1. Find the domain of the function

$$f(x) = \begin{cases} x+4, & \text{if } x > 3 \\ \dfrac{x}{\sqrt{x+2}}, & \text{if } x \leq 3 \end{cases}$$

2. Which of the following are polynomials? For each polynomial determine its degree and circle its leading coefficient.

   (a) $f(x) = x^5 + x^2 - 6 - x^{11}$

   (b) $g(x) = 5\sqrt{x} + 4x - 2$

   (c) $h(x) = 2x^4 - x^2 + x$

   (d) $r(x) = x^2 + x^{-2}$

3. Solve for x

$$7^{x^2} = 7^{2x+3}$$

4. Amanda would like to remodel her kitchen in 4 years. How much should she invest now at 7% compounded monthly to have \$15,000 four years from now? Round your answer to the nearest cent.

5. Solve for x

$$\log_5 x + \log_5(x+3) = \log_5 10$$

6. The financial department of a company that produces pens obtains the following price-demand equation

$$p = 35 - 0.34x$$

   where p is the wholesale price in dollars per pen at which x pens are sold. The fixed costs for the company is \$200 and the variable costs is \$4.50 per pen. How many pens should be produced by the company to maximize the profit? Round the answer to the nearest integer.

7. A company that produces and sells T-shirts established the price-demand function $p(x) = 21 - 0.1x$, where $p(x)$ is the price per T-shirt at which x T-shirts can be sold. Suppose that the company must produce at least 50 shirts and its cost equation is $C(x) = 2x + 250$. How many T-shirts must the company produce to break-even? Round your answer to the nearest T-shirt.

8. The quantity demanded of a certain brand of computers is 300/wk when unit price is \$450. For each decrease in unit price of \$30, the quantity demanded increases by 100 units. The company will not supply any computers if the unit price is \$250 or lower. However, they will supply 375 computers if unit price is \$325. Find the equaibrium price and the equilibrium quantity.

9. Suppose \$29,000 is deposited into an account paying 7.5% annual interest. How much will be in the account after 5 years if the account is compounded continuously?

10. Express the given quatities as a single logarithm:

    (a) $\log_2 x + 5\log_2(x+1) + \frac{1}{2}\log_2(x-1)$

    (b) $2\ln 4 - \ln 2$

11. How long will it take for the amount in an account to triple if the money is compounded continuously at an annual interest rate of 4.7%?

12. Evaluate the limit

    (a) $\lim_{x\to 5} \frac{x^2-25}{x^2+x-30}$

    (b) $\lim_{h\to 0} \frac{\sqrt{a+h}-\sqrt{a}}{h}$, $a \geq 0$.

    (c) $\lim_{x\to\infty} \frac{2x^3+1}{4-x-x^3}$

13. Find the vertical and horizontal asymptotes of the curve $y = \frac{x^2+4}{3x^2-3}$.

14. Find all points of discontinuity for the function

$$f(x) = \begin{cases} x^2+1 & , \text{ if } x < 2, \\ x+2 & , \text{ if } x \geq 2. \end{cases}$$

15. The displacement of an object moving in a straight line is given by $s(t) = 1 + 2t + t^2/4$ (t is in seconds).

    (a) Find the average velocity when t changes from $t = 1$ to $t = 2$.

    (b) Find the velocity of the object when $t = 1$.

16. Find the equation of the tangent line to the curve $y = 2x^2 - 3$ at the point (2,5).

17. Let

$$p = 25 - 0.01x \qquad \text{and} \qquad C(x) = 2x + 9000$$

    where $0 \leq x \leq 2500$, be the price-demand equation and cost function, respectively, for the manufacture of umbrellas.

    (a) Find the exact cost of producing the 31st umbrella.

    (b) Use the marginal cost to approximate the cost of producing the 31st umbrella.

18. Find the equation of the tangent line to the graph of the function $f(x) = \ln(1 - x^2 + 2x^4)$ at the point where $x = 1$.

19. Find the value(s) of x where the tangent line to the graph of the function $y = 5e^{x^2-4x+1}$ is horizontal.

20. Find each derivative

(a) $\dfrac{d}{dx}\log_3(\sqrt[4]{4x^3+5x+7})$

(b) $\dfrac{d}{dx}8^{1-2x^3}$

(c) $\dfrac{d}{dx}\dfrac{3x^2}{(x^2+5)^3}$

(d) $\dfrac{d}{dx}[(x^2+x-3)e^{2x+3}]$

21. Given the price-demand equation

$$0.02x + p = 60$$

(a) Find the elasticity of demand $E(p)$.

(b) For which values of p is the revenue maximized? Find the maximum revenue.

(c) If $p = \$10$ and the price is increased by 5%, what is the approximate change in demand?

(d) If $p = \$40$ and the price is decreased, will revenue increase or decrease?

22. Find $f''(x)$ for the functions

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

(b) $f(x) = \dfrac{2}{x} - \dfrac{6}{x^3}$

23. Find the limit

(a) $\lim_{x\to\infty}(x - x^3)$

(b) $\lim_{x\to-\infty}(x - x^3)$

(c) $\lim_{x\to-\infty}\dfrac{x^3-1}{2x^4+1}$

(d) $\lim_{x\to\infty}\dfrac{x^4-1}{1-x^3}$

(e) $\lim_{x\to\infty}\dfrac{x^4-2x^2+3}{1-x^4}$

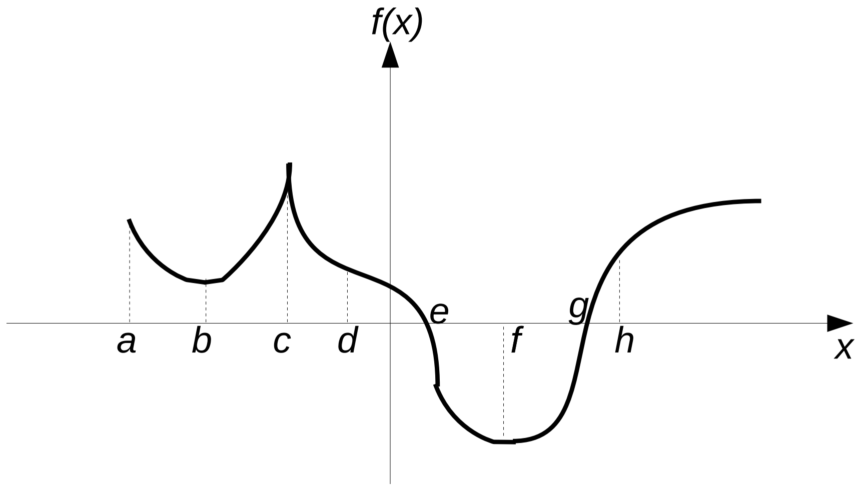
(f) $\lim_{x\to-\infty}\dfrac{e^{-2x}+4}{3-2e^{-2x}}$

24. Find the horizontal asymptotes of the function

(a) $f(x) = \dfrac{x^4+3x}{2-6x^4}$

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

25. Given the graph of the function $y = f(x)$.



(a) Find the intervals on which $f'(x) > 0$.

(b) Find the intervals on which $f'(x) < 0$.

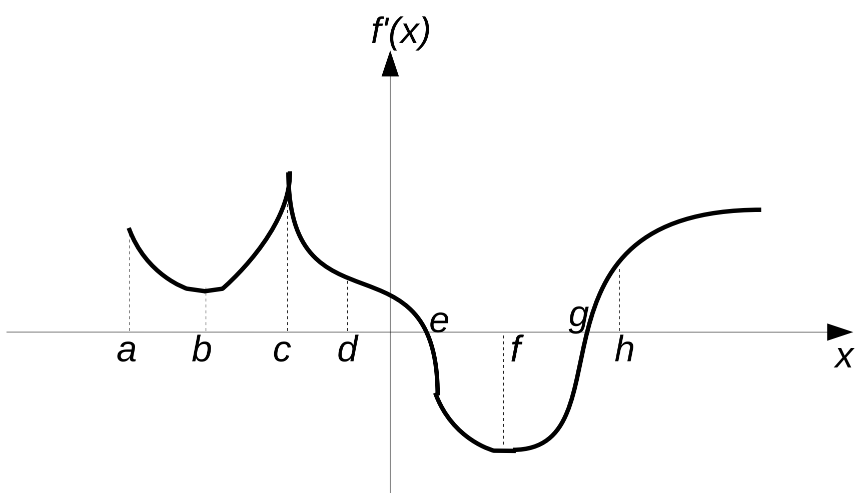
(c) Find x-coordinates of the points where $f'(x) = 0$.

(d) Find the intervals on which $f''(x) > 0$.

(e) Find the intervals on which $f''(x) < 0$.

(f) Find x-coordinates of the points where $f''(x) = 0$.

26. Given the graph of the derivative $f'(x)$ of the fuunction $f(x)$.



(a) Find the intervals on which $f(x)$ is increasing/decreasing.

(b) Find x-coordinates of the critical values for $f(x)$.

(c) Find the intervals on which $f(x)$ is convcave up/concave down.

(d) Find x-coordinates of the inflection points.

27. Given the function $f(x) = \frac{1}{4}x^4 - 4x$.

   (a) Find critical values of $f(x)$.
   (b) Find intervals on which $f(x)$ is increasing and decreasing.
   (c) Find local extrema for $f(x)$.
   (d) Find intervals on which $f(x)$ is concave upward and concave downward.
   (e) Find all inflection points of $f(x)$.

28. Find the absolute maximum and absolute minimum for the function $f(x) = \sqrt{9 - x^2}$ on the interval $[-1, 2]$.

29. Find the absolute maximum and minimum for the function $f(x) = \dfrac{x^2 - 1}{x^2 + 1}$.

30. A box with a square base and open top must have a volume of 32000 cm^3. Find the dimensions of the box that minimize the amount of material used.

31. Find the following indefinite integrals:

   (a) $\int \frac{1}{\sqrt{x}} e^{\sqrt{x}}\, dx$
   (b) $\int \frac{x^3 - 3}{x^4 - 12x + 3}\, dx$
   (c) $\int \frac{(\ln x)^2}{x}\, dx$
   (d) $\int \frac{x}{(5 - 2x^2)^5}\, dx$
   (e) $\int \frac{x}{\sqrt{3 - x}}\, dx$
   (f) $\int e^{2x-1}\, dx$

32. The weekly marginal revenue from the sale of x pairs of tennis shoes is given by

$$R'(x) = 40 - 0.002x + \frac{200}{x + 1}, \qquad R(0) = 0,$$

   where $R(x)$ is revenue in dollars. Find the revenue function $R(x)$. Find the revenue from the sale of 1000 pairs of shoes.

33. Use L_6 and R_6 to approximate $\int_2^5 (0.25x^2 - 4)dx$.

34. Evaluate each of the definite integrals:

   (a) $\int_0^A 32(x^2 + 1)^7 x\, dx \quad (A > 0)$

(b) $\int_B^2 \left(5x - 4\frac{x^2}{\sqrt[4]{x^3}}\right) dx, \quad (0 < B < 2)$

35. Find the average value of the function $f(x) = 4x - 3x^2$ over the interval $[-2, 2]$.

36. Find the area of the region bounded by:

   (a) $y = 3 - x^2$, $y = 2x^2 - 4x$

   (b) $y = x^3$, $y = 4x$

   (c) $y = -x^2 - 2x$, $y = 0$, $x = -2$, $x = 1$.

37. Find the consumers' surplus and producers' surplus at the equilibrium price level for the given price-demand and price-supply equations.

$$p = D(x) = 70 - 0.2x$$
$$p = S(x) = 13 + 0.0012x^2$$

   Round all values to the nearest integer.

38. Let $f(x, y) = 2x - 3y + 14$ and $g(x, y) = \dfrac{10}{x^2 + 4y}$. Find $f(2, -3) - 4g(-1, 2)$.

39. Weston Publishing publishes a deluxe edition and a standard edition of its English language dictionary. Weston's management estimates that the number of deluxe editions demanded is x copies/day and the number of standard editions demanded is y copies/day when the unit prices are

$$p = 20 - 0.005x - 0.001y$$
$$q = 15 - 0.001x - 0.003y$$

   dollars, respectively. Find the daily total revenue function $R(x, y)$. Evaluate $R(7, 3)$.

40. Find f_x and f_y for the functions:

   (a) $f(x, y) = \dfrac{2xy}{1 + x^2y^2}$

   (b) $f(x, y) = \sqrt{2x - y^2}$

   (c) $f(x, y) = xe^{x\sqrt{y}}$

41. Find f_x, f_y, f_{xx}, f_{xy}, and f_{yy} for the function $f(x, y) = -4x^3y^5 + 9x^6y^2$.

42. Find the local extrema for the function $f(x, y) = x^3 - 3xy^2 + 6y^2$.