Sketching Graphs and Comparing Functions · Form C

Examples 1 and 2

Use the key features of each function to sketch its graph.
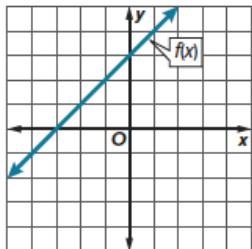
1. *x*-intercept: (0, 0)
   y-intercept: (0, 0)
   Linearity: linear
   Continuity: continuous
   Positive: for values $x < 0$
   Negative: for values of $x > 0$
   Decreasing: for all values of x
   End Behavior: As $x \to \infty$, $f(x) \to -\infty$ and as $x \to -\infty$, $f(x) \to \infty$.

2. *x*-intercept: (5, 0)
   y-intercept: (0, 2)
   Linearity: linear
   Continuity: continuous
   Positive: for values $x < 5$
   Decreasing: for all values of x
   End Behavior: As $x \to \infty$, $f(x) \to -\infty$ and as $x \to -\infty$, $f(x) \to \infty$.

3. *x*-intercept: (−3, 0) and (2, 0)
   y-intercept: (0, −4)
   Linearity: nonlinear
   Continuity: continuous
   Positive: for values $x < -3$ and $x > 2$
   Negative: for values of $-3 < x < 2$
   Increasing: for all values of $x > 0$
   Decreasing: for all values of $x < 0$
   Extrema: minimum at (0, −4)
   End Behavior: As $x \to \infty$, $f(x) \to \infty$ and as $x \to -\infty$, $f(x) \to \infty$.

4. *x*-intercept: (−2, 0) and (2, 0)
   y-intercept: (0, −1)
   Linearity: nonlinear
   Continuity: continuous
   Symmetry: symmetric about the line $x = 0$
   Positive: for values $x < -2$ and $x > 2$
   Negative: for values of $-2 < x < 2$
   Increasing: for all values of $x > 0$
   Decreasing: for all values of $x < 0$
   Extrema: minimum at (0, −1)
   End Behavior: As $x \to -\infty$, $f(x) \to \infty$ and as $x \to \infty$, $f(x) \to \infty$.
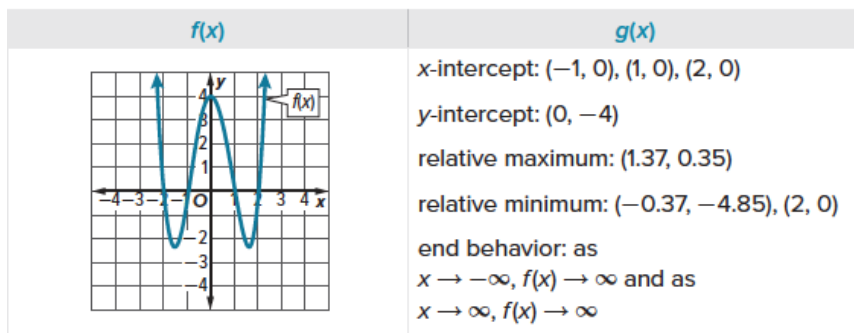
Example 3

5. **SCOOTERS** Greg rides his motorized scooter for 20 minutes. Greg starts riding at 0 mph. Greg's maximum speed is 35 mph, which he reaches 5 minutes after he starts riding. Greg's speed increases steadily for 5 minutes. At the 10-minute mark, Greg decreases his speed for 2.5 minutes, then he stays at 20 mph for 5 minutes. At the 17.5-minute mark, he again decreases his speed for 2.5 minutes until he stops. Use the key features to sketch a graph.

Examples 4 and 5

6. Compare the key features of the functions represented with a graph and a verbal description.

f(x)	g(x)
	x-intercept: (−2, 0) y-intercept: (0, −2) slope: −1

7.Compare the key features of the functions represented with a graph and a verbal description.

f(x)	g(x)
	x-intercept: (−1, 0), (1, 0), (2, 0) y-intercept: (0, −4) relative maximum: (1.37, 0.35) relative minimum: (−0.37, −4.85), (2, 0) end behavior: as $x \to -\infty$, $f(x) \to \infty$ and as $x \to \infty$, $f(x) \to \infty$

8. Compare the key features of the functions represented with a graph and a table.

f(x)	g(x)	
	x	**f(x)**
	−1	7
	−0.56	0
	0	−3
	1.89	0
	2	1
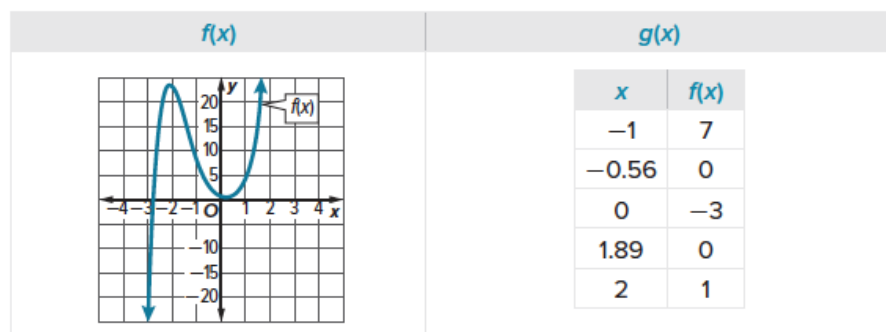
MIXED EXERCISES

9. USE A MODEL Sketch the graph of a linear graph with the following key features. The x-intercept is 2. The y-intercept is 2. The function is decreasing for all values of x. The function is positive for x < 2. As $x \to -\infty$, $f(x) \to \infty$ and as $x \to \infty$, $f(x) \to -\infty$.

10. USE TOOLS Monica walks for 60 minutes. She starts walking from her house. The maximum distance Monica is from her house is 2 miles, which she reaches 30 minutes after she starts walking. At the 30-minute mark, Monica starts waking back to her house for 30 minutes until she reaches her house. Use the key features to sketch a graph.

11. **SKI LIFT** A ski lift descends at a steady pace down a mountainside from a height of 1800 feet to ground level. If it makes no stops along the way to load or unload passengers, then the time it takes to complete its descension is 4 minutes.

   a. Is the graph that relates the lift's height as a function of time linear or nonlinear? Explain.

   b. Use the key features to sketch a graph.

12. **CREATE** Choose a function and create a list key features to describe the function. Then sketch the function.

13. **WRITE** Describe the relationship between the slope of a linear function and when the function is increasing or decreasing.

14. **ANALYZE** Determine whether the statement is *always*, *sometimes*, or *never* true.
*A graph that has more than one x-intercept is represented by a nonlinear function.*

15. **PERSEVERE** Deborah filled an empty tub with water for 30 minutes. The maximum amount of water in the tub is 50 gallons, which is reached 10 minutes after Deborah starts filling the tub. The amount of water in the tub increases steadily for 10 minutes. At the 10-minute mark, the amount of water in the tub starts decreasing for 20 minutes until there is no water left in the tub.

   a. Use the key features to sketch a graph.

   b. Describe an event that could have occurred at the 10-minute mark if Deborah continues filling the tub at the same rate from the 10-minute mark to the 30-minute mark as the rate from the 0-minute mark to the 10-minute mark.

16. **FIND THE ERROR** Linda and Rubio sketched a graph with the following key features. The *x*-intercept is 2. The *y*-intercept is −9. The function is positive for $x > 2$. As $x \to -\infty$, $f(x) \to -\infty$ and as $x \to \infty$, $f(x) \to \infty$. Is either graph correct based on the key features? Explain your reasoning.

Linda's Graph
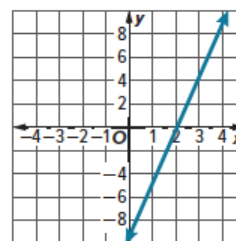
Rubio's Graph
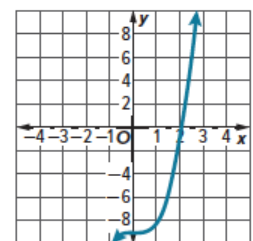
Graphing Linear Functions and Inequalities · Form C

Mixed Exercises

Graph each equation or inequality.

1. $x + y = 1$

2. $x + 2y > 6$

3. $y + 3 = 0$

4. $x + y = 3$

5. $4x + 3y = 12$

6. $-\frac{1}{2}x + y = -2$

7. $y = -2x + 3$

8. $2y + 3 \leq 11$

9. $6x + 4y \leq -24$

10. **REASONING** Name the *x*- and *y*-intercept for the linear equation given by $6x - 2y = 12$. Use the intercepts to graph the equation and describe the graph as *increasing*, *decreasing*, or *constant*.

11. **COMPUTERS** A school system is buying new computers. They will buy desktop computers costing $1000 per unit, and notebook computers costing $1200 per unit. The total cost of the computers cannot exceed $80,000.
  a. Write an inequality that describes this situation.
  b. Graph the inequality.
  c. If the school wants to buy 50 desktop computers and 25 notebook computers, will they have enough money? Explain.

12. **FUNDRAISING** The school drama club is putting on a play to raise money. Suppose it will cost $400 to put on the play and that 300 students and 150 adults will attend.
  a. Write an equation to represent the situation if the club wants to raise $1400.
  b. Graph your equation. Then determine four possible prices that could be charged for student and adult tickets to earn $1400 in profit.

13. SPIRITWEAR A company makes long-sleeved and short-sleeved shirts. The profit on a long-sleeved shirt is $7 and the profit on a short-sleeved shirt is $4. How many shirts must the company sell to make a profit of at least $280?

   a. Write and graph a linear inequality to describe this situation.

   b. Write two possible solutions to the problem.

   c. Which values are reasonable for the domain and for the range? Explain.

   d. The point (−10, 90) is in the shaded region. Is it a solution of the problem? Explain your reasoning.

14. FIND THE ERROR Paulo and Janette are graphing $x - y \geq 2$. Is either of them correct? Explain your reasoning.

Paulo

Janette
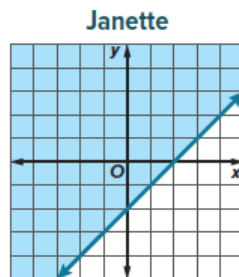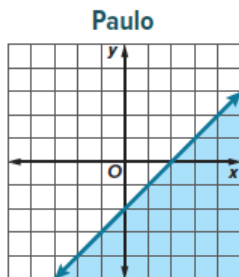
15. WRITE You can graph a line by making a table, using the x- and y-intercepts, or by using m and b. Which method do you prefer? Explain your reasoning.

16. PERSEVERE Write an equation of the line that has the same slope as $2x - 8y = 7$ and the same y-intercept as $4x + 3y = 15$.