

1. Find the slope of each of the following lines:

- (a) through $(1, -1)$ and $(3, 2)$
- (b) given by the equation $2x + 3y = 5$
- (c) through $(1, -2)$, parallel to the line with equation $x - 2y = 1$.
- (d) horizontal, through $(-4, 7)$

2. Find the equation of each of the following lines:

- (a) Through $(1/2, 1)$ with slope $-2/3$.
- (b) Through $(0, -1)$ and $(-2, 5)$
- (c) Through $(1, 1)$ and $(-1, 3)$
- (d) Through $(-3, -1)$ and $(5, -1)$
- (e) Through $(-3, -1)$ and $(-3, 2)$.
- (f) Through the point $(4, -1)$ and parallel to the line $2x + 5y = 6$.

3. Determine whether each of the following functions is continuous. If not, find the discontinuities.

$$(a) f(x) = \begin{cases} 2x - 1 & \text{if } x < 0 \\ 1 - x & \text{if } 0 \leq x \leq 1 \\ x - 1 & \text{if } x > 1 \end{cases}$$

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

$$(c) f(x) = \begin{cases} x^2 + 1 & \text{if } x \leq 0 \\ 1 & \text{if } 0 < x < 1 \\ x^2 & \text{if } x \geq 1 \end{cases}$$

$$(d) f(x) = \begin{cases} x^2 & \text{if } x \leq 0 \\ 1 & \text{if } 0 < x < 1 \\ x^2 + 1 & \text{if } x \geq 1 \end{cases}$$

4. Find the natural domain of each of the following functions.

$$(a) f(x) = \sqrt{x - 2}$$

$$(b) f(x) = \frac{1}{\sqrt{x - 2}}$$

$$(c) f(x) = \frac{\sqrt{x}}{x - 2}$$

$$(d) \frac{x}{x^2 + 4}$$

$$(e) \frac{x}{x^2 - 4}$$

$$(f) \frac{x}{\sqrt{x^2 - 4}}$$

5. Find the vertical and horizontal asymptotes, if any, for the graphs of the following functions. If there are none, write “none.”

$$(a) f(x) = \frac{x^2 - 1}{x^2 + 1}$$

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

$$(c) f(x) = \frac{x^4}{x^2 - 100}$$

$$(d) f(x) = \frac{x + 2}{3x - 4}$$

$$(e) f(x) = \frac{3x^4 + 15x^3 + 10x^2 + 5x + 20}{x^4 + 1}$$

6. A ball is thrown upward from a height of 15 feet with an initial speed of 8 feet per second. The height of the ball is given by the formula

$$h = -16t^2 + 8t + 15$$

where h is the height (in feet) and t is the time (in seconds).

- (a) When does the ball reach its highest point?
- (b) How high does it go?
- (c) When does it hit the ground?

7. Complete the squares of each of the following quadratics. Then state whether the graph has a maximum or a minimum point and find the coordinates of the point.

(a) $2x^2 + 12x + 13$

(b) $-3x^2 + 10x - 8$

8. A company that makes Adirondack chairs has fixed costs of \$5,000 per month plus a cost of \$30 per chair. The company plans to sell the chairs for \$50 each. Suppose they produce q chairs a month, and assume that they sell every chair they produce.

(a) Find the monthly profit function.

(b) Find the break-even point.

9. A small company manufacturing tennis rackets has fixed costs of \$700 per week. For the first 50 rackets they make, each one costs \$32 to produce. Every racket over 50 they make costs \$38. If x is the number of rackets they produce in a given week, find the cost function $C(x)$.

10. A company offers dinner cruises on the Chicago River. The company has found that the average number of passengers per night is 80 if the price is \$45 per person. At a price of \$30 per person, the average number of passengers per night is 125. Let p denote the price and q denote the demand (the average number of passengers).

(a) Assuming that the demand is a linear function of the price, write the demand as a function of the price.

(b) Write the nightly revenue R as a function of the price.

(c) What price should the company charge to maximize the revenue? (Round your answer off to the nearest dollar.)

11. Compute each of the following without a calculator. Your answer should be an integer or simple fraction.

(a) $\left(\frac{1}{9}\right)^{1/2}$

(b) $\left(\frac{1}{9}\right)^{-2}$

(c) $(0.1)^3$

(d) $(0.1)^{-3}$

12. Let $f(x) = \frac{1}{(x+2)^2}$. Compute the following.

(a) $f(1)$

(b) $f(0)$

(c) $f(a-1)$

Answers :

1. (a) $3/2$ (b) $-2/3$ (c) $1/2$ (d) 0

2. (a) $y = -(2/3)x + (4/3)$

(b) $y = -3x - 1$ (c) $y = -x + 2$ (d) $y = -1$ (e) $x = -3$ (f) $2x + 5y = 3$

3. (a) disc. at $x = 0$ (b) cont. (c) cont. (d) disc. at $x = 0, 1$

4. (a) $x \geq 2$ (b) $x > 2$ (c) $x \geq 0, x \neq 2$ (d) all x (e) $x \neq \pm 2$ (f) $|x| > 2$

5. (a) h.a. $y = 1$, no v.a. (b) h.a. $y = 0$, v.a. $x = 2, x = -2$

(c) no h.a., v.a. $x = 10, x = -10$ (d) h.a. $y = 1/3$, v.a. $x = 4/3$

(e) h.a. $y = 3$, no v.a.

6. (a) $1/4$ sec (b) 16 ft (c) $5/4$ sec

7. (a) $2(x + 3)^2 - 5$, min at $(-3, -5)$

(b) $-3(x - (5/3))^2 + (1/3)$, max at $(5/3, 1/3)$

8. (a) $P(x) = 20x - 5000$ (b) 250

9. $C(x) = \begin{cases} 700 + 32x & \text{if } 0 \leq x \leq 50 \\ 2300 + 38(x - 50) & \text{if } 50 < x \end{cases}$

10. (a) $q = -3p + 215$ (b) $R = -3p^2 + 215p$ (c) 36

11. (a) $1/3$ (b) 81 (c) 0.001 (d) 1000

12. (a) $1/9$ (b) $1/4$ (c) $\frac{1}{(a+1)^2}$