c) ______________________

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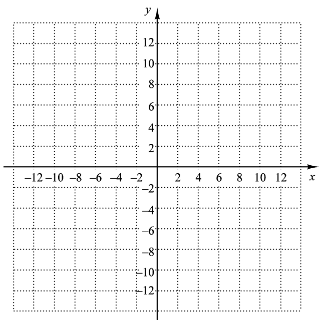
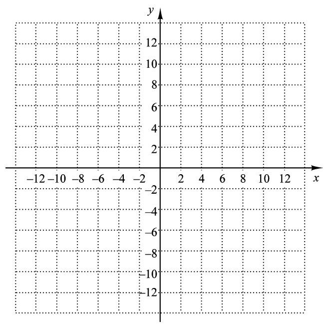
Chapter 2, Form B

Find all relative minimum or maximum values as well as the x-values at which they occur. State where each function is increasing or decreasing. Then sketch a graph of the function.

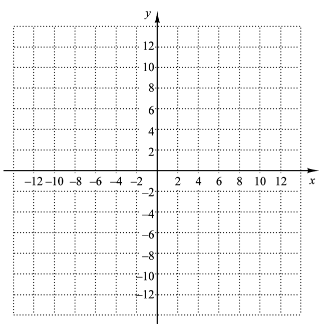
1. $f(x) = x^2 - 5x + 6$



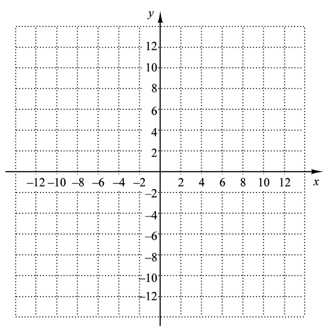
2. $f(x) = 2 + 3x - x^3$



3. $f(x) = (x-3)^{2/5} + 1$

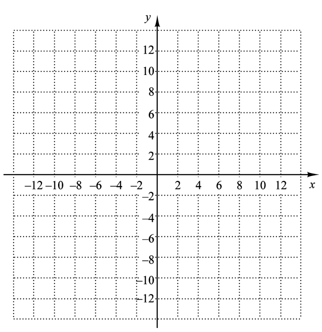


4. $f(x) = \dfrac{-8}{x^2 + 2}$

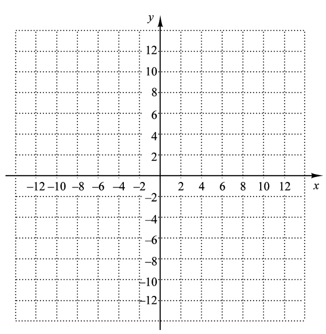


Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of inflection.

5. $f(x) = -8x^3 + 9x^2 + 6x - 5$



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



1. ______________________________

2. ______________________________

3. ______________________________

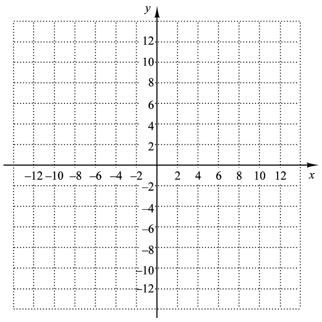
4. ______________________________

5. ______________________________

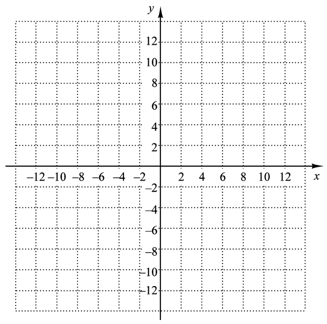
6. ______________________________

Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of inflection.

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



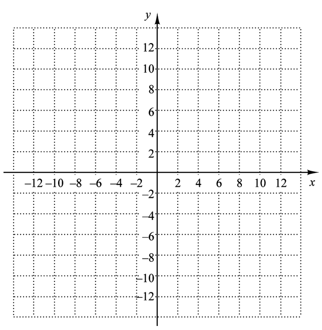
8. $f(x) = x\sqrt{49-16x^2}$



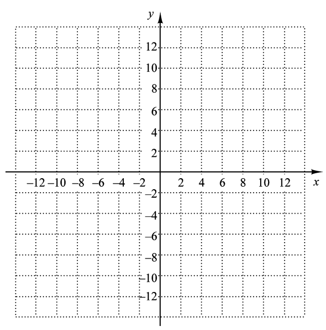
7. ____________________

8. ____________________

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



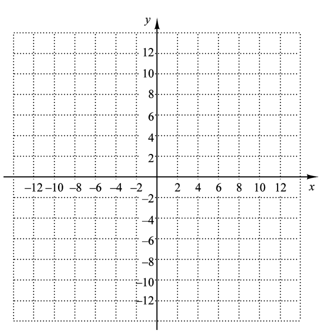
10. $f(x) = \dfrac{-2}{x^2+2x-3}$



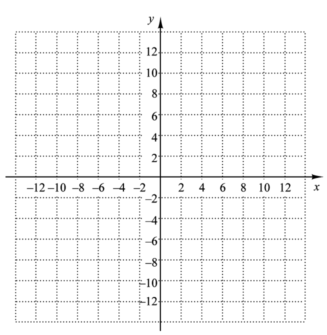
9. ____________________

10. ____________________

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



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



11. ____________________

12. ____________________

Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line.

13. $f(x)=x(4-x)$ **13.** ______________

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

15. $f(x)=-x^2-5.6x+5$ **15.** ______________

16. $f(x)=-2x+3;\ [-2,\ 2]$ **16.** ______________

17. $f(x)=-2x+3$ **17.** ______________

18. $f(x)=5x^2-2x-3$ **18.** ______________

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

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

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

22. *Business: maximum profit.* Find the maximum profit and the number of units x that must be produced and sold in order to yield the maximum profit. Assume that $R(x)$ and $C(x)$ are the revenue and the cost, in dollars, when x units are produced. **22.** ______________

$$R(x)=x^2+150x+40$$
$$C(x)=1.3x^2+30x+90.$$

23. 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 an open box. What dimensions will yield a box of maximum volume? What is the maximum volume? **23.** ______________

24. *Business: minimizing inventory costs*. An office supplies store sells 2500 printer cartridges per year. It costs \$20 to store one printer cartridge for one year. To reorder, there is a fixed cost of \$40, plus \$2.50 for each printer cartridge. How many times per year should the store order printer cartridges and in what lot size, in order to minimize inventory costs? **24.** ______________

25. For $y = f(x) = x^2 + 2,\ x = 5,$ and $\Delta x = -0.1,$ find Δy and $f'(x)\Delta x.$

25. ______________________

26. Approximate $\sqrt{40}$ using $\Delta y \approx f'(x)\Delta x.$

26. ______________________

27. For $y = \sqrt{x^2 + 6}$:

(a) Find dy.

(b) Find dy when $x = 2$ and $dx = 0.01$.

27. (a) ______________________

(b) ______________________

28. Differentiate the following implicitly to find dy/dx. Then find the slope of the curve at $(3, 2)$:

$$x^2 - y^3 = 1.$$

28. ______________________

29. *Surface area of sphere*. A spherical balloon has a radius of 18 cm. Use a differential to find the approximate change in the surface area of the balloon if the radius is decreased or increased by 0.2 cm. The surface area of a sphere is $S = 4\pi r^2$. Use 3.14 for π.

29. ______________________

30. 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?

30. ______________________

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31. Find the absolute maximum and minimum values of the function, if they exist, over $(-\infty, 0]$:

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

31. ______________________

32. *Business: minimizing average cost*. The total cost in dollars of producing x units of a product is given by

$$C(x) = 120x + 120\sqrt{x} + \frac{\sqrt{x^3}}{120}.$$

How many units should be produced to minimize the average cost?

32. ______________________

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33. Use a calculator to estimate any extrema of the function

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

33. ______________________

34. *Business advertising*. The business of manufacturing and selling golf clubs, in particular, drivers, is one of frequent changes. Companies introduce new models to the market as innovations and advances in technology lead to improvements in drivers. Many factors contribute to a company's decision-making processes when deciding how to best use advertising dollars. One of the factors is to track the sales in relation to the amount spent on advertising. Suppose that a company has the following data from past sales.

Amount Spent on Advertising (in thousands)	Number of Drivers sold, N
\$ 0	30
\$ 25	12,975
\$ 50	18,432
\$ 75	21,615
\$100	20,325
\$125	14,762
\$150	56

(a) Use REGRESSION to fit linear quadratic, cubic and quartic functions to the data.

(b) Determine the domain of the function.

(c) Based on the quadratic fit, use a calculator to approximate the maximum value. Approximate also how much the company should spend on advertising the next new model in order the maximum the number of drivers sold.

34. (a) ______________________

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____

(b) ______________________

(c) ______________________

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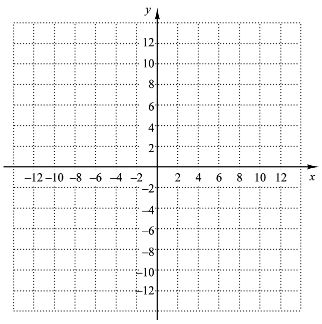
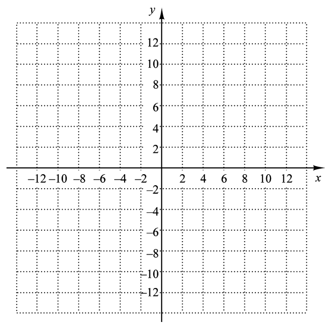
Chapter 2, Form C

Find all relative minimum or maximum values as well as the x-values at which they occur. State where each function is increasing or decreasing. Then sketch a graph of the function.

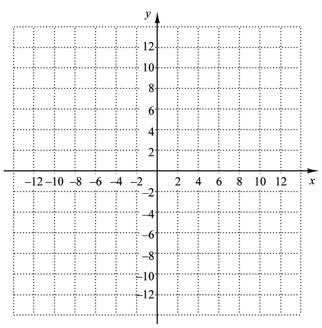
1. $f(x) = x^2 - 6x + 5$



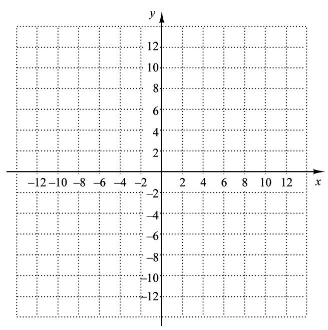
2. $f(x) = -5 + 6x - 2x^3$



3. $f(x) = (x+2)^{2/3} - 5$

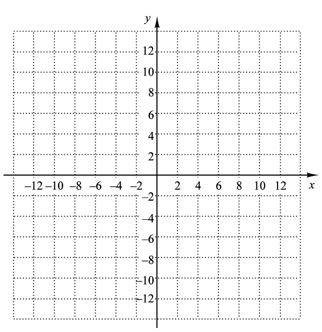


4. $f(x) = \dfrac{20}{x^2 + 5}$

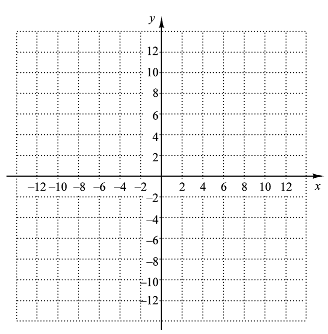


Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of inflection.

5. $f(x) = 4x^3 + 3x^2 - 6x - 5$



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



1. ______________________________

2. ______________________________

3. ______________________________

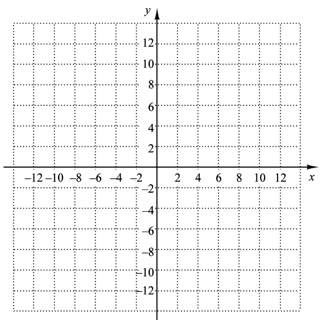
4. ______________________________

5. ______________________________

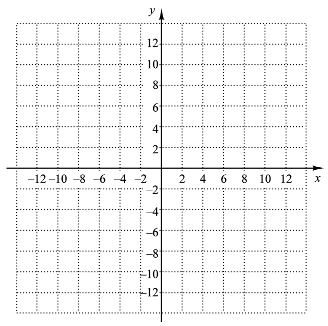
6. ______________________________

Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of inflection.

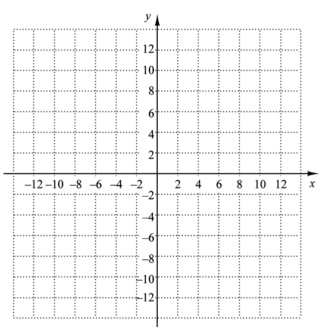
7. $f(x) = (x+3)^3$



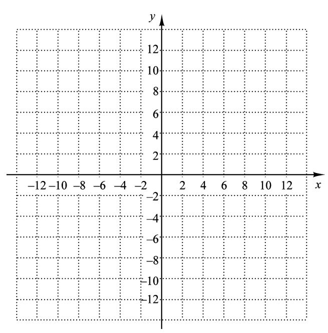
8. $f(x) = x\sqrt{16 - x^2}$



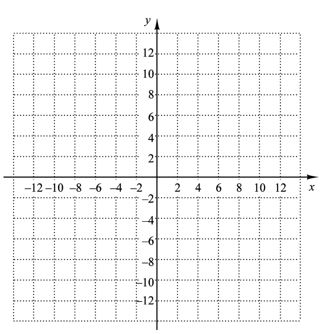
9. $f(x) = \dfrac{2}{x-3}$



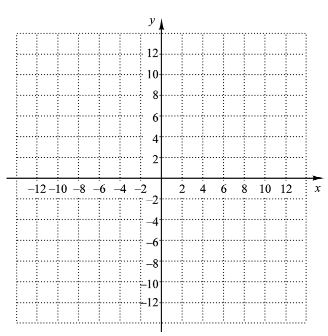
10. $f(x) = \dfrac{-3}{x^2 + x - 6}$



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



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



7. ______________________________

8. ______________________________

9. ______________________________

10. ______________________________

11. ______________________________

12. ______________________________

Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line.

13. $f(x) = x(12 - x)$ **13.** ______________

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

15. $f(x) = -3x^2 + 10.8x - 2$ **15.** ______________

16. $f(x) = -2x + 3;\ [-3, 3]$ **16.** ______________

17. $f(x) = -2x + 3$ **17.** ______________

18. $f(x) = 3x^2 - 4x + 9$ **18.** ______________

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

20. Of all numbers whose difference is 10, find the two that have the minimum product. **20.** ______________

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

22. *Business: maximum profit.* Find the maximum profit and the number of units x that must be produced and sold in order to yield the maximum profit. Assume that $R(x)$ and $C(x)$ are the revenue and the cost, in dollars, when x units are produced: **22.** ______________

$$R(x) = x^2 + 100x + 80$$
$$C(x) = 1.2x^2 + 40x + 120.$$

23. 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 an open box. What dimensions will yield a box of maximum volume? What is the maximum volume? **23.** ______________

24. *Business: minimizing inventory costs.* A health and nutrition store sells 3600 canisters of a special protein formula per year. It costs \$4 to store one canister for one year. To reorder, there is a fixed cost of \$18 plus \$1.50 for each canister. How many times per year should the store order the protein formula and in what lot size, in order to minimize inventory costs? **24.** ______________

25. For $y = f(x) = x^2 + 4$, $x = -3$, and $\Delta x = 0.1$, find Δy and $f'(x)\Delta x$.

25. ______________________

26. Approximate $\sqrt{12}$ using $\Delta y \approx f'(x)\Delta x$.

26. ______________________

27. For $y = \sqrt{x^2 + 7}$:

(a) Find dy.

(b) Find dy when $x = 3$ and $dx = 0.01$.

27. (a) ______________________

(b) ______________________

28. Differentiate the following implicitly to find dy/dx. Then find the slope of the curve at $(3, 4)$:

$$2x^3 - y^3 = -10.$$

28. ______________________

29. *Volume of sphere.* A spherical balloon has a radius of 9 cm. Use a differential to find the approximate change in the volume of the balloon if the radius is decreased or increased by 0.2 cm. The volume of a

sphere is $V = \frac{4}{3}\pi r^3$. Use 3.14 for π.

29. ______________________

30. 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?

30. ______________________

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31. Find the absolute maximum and minimum values of the function, if they exist, over $[0, \infty]$:

$$f(x) = \frac{2x^2}{8 + x^3}.$$

31. ______________________

32. *Business: minimizing average cost.* The total cost, in dollars, of producing x units of a product is given by:

$$C(x) = 15x + 15\sqrt{x} + \frac{\sqrt{x^3}}{15}.$$

How many units should be produced to minimize the average cost?

32. ______________________

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33. Use a calculator to estimate any extrema of the function:

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

33. ______________________

34. *Business Advertising*. The business of manufacturing and selling smartphones is one of frequent changes. Companies introduce new models to the market as innovations and advances in technology lead to improvements in their functionality. Many factors contribute to a company's decision-making processes when deciding how to best use advertising dollars. One of the factors is to track the sales in relation to the amount spent on advertising. Suppose that a company has the following data from past sales.

Amount Spent on Advertising (in thousands)	Number of Smartphones sold, N
\$ 0	75
\$ 40	28,270
\$ 80	34,316
\$120	38,296
\$160	36,998
\$200	32,476
\$240	110

(a) Use REGRESSION to fit linear quadratic, cubic and quartic functions to the data.

(b) Determine the domain of the function.

(c) Based on the quadratic fit, use a calculator to approximate the maximum value. Approximate also how much the company should spend on advertising the next new model in order the maximum the number of smartphones sold.

34. (a) ____________________

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(b) ____________________

(c) ____________________

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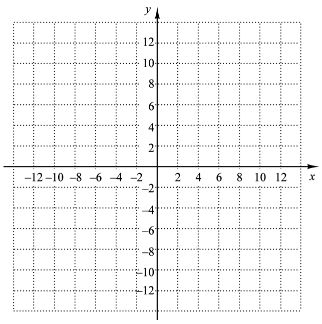
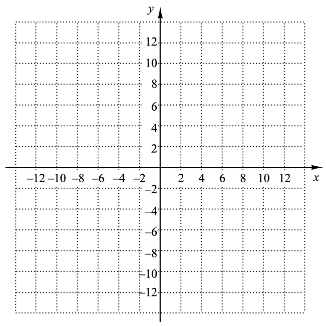
Chapter 2, Form D

Find all relative minimum or maximum values as well as the x-values at which they occur. State where each function is increasing or decreasing. Then sketch a graph of the function.

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



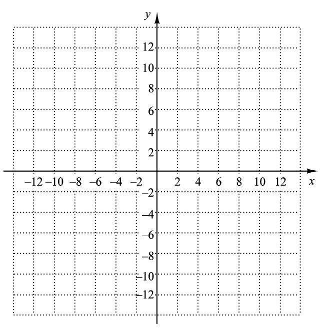
2. $f(x) = 5 - 3x + x^3$



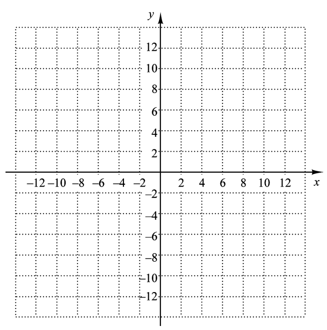
1. ______________________________

2. ______________________________

3. $f(x) = (x-1)^{2/5} + 3$



4. $f(x) = \dfrac{-24}{x^2 + 4}$

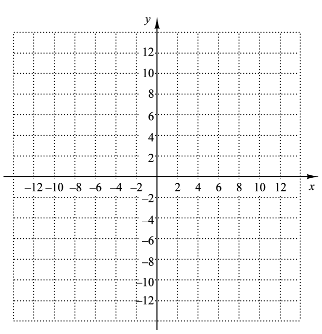


3. ______________________________

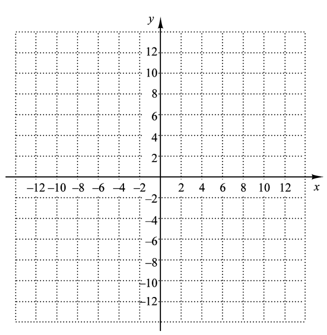
4. ______________________________

Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of inflection.

5. $f(x) = 2x^3 - 5x^2 - 4x + 3$



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



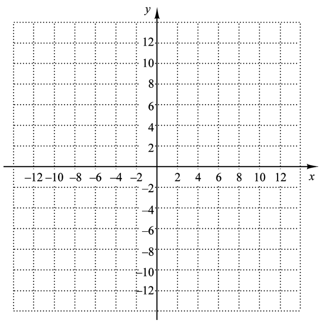
5. ______________________________

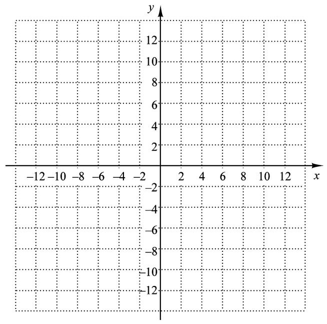
6. ______________________________

Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of inflection.

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

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



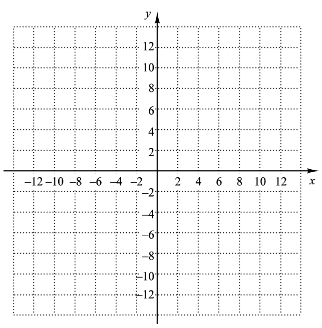


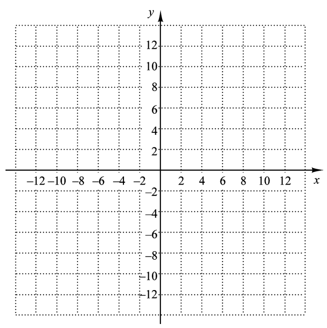
7. ______________________________

8. ______________________________

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

10. $f(x) = \dfrac{-8}{x^2 - 16}$



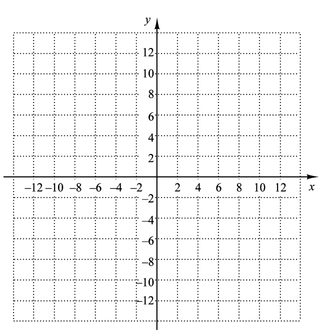


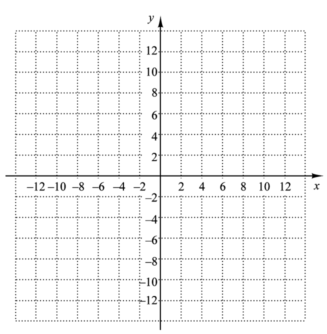
9. ______________________________

10. ______________________________

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

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





11. ______________________________

12. ______________________________

Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line.

13. $f(x) = x(7-x)$ **13.** ______________

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

15. $f(x) = -4x^2 + 16.8x + 3$ **15.** ______________

16. $f(x) = -2x + 7;\ [-2, 2]$ **16.** ______________

17. $f(x) = -2x + 7$ **17.** ______________

18. $f(x) = 3x^2 - 4x + 10$ **18.** ______________

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

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

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

22. *Business: maximum profit*. Find the maximum profit and the number of units x that must be produced and sold in order to yield the maximum profit. Assume that $R(x)$ and $C(x)$ are the revenue and the cost, in dollars, when x units are produced. **22.** ______________

$$R(x) = x^2 + 90x + 20$$
$$C(x) = 1.1x^2 + 4x + 75.$$

23. 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 an open box. What dimensions will yield a box of maximum volume? What is the maximum volume? **23.** ______________

24. *Business: Minimizing Inventory Costs*. A hardware and garden supplies store sells 490 lawn mowers per year. It costs \$20 to store one lawn mower for one year. To recorder, there is a fixed cost of \$25 plus \$50 for each lawn mower. How many times per year should the store order lawn mowers and in what lot size, in order to minimize inventory costs? **24.** ______________

25. For $y = f(x) = x^2 + 3$, $x = 4$, and $\Delta x = 0.2$, find Δy and $f'(x)\,\Delta x$.

25. ______________

26. Approximate $\sqrt{75}$ using $\Delta y \approx f'(x)\Delta x$.

26. ______________

27. For $y = \sqrt{3x^2 + 2}$:

(a) Find dy.

(b) Find dy when $x = 4$ and $dx = 0.01$.

27. **(a)** ______________

(b) ______________

28. Differentiate the following implicitly to find dy/dr. Then find the slope of the curve at $(-3, -2)$:

$$x^3 - 2y^3 = -11.$$

28. ______________

29. *Volume of sphere.* A spherical balloon has a radius of 18 cm. Use a differential to find the approximate change in the volume of the balloon if the radius is increased or decreased by 0.1 cm. The volume of a sphere is $V = \frac{4}{3}\pi r^3$. Use 3.14 for π.

29. ______________

30. 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?

30. ______________

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31. Find the absolute maximum and minimum values of the function, if they exist, over $(-\infty, 0]$:

$$f(x) = \frac{x^2}{4 - x^3}.$$

31. ______________

32. *Business: minimizing average cost*. The total cost, in dollars, of producing x units of a product is given by:

$$C(x) = 200x + 200\sqrt{x} + \frac{\sqrt{x^3}}{200}.$$

How many units should be produced to minimize the average cost?

32. ______________

---

33. Use a calculator to estimate any extrema of the function:

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

33. ______________

34. *Business Advertising.* The business of manufacturing and selling GPS locators is one of frequent changes. Companies introduce new models to the market as innovations and advances in technology lead to improvements in their functionality. Many factors contribute to a company's decision-making processes when deciding how to best use advertising dollars. One of the factors is to track the sales in relation to the amount spent on advertising. Suppose that a company has the following data from past sales.

Amount Spent on Advertising (in thousands)	Number of GPS Locators sold, *N*
$ 0	48
$ 50	14,839
$100	22,877
$150	26,530
$200	24,000
$250	15,654
$300	62

(a) Use REGRESSION to fit linear quadratic, cubic and quartic functions to the data.

(b) Determine the domain of the function.

(c) Based on the quadratic fit, use a calculator to approximate the maximum value. Approximate also how much the company should spend on advertising the next new model in order the maximum the number of GPS locators sold.

34. (a) ____________________

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(b) ____________________

(c) ____________________

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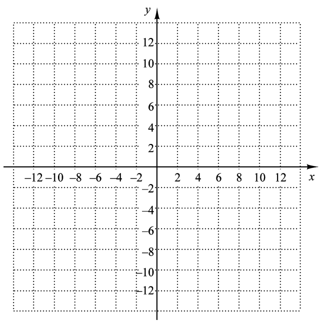
CALCULUS AND ITS APPLICATIONS

Name:

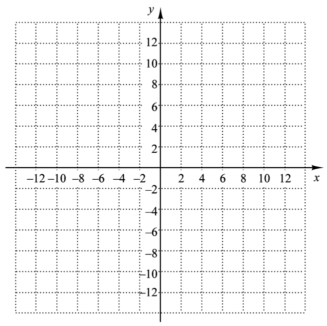
Chapter 2, Form E

Find all relative minimum or maximum values as well as the x -values at which they occur. State where each function is increasing or decreasing. Then sketch a graph of the function.

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



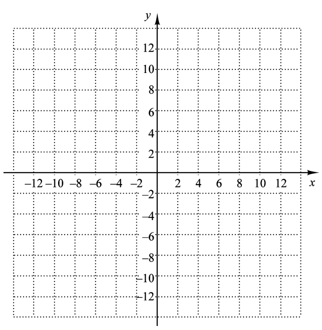
2. $f(x) = 6 - 3x + x^3$



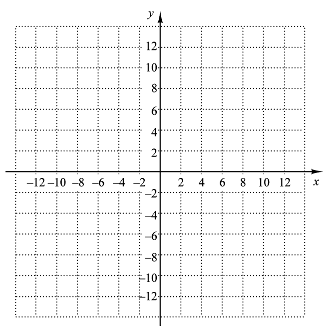
1. ______________________________

2. ______________________________

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



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

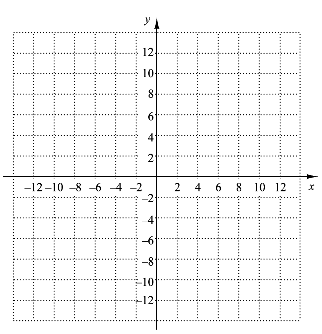


3. ______________________________

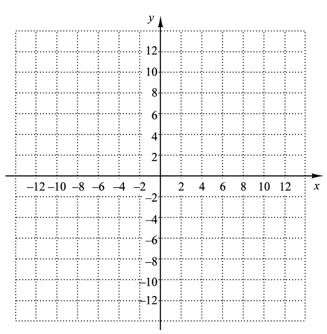
4. ______________________________

Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of inflection.

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



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

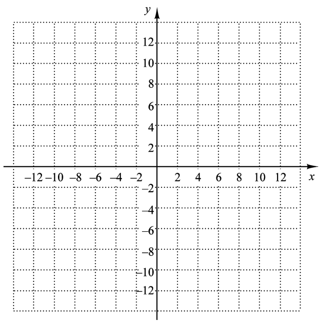


5. ______________________________

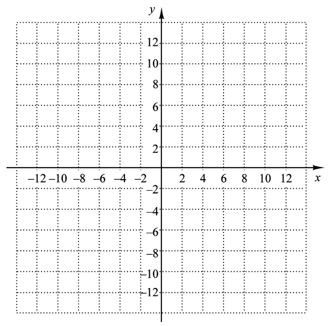
6. ______________________________

Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of inflection.

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



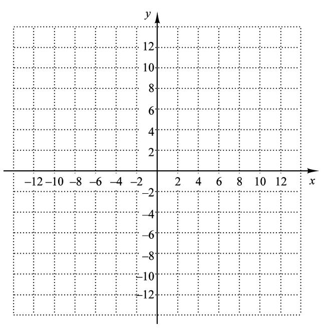
8. $f(x)=x\sqrt{25-16x^2}$



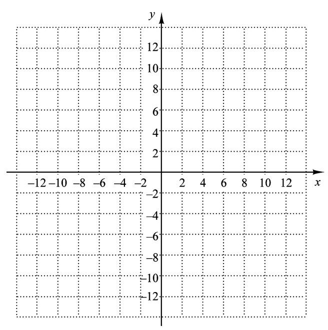
7. ______________________

8. ______________________

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



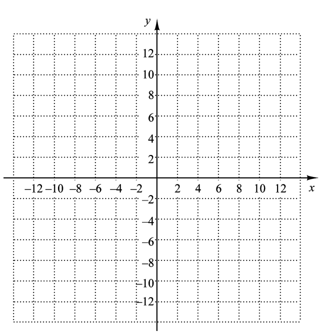
10. $f(x)=\dfrac{-1}{x^2-4x+4}$



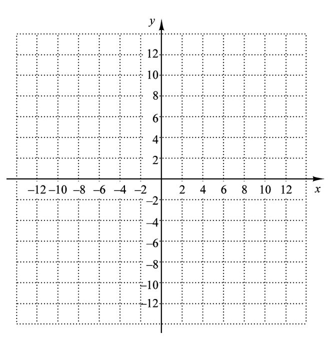
9. ______________________

10. ______________________

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



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



11. ______________________

12. ______________________

Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line.

13. $f(x) = x(8 - x)$ **13.** ______________

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

15. $f(x) = -x^2 + 6.8x + 6$ **15.** ______________

16. $f(x) = -2x + 7;\ [-2, 2]$ **16.** ______________

17. $f(x) = -2x + 7$ **17.** ______________

18. $f(x) = 6x^2 - 3x - 8$ **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 $Q = x^2 + 2y^2$, where $x + y = 6$. **21.** ______________

22. *Business: maximum profit*. Find the maximum profit and the number of units x that must be produced and sold in order to yield the maximum profit. Assume that $R(x)$ and $C(x)$ are the revenue and the cost, in dollars, when x units are produced: **22.** ______________

$$R(x) = x^2 + 210x + 80$$
$$C(x) = 1.4x^2 + 30x + 110.$$

23. 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 an open box. What dimensions will yield a box of maximum volume? What is the maximum volume? **23.** ______________

24. *Business: minimizing inventory costs*. A furniture boutique sells 51 credenzas per year. It costs $30 to store one credenza for one year. To reorder, there is a fixed cost of $85 plus $50 for each credenza. How many times per year should the boutique order credenzas, and in what lot size, in order to minimize inventory costs? **24.** ______________

25. For $y = f(x) = x^2 + 8$, $x = -4$, and $\Delta x = -0.1$, find Δy and $f'(x)\Delta x$.

25. ______________________

26. Approximate $\sqrt{60}$ using $\Delta y \approx f'(x)\Delta x$.

26. ______________________

27. For $y = \sqrt{x^2 + 7}$:

(a) Find dy.

(b) Find dy when $x = 2$ and $dx = 0.01$.

27. (a) ______________________

(b) ______________________

28. Differentiate the following implicitly to find dy/dx. Then find the slope of the curve at $(2, 4)$:

$$5x^3 - y^3 = -24\,.$$

28. ______________________

29. *Surface area of sphere*. A spherical balloon has a radius of 12cm. Use a differential to find the approximate change in the surface area of the balloon if the radius is increased or decreased by 0.3 cm. The surface area of a sphere is $S = 4\pi r^2$. Use 3.14 for π.

29. ______________________

30. 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?

30. ______________________

---

31. Find the absolute maximum and minimum values of the function, if they exist, over $[0,\infty)$:

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

31. ______________________

32. *Business: minimizing average cost*. The total cost, in dollars, of producing x units of a product is given by:

$$C(x) = 180x + 180\sqrt{x} + \frac{\sqrt{x^3}}{180}\,.$$

How many units should be produced to minimize the average cost?

32. ______________________

---

33. Use a calculator to estimate any extrema of the function:

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

33. ______________________

34. *Business Advertising.* The business of manufacturing and selling laptop computers is one of frequent changes. Companies introduce new models to the market as innovations and advances in technology lead to improvements in their functionality. Many factors contribute to a company's decision-making processes when deciding how to best use advertising dollars. One of the factors is to track the sales in relation to the amount spent on advertising. Suppose that a company has the following data from past sales.

Amount Spent on Advertising (in thousands)	Number of laptop computers sold, *N*
\$0	9
\$25	6,725
\$50	10,912
\$75	12,964
\$100	11,534
\$125	6,500
\$150	5

(a) Use REGRESSION to fit linear quadratic, cubic and quartic functions to the data.

(b) Determine the domain of the function.

(c) Based on the quadratic fit, use a calculator to approximate the maximum value. Approximate also how much the company should spend on advertising the next new model in order the maximum the number of laptop computers sold.

34. a) ____________________

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____

(b) ____________________

(c) ____________________

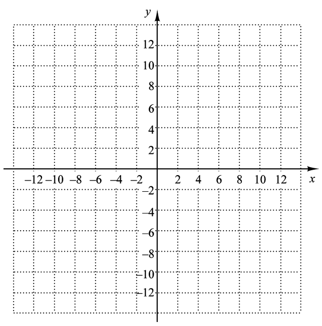
____

 Name:

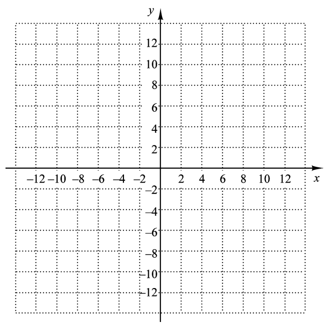
Chapter 2, Form F

Find all relative minimum or maximum values as well as the x-values at which they occur. State where each function is increasing or decreasing. Then sketch a graph of the function.

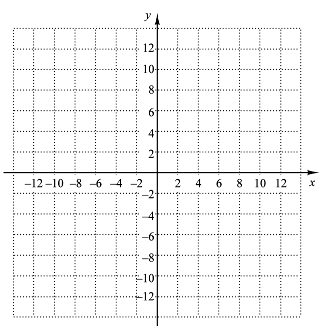
1. $f(x) = x^2 + x - 6$



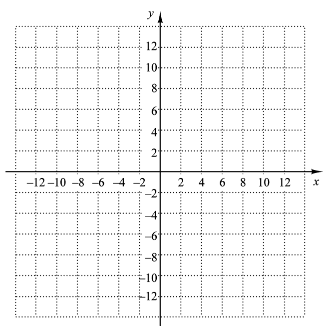
2. $f(x) = 5 + 2x - \frac{2}{3}x^3$



3. $f(x) = (x+4)^{4/5} - 7$

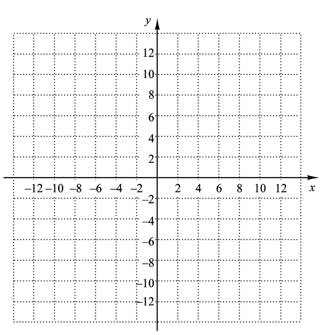


4. $f(x) = \dfrac{-18}{x^2+3}$

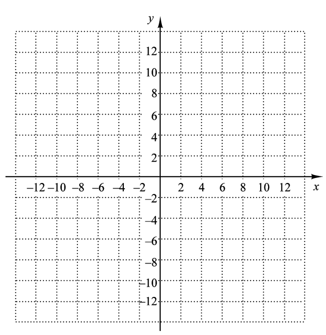


Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of infection.

5. $f(x) = -8x^3 + 9x^2 + 6x - 2$



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



1. ______________________

2. ______________________

3. ______________________

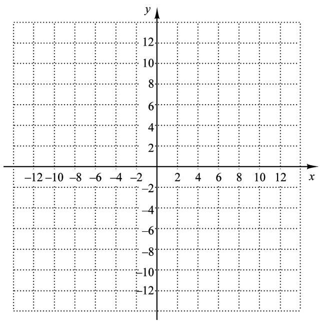
4. ______________________

5. ______________________

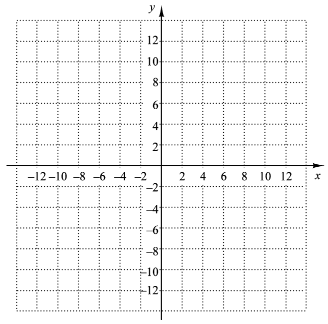
6. ______________________

Sketch a graph of each function. List any extrema, and indicate any asymptotes or points of inflection.

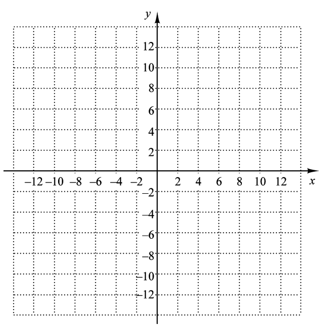
7. $f(x)=(x+3)^3-4$



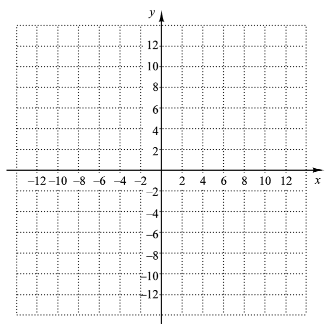
8. $f(x)=x\sqrt{49-9x^2}$



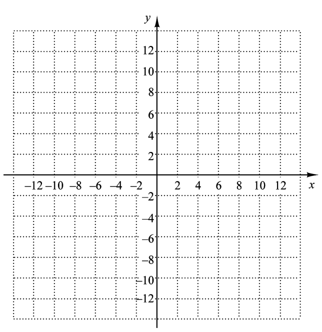
9. $f(x)=\dfrac{5}{x-3}$



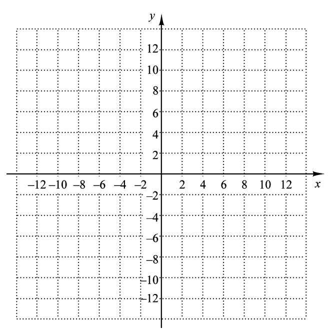
10. $f(x)=\dfrac{-3}{x^2-10x+25}$



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



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



7. ______________________________

8. ______________________________

9. ______________________________

10. ______________________________

11. ______________________________

12. ______________________________

Find the absolute maximum and minimum values of the function, if they exist, over the indicated interval. Where no interval is specified, use the real line.

13. $f(x) = x(9 - x)$ — **13.** ______

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

15. $f(x) = -x^2 - 7.2x + 1$ — **15.** ______

16. $f(x) = -x + 5;\ [-2, 2]$ — **16.** ______

17. $f(x) = -x + 5$ — **17.** ______

18. $f(x) = 4x^2 - 5x + 16$ — **18.** ______

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

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

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

22. *Business: maximum profit*. Find the maximum profit and the number of units x that must be produced and sold in order to yield the maximum profit. Assume that $R(x)$ and $C(x)$ are the revenue and the cost, in dollars, when x units are produced: — **22.** ______

$$R(x) = x^2 + 120x + 40$$
$$C(x) = 1.3x^2 + 30x + 100.$$

23. 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 an open box. What dimensions will yield a box of maximum volume? What is the maximum volume? — **23.** ______

24. *Business: minimizing inventory costs*. A corner coffee shop sells 1200 thermal travel cups per year. It costs \$0.50 to store one travel cup for one year. To recorder, there is a fixed cost of \$18.75 plus \$1.00 for each travel cup. How many times per year should the shop order the thermal travel cups and in what lot size, in order to minimize inventory costs? — **24.** ______

25. For $y = f(x) = x^2 + 9$, $x = 4$, and $\Delta x = -0.1$, find Δy and $f'(x)\Delta x$.

25. ______________________________

26. Approximate $\sqrt{20}$ using $\Delta y \approx f'(x)\Delta x$.

26. ______________________________

27. For $y = \sqrt{2x^2 - 1}$:

(a) Find dy:

(b) Find dy when $x = 5$ and $dx = 0.01$.

27. (a) ___________________________

(b) ___________________________

28. Differentiate the following implicitly to find dy/dx. Then find the slope of the curve at $(1, 3)$:

$$x^3 + 2y^2 = 19 .$$

28. ______________________________

29. *Volume of sphere*. A spherical balloon has a radius of 14 cm. Use a differential to find the approximate change in the volume of the balloon if the radius is increased or decreased by 0.4 cm. The volume of a sphere is $V = \frac{4}{3}\pi r^3$. Use 3.14 for π.

29. ______________________________

30. 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?

30. ______________________________

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31. Find the absolute maximum and minimum values of the function, if they exist, over $[0, \infty)$:

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

31. ______________________________

32. *Business: minimizing average cost*. The total cost, in dollars, of producing x units of a product is given by:

$$C(x) = 90x + 90\sqrt{x} + \frac{\sqrt{x^3}}{90} .$$

How many units should be produced to minimize the average cost?

32. ______________________________

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33. Use a calculator to estimate any extrema of the function:.

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

33. ______________________________

34. *Business Advertising*. The business of manufacturing and selling digital cameras is one of frequent changes. Companies introduce new models to the market as innovations and advances in technology lead to improvements in their functionality. Many factors contribute to a company's decision-making processes when deciding how to best use advertising dollars. One of the factors is to track the sales in relation to the amount spent on advertising. Suppose that a company has the following data from past sales.

Amount Spent on Advertising (in thousands)	Number of Digital Cameras sold, N
\$ 0	7
\$ 20	5,044
\$ 40	8,184
\$ 60	9,723
\$ 80	8,651
\$100	4,875
\$120	4

(a) Use REGRESSION to fit linear quadratic, cubic and quartic functions to the data.

(b) Determine the domain of the function.

(c) Based on the quadratic fit, use a calculator to approximate the maximum value. Approximate also how much the company should spend on advertising the next new model in order the maximum the number of digital cameras sold.

34. a) ______________________________

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(b) ______________________________

(c) ______________________________

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