

Work-out Problems

Study tip : Show all your work !

Exercise 1. Let x denote the input variable and y denote the output variable. Determine which of the following gives y as a function of x .

1. $\{(-1, 0), (0, -3), (2, -3), (3, 0), (4, 5)\}$
2. $\{(6, 10), (-7, 3), (0, 4), (6, -4)\}$
3. $y = x^2 + 1$
4. $y^2 = x + 1$
5. $x^2 + y^2 = 4$

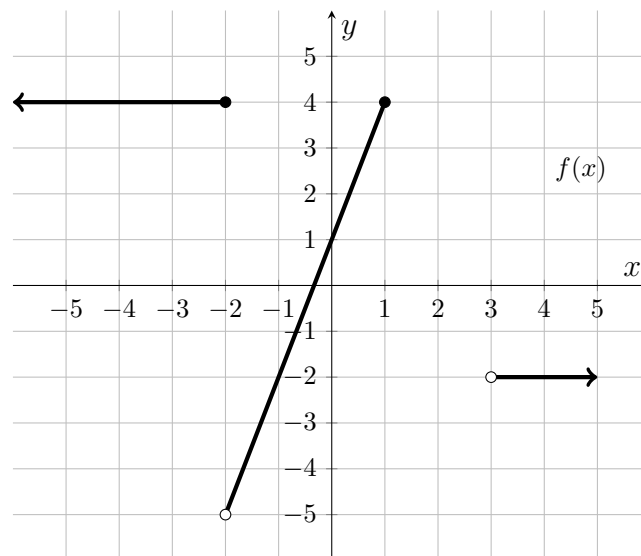
Exercise 2. Given $f(x) = -6x^2 + ax - 7$ and $g(x) = -x^2 - \frac{4}{5}x$ evaluate each of the following.

1. $f(-10)$
2. $f(0)$
3. $f(t)$
4. $f(t + 1)$
5. $f(x + 1)$
6. $f(x) + 1$
7. $g(x + h)$
8. $g(x^2 - 5)$

Exercise 3. Express the following sets of numbers using interval notation.

1. $\{x \mid x \geq \frac{1}{2} \text{ and } x \neq \pm\sqrt{7}\}$
2. $\{x \mid \frac{11}{5} > x \text{ or } \frac{11}{5} \leq x < 26\}$
3. $\{x \mid x < -4 \text{ and } 2x + 5 > 21\}$
4. $\{x \mid x \geq -3 \text{ and } x \leq 0\} \cup \{(x + 2)(x - 5) \neq 0 \text{ and } 0 < x \leq 6\} \cup \{x > 8 \text{ and } x \geq 10\}$

Exercise 4. The graph given below is the graph of a function $f(x)$ (why?).



Determine the following.

1. The domain of f (in interval notation)
2. The range of f (in interval notation)
3. $f(-3)$
4. $f(-2)$
5. $f(2)$
6. All zeros of f
7. Where $f(x) = -2$

Exercise 5. Anakin Skywalker, the consultant for the company "It's Lit!" determines that if the company sells x lightsabers, their demand equation (where x is the number of lightsabers demanded and p is the price in dollars) is the function $p(x) = -\frac{1}{50}x + 1000$.

1. Determine the company's revenue equation.
2. Find the number of lightsabers that should be produced to yield a maximum revenue. Round to the nearest whole number, if necessary. *Answer with a complete sentence, using the correct units.*
3. Calculate the maximum revenue of the company in dollars. Round your answer to 2 decimal places, if necessary. *Answer with a complete sentence, using the correct units.*
4. Find the price at which each lightsaber should be sold to maximize their revenue. Round your answer to 2 decimal places, if necessary. *Answer with a complete sentence, using the correct units.*
5. The company's cost equation is given by $C(x) = \frac{1568}{5}x + 1,139,950$. How many lightsabers should Anakin sell to break even?

Exercise 6. A degree 3 polynomial $f(x) = ax^3 + bx^2 + cx + d$ has y -intercept $(0, -4)$ and exactly three real zeros at $x = 8$, $x = -3$, and $x = \frac{1}{2}$.

- Find the equation of f .
- Describe the end behavior of the graph of $f(x)$ (both symbolically and with a quick sketch).
- What is the domain of f ?

Exercise 7. Determine if each of the following is a polynomial. If it is a polynomial, specify its degree, leading coefficient, end behavior, and domain. If it is not a polynomial, state a reason for your answer.

- $f(x) = 3x^{1/2} + x\sqrt{2}$
- $g(x) = x + 2x^{-1}$
- $h(x) = x^3 + 2x + \frac{\sqrt{6}}{7}$
- $j(x) = 130x - \frac{5^{2/3}}{4}\sqrt{3}x^{23} + 17x^{12}$
- $k(x) = ax^6 + bx^{58} - cx^5 + dx^{11} + 18x^2$ where $a < 0$, $b < 0$, $c < 0$, and $d > 0$.

Exercise 8. Given $y = -5x^2 + 10x - 4$, without graphing determine the vertex, axis of symmetry, maximum value, minimum value, domain, range, y -intercept, and x -intercept(s) of the function.

Exercise 9. Let $f(x) = -x^2 + 3x$. Find and simplify the following completely.

$$\frac{f(x+h) - f(x)}{h}$$

This expression is called a difference quotient. This important concept is introduced in Section 5.2 and we will see it throughout Chapter 5.

Multiple Choice Problems

Study tip : Write out all your work when you complete the multiple-choice problems.

Multiple Choice 1. It has been determined that the revenue function for a stapler is given by $R(x) = -0.025x^2 + 8.25x$ and the cost function is given by $C(x) = 1.25x + 500$ where $R(x)$ and $C(x)$ are in dollars and x represents the number of staplers produced and sold. What is the selling price of the stapler when the profit is maximized? (Answers are given to the nearest penny.)

- \$140.00
- \$4.75
- \$4.13
- \$10.00
- None of these

Multiple Choice 2. What is the range of the function

$$h(x) = -(x-3)^2 + 18?$$

- $(-\infty, \infty)$
- $[18, \infty)$
- $(-\infty, 3]$
- $(-\infty, 18]$
- $(-\infty, 18)$

Multiple Choice 3. Find all the exact zeros of the quadratic function :

$$f(x) = 10x^2 - 3x - 4$$

- $x = \frac{4}{5}, -\frac{1}{2}$
- $x = -\frac{4}{5}, \frac{1}{2}$
- $x = \frac{3}{20}$
- $x = -4$
- None of the given answer choices are correct.

Multiple Choice 4. Let h be the function $h(x) = -5x^8 + 85x^7 + 45x^6 - 6345x^5 + 15120x^4 + 121500x^3 - 349920x^2$ which factors into :

$$h(x) = -5(x-0)^2(x+6)^2(x-3)(x-9)^2(x-6).$$

Which of the following statements is **FALSE**?

- The domain of the function is $(-\infty, \infty)$.
- $h(9) = 0$
- The function $h(x)$ is a polynomial.
- $h(x) \rightarrow \infty$ as $x \rightarrow -\infty$.
- The function $h(x)$ has zeros at $x = -6, 0, 3, 6, 9$.

Multiple Choice 5. Elena's Biking Company manufactures and sells bikes. Each bike costs \$40 to make and the company's fixed costs are \$5000. Elena knows that the company's cost is given by a linear function, and that the unit price (in dollars) of each bike is a linear function of the number of bikes sold. Based on her sales data, when the unit price of a bike is \$280, she knows that 10 bikes will be sold, and if the unit price drops by \$60, then 40 bikes will be sold. Which of the following statements is **FALSE**? (All answers are rounded to the *nearest* whole number).

- Elena's cost equation is given by $C(x) = 40x + 5000$, x denotes the number of bikes sold.
- The graph of the profit equation is a parabola that opens downward.
- $(x, p) = (40, 60)$ is a point on the graph of the linear demand function where the unit price p is a function of number of bikes sold, x
- Elena will maximize her profit if 65 bikes are sold
- To break even, Elena should sell approximately 23 bikes or 107 bikes.