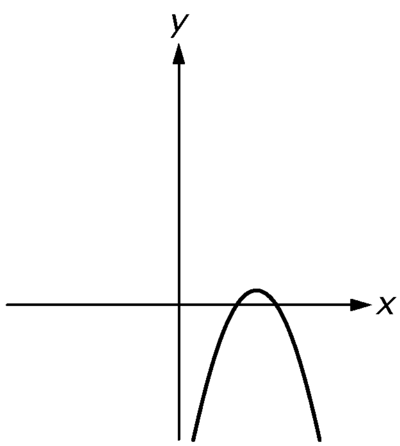
Name ________________________ Period ______ Date ____________

Algebra 1 Unit 4 Model Curriculum Assessment

1. The quadratic function f can be written as $f(x) = -(x + a)(x - b)$, where a and b are positive numbers and $a < b$. Which of the following could be the graph of f in the coordinate plane?

a.



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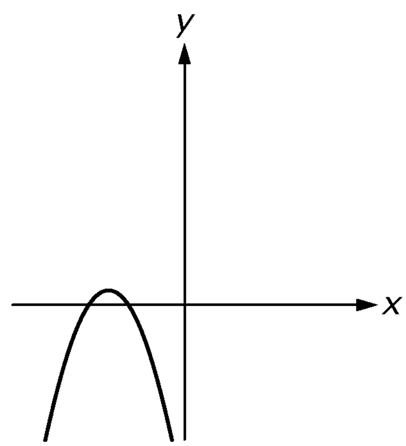

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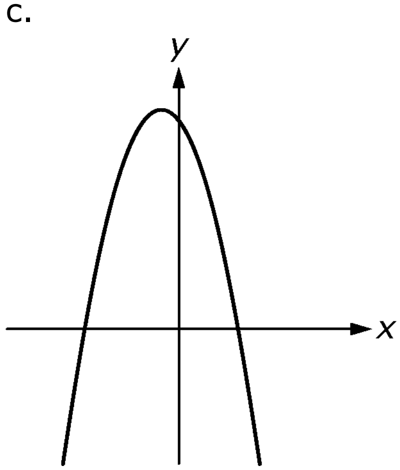

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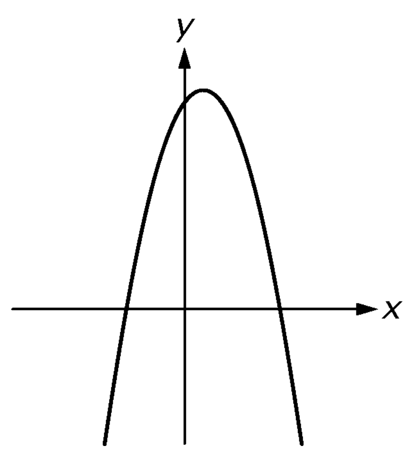
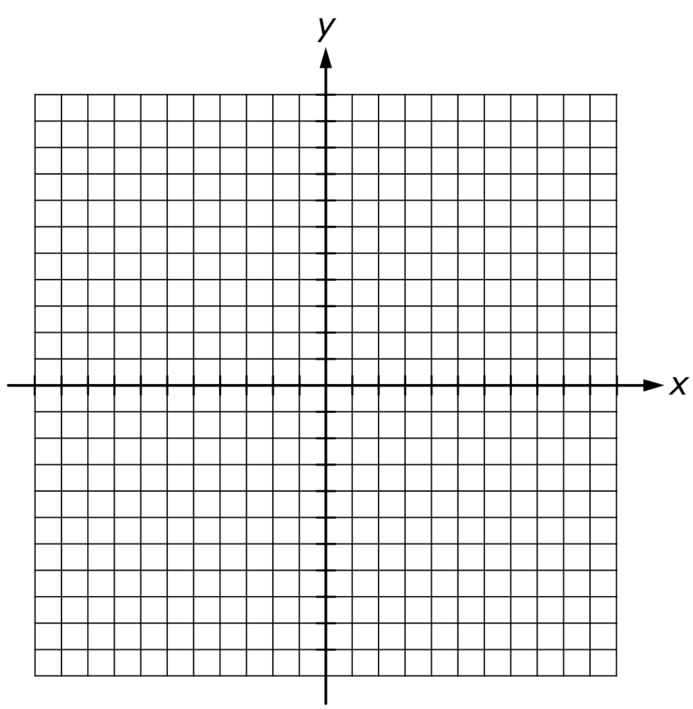


2. What are the x- and y-intercepts of the graph in the coordinate plane of the polynomial function $y = x(2x-3)(4x+1)$?

3. Use the function $g(x) = x^2 + 8x + 16$ to answer the following questions.

Part A: What are the zeros of the function?

Part B: Using your answer from Part A, sketch a graph of the function on the coordinate plane below. Provide an appropriate scale on the axes.



4. If $\left(9^{\frac{1}{5}}\right)^{x} = 9,$ what is the value of x ? Explain your reasoning.

5. When the nth root of a positive number a is written as a^{x}, what is the value of x ? Show your work.

6. Which of the following is equivalent to $a^{\frac{1}{3}}b^{\frac{5}{6}}$?

   a. $\sqrt{a^3b^6}$

   b. $\sqrt{ab^5}$

   c. $\sqrt[6]{a^2b^5}$

   d. $\sqrt[6]{ab^5}$

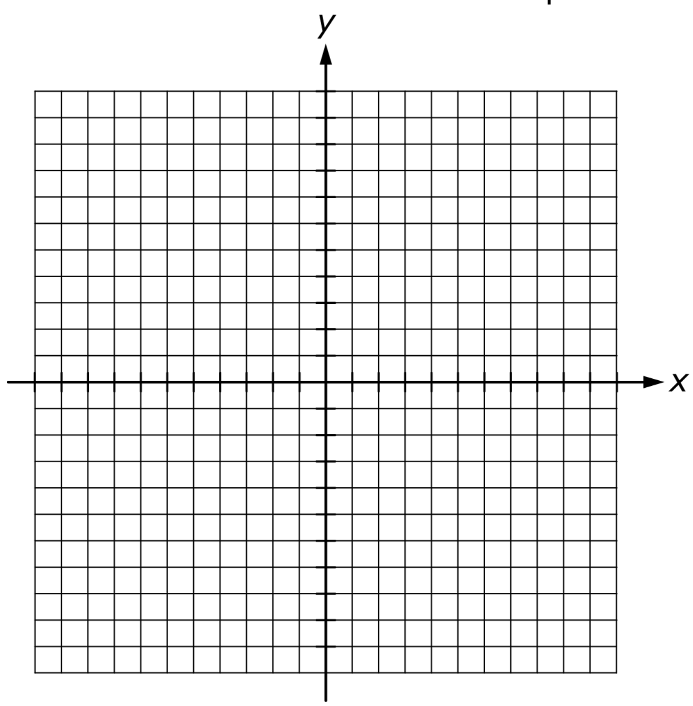
7. If s and t are two rational numbers, are $s+t$ and $s-t$ rational or irrational? Explain your reasoning.

8. If a is a nonzero rational number and b is an irrational number, identify whether each of the expressions in the table must be rational, must be irrational, or could be either rational or irrational by placing a check in the appropriate cells.

	Must Be Rational	Must Be Irrational	Could Be Either Rational or Irrational
ab			
$\frac{a}{b}$			
$a+b$			
$a-b$			

9. Mr. Barnes hired a plumber to fix a leak. The total cost, in dollars, that the plumber charges for a job can be modeled by the function $p(x) = 45 + 35x$, where x represents the time, in hours, that the plumber used to complete the job.

Part A: Graph $p(x)$ for $x \geq 0$ on the coordinate plane below.

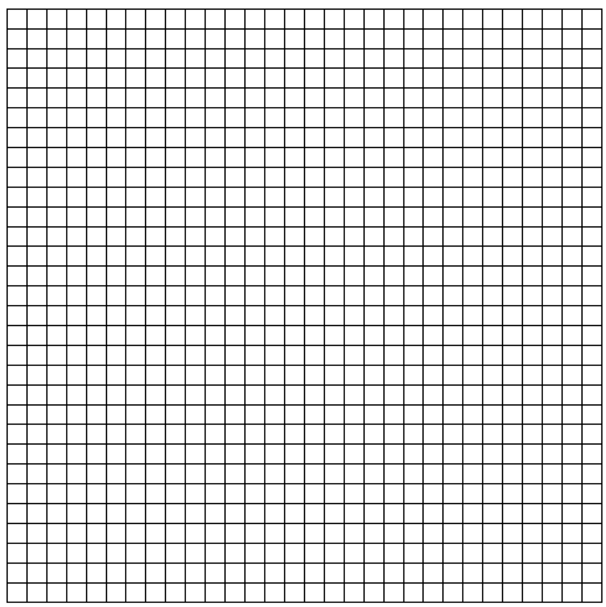


Part B: If Mr. Barnes budgeted $200 to pay the plumber for the job, at what time will the cost of the job exceed Mr. Barnes's budget?

10. In a city, the residential electricity consumption rate, c, in hundreds of kilowatts, during a certain 24-hour period that starts at midnight and ends the next day at midnight, is a function of the number of hours t since midnight. The consumption rate can be modeled by the function $c(t) = t^2 - 20t + 115$.

Part A: What domain makes sense for the function in this context?

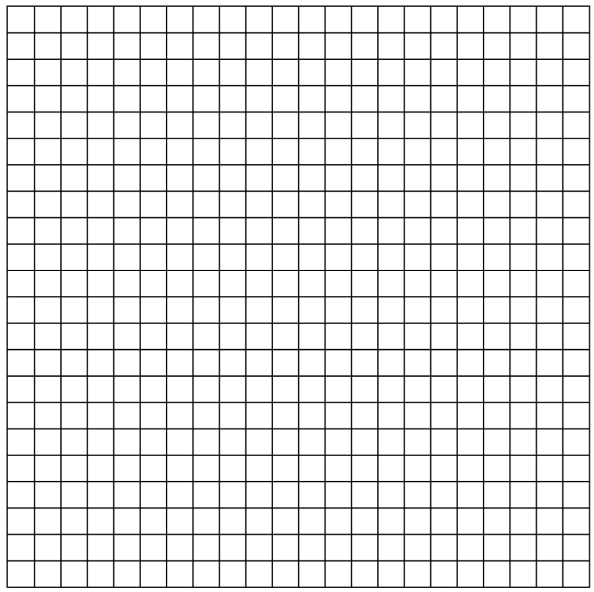
Part B: Use the domain from Part A to sketch a graph of the function. Be sure to include labels and scales on the graph.



Part C: At what time during the 24-hour period was the residential electricity consumption the least?

11. On a windy morning, a hot air balloon starts ascending and flying away from the top of a hill. The altitude, h, in feet, of the balloon x hours after starting its ascent from the hill can be modeled by the function $h(x) = -16x^2 + 64x + 80$.

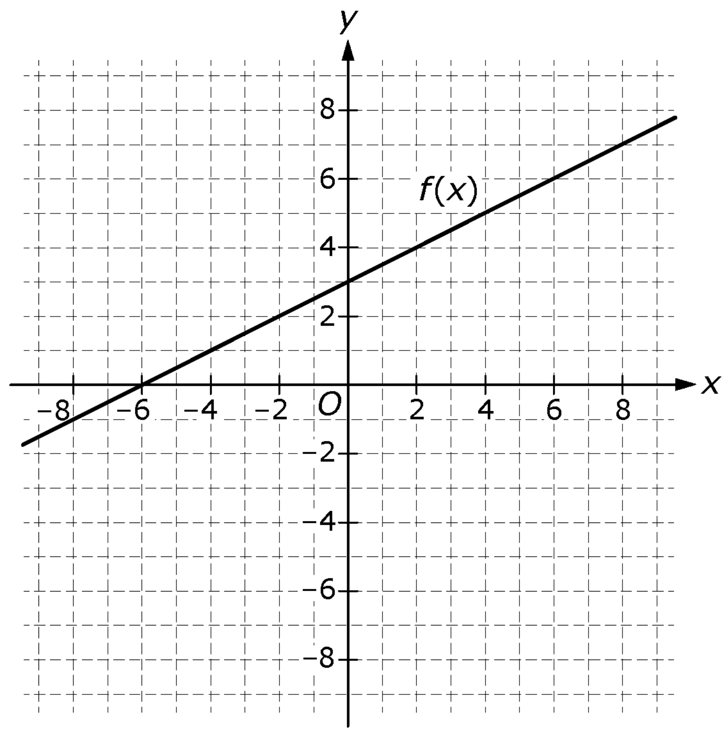
Part A: Sketch a graph of the function. Provide scales and units on the axes.



Part B: Identify the x- and y-intercepts and explain their meaning in context.

Part C: When does the balloon reach its maximum altitude, and what is the maximum altitude obtained?

12.



The graph of the linear function $f(x)$ is shown in the coordinate plane above. The function g is defined by $g(x) = \frac{2}{5}x + 4.$ Indicate the relationship between each pair of quantities in the table below by placing >, <, or = in the middle column.

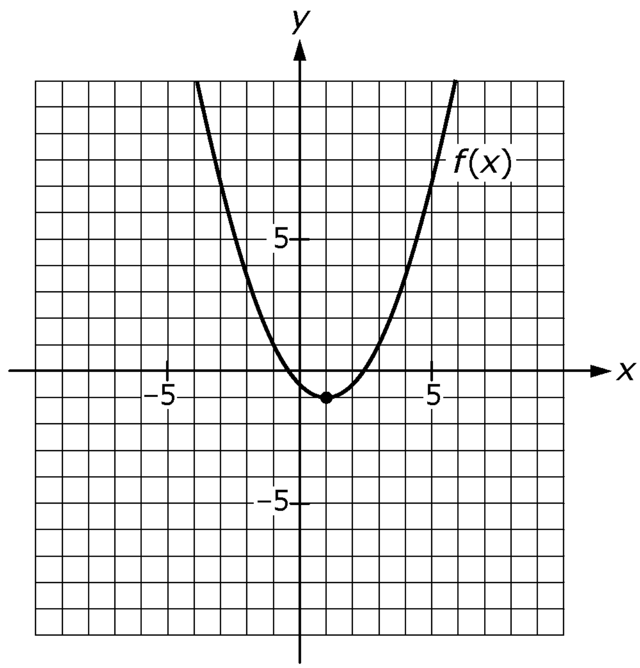
First Quantity	>, <, or =	Second Quantity
Slope of $f(x)$		Slope of $g(x)$
y-intercept of $f(x)$		y-intercept of $g(x)$
x-intercept of $f(x)$		x-intercept of $g(x)$
$f(10)$		$g(10)$
$f(20)$		$g(20)$

13.

x	0	1	2	3	4	5	6	7	8	9	10
$f(x)$	80	103	122	137	148	155	158	157	152	143	130

A table of values for the quadratic function f is shown above. The function g is defined by $g(x) = -4x^2 + 48x + 10$. Which function has the greater maximum value? Show your work.

14.



The graph of a parabola f is shown above. The function g is defined by $g(x) = (x - 1)^2 - 3$.

Part A: Which function has the smaller minimum? What is its value?

Part B: Is the leading coefficient of the function f greater than 1, equal to 1, greater than 0 but less than 1, or less than 0 ? Explain your answer.

15.

Year	United States Population, in Millions
1910	92.40
1920	106.46
1930	123.07
1940	132.12
1950	152.27
1960	180.67
1970	205.05
1980	227.22
1990	249.43
2000	282.16
2010	309.33

The table above shows the population, in millions, of the United States in ten-year intervals from 1910 to 2010. Calculate the average rate of change, in millions of people per year, of the population of the United States for each of the following time intervals.

1910–1960: _______________

1960–2010: _______________

Interpret what these numbers mean in the context of the problem.

16. The circumference, C, of a circle with radius r is given by the equation $C = 2\pi r$. The area, A, of a circle with radius r is given by the equation $A = \pi r^2$.

Part A: If the radius of a circle is increased from 2 feet to 4 feet, calculate the average rate of change of the circumference and the area.

Average rate of change of circumference:
______ feet of circumference per foot of radius

Average rate of change of area:
______ square feet of area per foot of radius

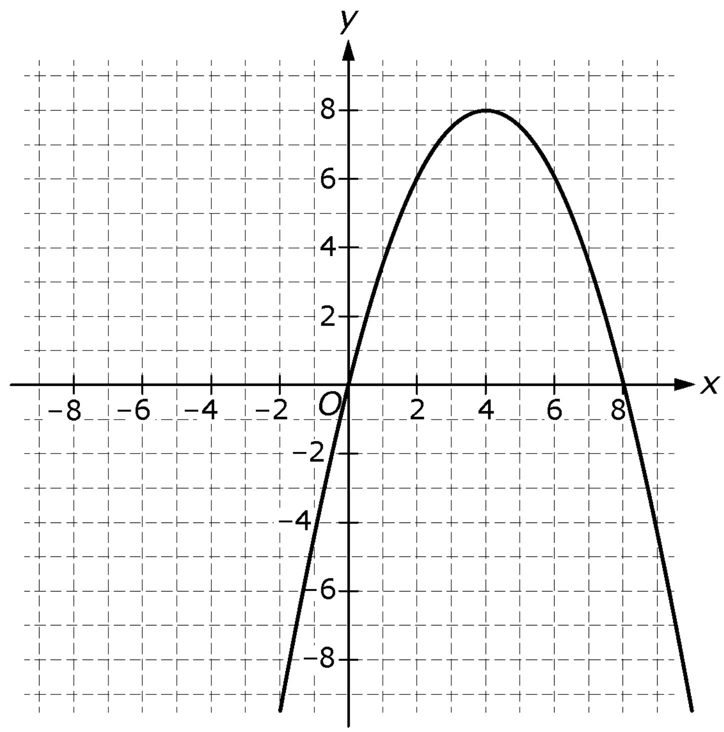
Part B: If the radius of the circle is increased from 4 feet to 6 feet, calculate the average rate of change of the circumference and the area.

Average rate of change of circumference:
______ feet of circumference per foot of radius

Average rate of change of area:
______ square feet of area per foot of radius

Part C: Compare the average rates of change of circumference that you found in Parts A and B. Compare the average rates of change of area that you found in Parts A and B. How are the comparisons related to the circumference and area equations? Explain.

17.



The graph of the quadratic function f is shown in the coordinate plane above. Estimate the average rate of change of f over each of the following intervals, and then place the intervals in order from greatest average rate of change to least average rate of change.

A	B	C	D	E
$0 \le x \le 2$	$0 \le x \le 4$	$0 \le x \le 7$	$1 \le x \le 7$	$2 \le x \le 4$

______	______	______	______	______
Greatest average rate of change				Least average rate of change

18. Write the function $f(x) = x^2 - 4x - 7$ in vertex form. Show your work.

19. Write the function $g(x) = 2x^2 + 7x - 15$ as the product of linear factors.

20. Write the function $h(x) = -5(x - 1)^2 + 3$ in standard form. Show your work.

21. Cindy is baking cakes to raise money for her track team. The total cost of all of the ingredients for her cakes is $50. She will sell each cake for $12. Write an equation that describes the relationship between the number of cakes Cindy sells and the amount of money raised for her track team. Be sure to define any variables used.

22.

$$y = 3x + 5$$

Which of the following scenarios could be described by the equation above?

a. The distance of a tortoise from the starting line in a race, if the tortoise started 5 miles ahead of the starting line and moved at a pace of 3 miles per hour.

b. The amount of money Miranda has, if for every $5 Miranda earns, she gives $3 to her mother.

c. The number of cards Larry has, if he had 3 collector cards and he adds 5 more cards to his collection every 3 days.

d. The number of points earned on a test, if each question is worth 5 points and Mr. Felder subtracted 3 points for every incorrect answer.

23.

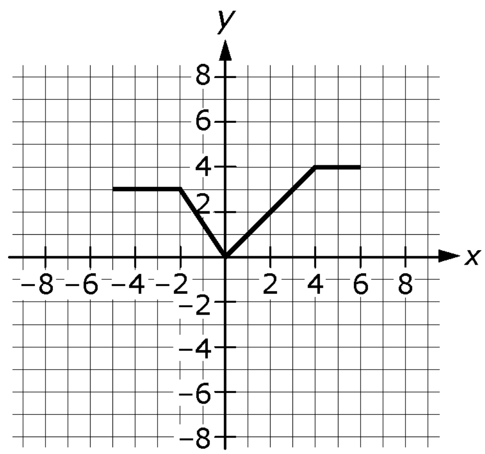
The figure above represents a television screen with a picture-in-picture functionality that displays two channels at the same time on the same screen, with one channel displayed in a smaller rectangle in the top right corner. The length of the television screen is $\frac{16}{9}$ times the width.

Part A: Write a function, $f(w)$, that represents the area, in square inches, of the television screen with a width of w inches.

Part B: The length of the smaller rectangle is $\frac{1}{4}$ the length of the television screen, and the width is $\frac{1}{3}$ the width of the television screen. Write a function, $g(w)$, that represents the area, in square inches, of the smaller rectangle for a television screen with a width of w inches.

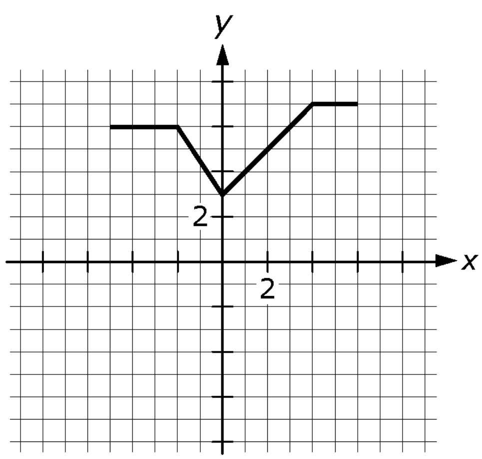
Part C: The area of the smaller rectangle is what percent of the area of the television screen?

24.



The graph of the function $f(x)$ is shown in the coordinate plane above. Which of the following is the graph of $f(x+3)$?

a.



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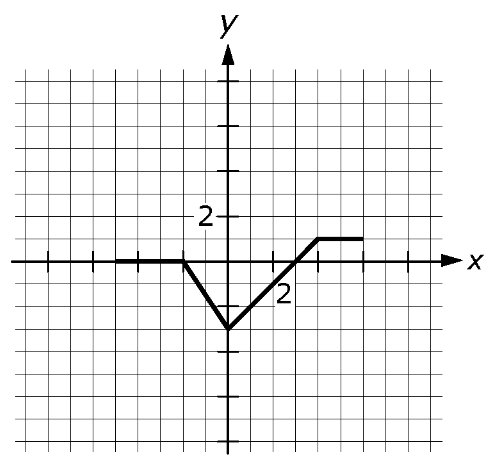
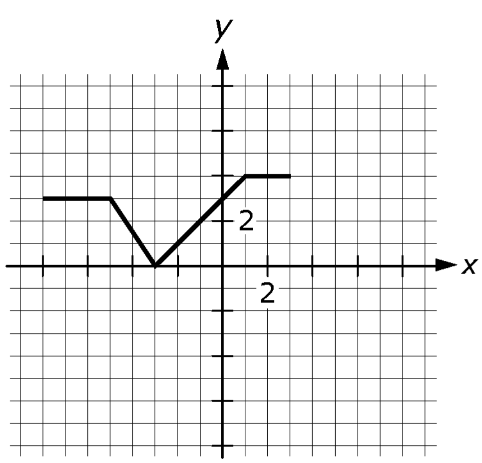
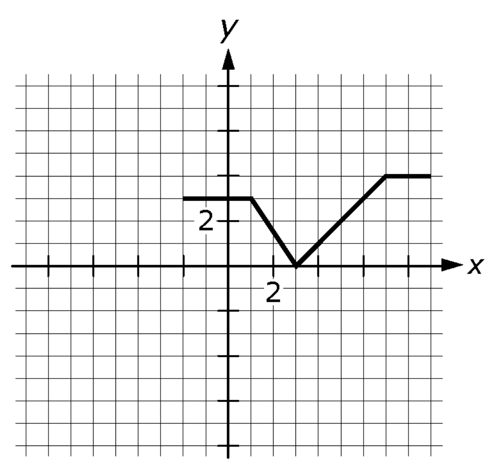


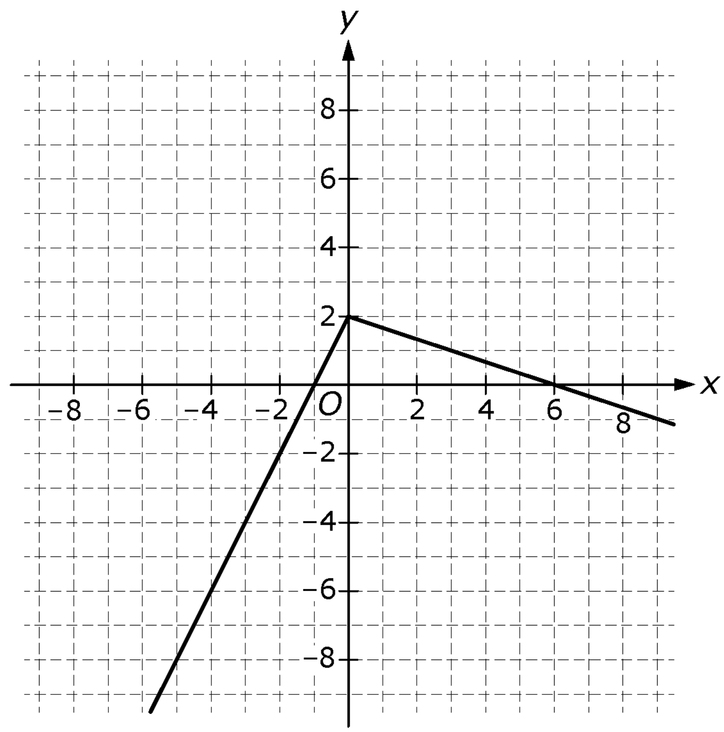
c.



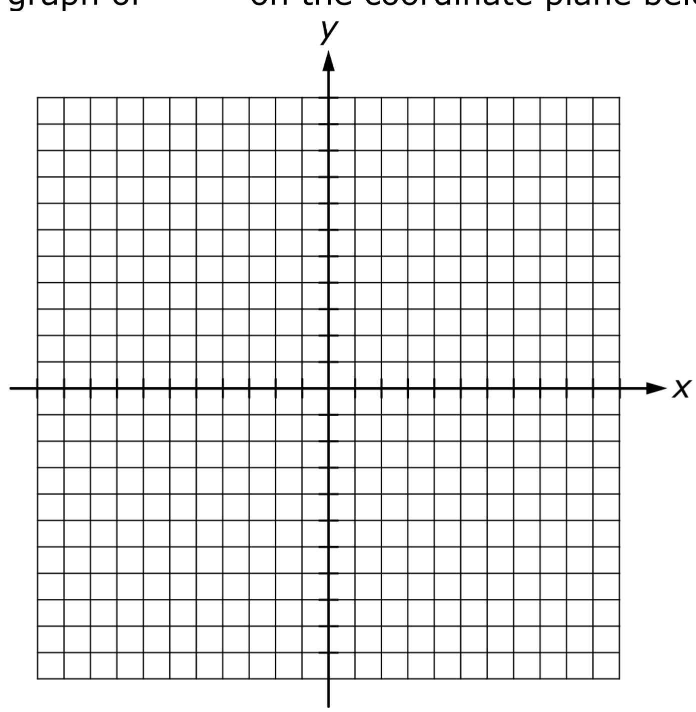
d.



25.



The graph of the function $f(x)$ is shown in the coordinate plane above. Sketch the graph of $f(3x)$ on the coordinate plane below.



26. Describe how the graph in the coordinate plane of each of the following functions differs from the graph of $f(x)$. Indicate whether the graph represents a horizontal or vertical shift, a vertical stretch or shrink, or a horizontal stretch or shrink. Be sure to give the direction and number of units of the shift or the scale factor of the stretch or shrink.

$f(x)+5$ ______________________________

$f(x-5)$ ______________________________

$f(5x)$ ______________________________

$5f(x)$ ______________________________

$f(\frac{1}{5}x)$ ______________________________

$\frac{1}{5}f(x)$ ______________________________

27. Marquise won the grand prize in a sweepstakes. He could choose to have his prize paid by either payment plan A or payment plan B.

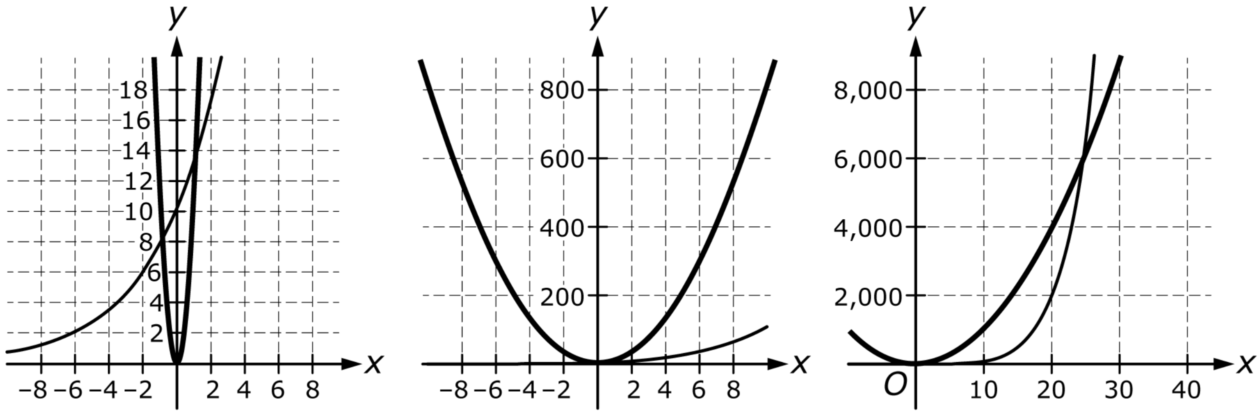
- Payment plan A—The total amount awarded in the first year is \$500,000. The total amount awarded up through any year after the first will be \$250,000 plus the total amount from the preceding year. That means that the total amount awarded up to year n is given by the formula $\$250,000 + \$250,000n$.

- Payment plan B—The total amount awarded in the first year is \$50,000. The total amount awarded up through any year after the first will be double the total amount from the preceding year. That means that the total amount awarded up to year n is given by the formula $\$50,000 \times 2^{n-1}$.

Complete the table below and determine which of the payment plans will result in the greater total amount of payment after 8 years.

Year	Total Amount Awarded by Payment Plan A	Total Amount Awarded by Payment Plan B
1	\$500,000	\$50,000
2		
3		
4		
5		
6		
7		
8		

28.



The graphs in the coordinate plane of the quadratic function $f(x) = 10x^2$ and the exponential function $g(x) = 10(1.3)^x$ are shown above in three different viewing windows. Analyze the graphs and describe how the values of the two functions compare as the values of x start at 0 and then increase.

29. From 1990 to 2010, the populations, in thousands, of city A and of city B can be modeled by the functions $A(t) = 275 \times (1.06)^t$ and $B(t) = 300(1 + 0.03t)^2$, respectively, where t is the number of years since 1990.

Part A: Compare the populations of the two cities in 1990, 1995, 2000, 2005, and 2010.

Year	t	Populations (rounded to the nearest thousand)	
		City A	City B
1990	0		
1995			
2000			
2005			
2010			

Part B: Use your results from Part A to compare the growth rates of the populations in the two cities from 1990 to 2010.