Name ____ Date ____________________

Functional Function: *F* of *x* It Is!
Functional Notation

Vocabulary

Provide an example of each term.

1. functional notation

2. evaluate a function

Problem Set

Determine the independent and dependent variables in each situation.

1. The equation $t = 20g + 5$ represents the time, *t,* that it takes to bowl *g* games.

***g* is the independent variable, and *t* is the dependent variable.**

2. The equation $c = 12d + 8$ represents the cost, *c,* when buying *d* DVDs.

3. The equation $c = 0.44s$ represents the cost, *c,* in dollars when purchasing *s* postage stamps.

4. The equation $t = 10p + 4$ represents the time, *t,* that it takes to paint *p* fence posts.

5. The equation $g = 20m + 50$ represents the cost, *g,* in dollars of paying for *m* gym memberships.

6. The equation $m = 60h$ represents the number of revolutions, m, the minute hand of a clock makes in h hours.

Evaluate each function at the given value. Then explain what it means in terms of the problem.

7. The function $f(d) = 2d + 5$ represents the number of song downloads a person can get for d dollars. What is $f(4)$?

   $f(4) = 2(4) + 5 = 8 + 5 = 13$

   For $4, one can get 13 downloads.

2

8. The function $f(p) = 2p + 3$ represents the amount of time in minutes it takes to wash p pots. What is $f(10)$?

9. The function $f(t) = 15t + 5$ represents the amount of time in minutes it takes to write t thank-you notes. What is $f(6)$?

10. The function $f(b) = 12b + 750$ represents the cost in dollars for printing b books with a publish-on-demand service. What is $f(100)$?

Determine the value that makes each equation true. Then explain what it means in terms of the problem.

11. The function $f(b) = 15b + 250$ represents the cost in dollars of having b books printed by a publish-on-demand book publishing company. What is the value of b such that $f(b) = 1000$?

$$f(b) = 1000 = 15b + 250$$
$$1000 - 250 = 15b + 250 - 250$$
$$750 = 15b$$
$$50 = b$$

   For $1000, one can get 50 books printed.

Name ______________________ Date ____________

12. The function $f(d) = d + 10$ represents the number of downloads that a person can get for d dollars. What is the value of d such that $f(d) = 50$?

13. The function $f(w) = 9w + 12$ represents the amount of time in minutes it takes a person to wash w windows. What is the value of w such that $f(w) = 75$?

2

14. The function $f(d) = \frac{9}{5}d + 32$ represents the temperature in Fahrenheit when it is d degrees in Celsius. What is the value of d such that $f(d) = 86$?

Evaluate each function for the given value.

15. If $f(x) = 3x + 5$, evaluate $f(5)$.

$f(5) = 3(5) + 5 = 15 + 5 = 20$

16. If $f(t) = 4 - 5t$, evaluate $f(2)$.

17. If $f(x) = 2x - 7$, evaluate $f(3.5)$.

18. If $f(t) = 9 - 1.5t$, evaluate $f(2.8)$.

Write a function to model each situation.

19. It takes one hour to set up a car wash and one half-hour to wash each car after everything is set up. Write a function that describes the number of hours, *w,* it takes to wash *c* cars, including setup time.

$w(c) = \frac{1}{2}c + 1$

2

20. A movie rental club charges a one-time membership fee of $25. Movies cost $2 each to rent. Write a function that describes the cost, *c* in dollars, of renting *m* movies.

21. Lucy is 200 miles from her home and drives at a rate of 50 miles per hour towards her home. Write a function that describes the distance, *d* miles, she is from home after *h* hours of driving.

22. You go to a carnival with $100. It costs you $5 for each ride. Write a function for the amount of money you have left, *m,* after riding *r* rides.

Name ______________________ Date ______________

Use each table to evaluate the function at the given value. Then explain what it means in terms of the problem.

23. The function $s(g)$ represents the number of students who received a score of g on a quiz. What is $s(80)$?

Grade on Quiz	Number of Students
0	0
10	1
20	0
30	0
40	2
50	1
60	5
70	7
80	12
90	9
100	3

$s(80) = 12$

Twelve students received a grade of 80 on the quiz.

2

24. The function $r(w)$ represents the amount of rain in inches that has fallen in the first w weeks of the year. What is $r(28)$?

Number of Weeks into the Year	Cumulative Rainfall (inches)
1	0
2	0.5
4	2
8	7
12	11
16	19
20	25.5
26	33
30	37
36	48.5
40	56.5
52	68

Name ______________________________ Date ______________

25. The function $h(w)$ represents the height in inches of a tomato plant w weeks after it was planted. What is $r(7)$?

Number of Weeks After Planting	Height (inches)
1	8
2	12
3	15
4	19
6	23
8	25
10	27
12	29
14	30
16	31
18	33
20	34

26. The function *s*(*h*) represents the number of students in the first grade class who are *h* inches tall. What is *s*(49)?

Height (inches)	Number of Students
43	1
44	0
45	3
46	2
47	5
48	7
49	4
50	5
51	2
52	4
53	1

2

Name ______________________ Date ____________

Use the given information to complete parts (a) and (b) for each question.

27. The function $r(w)$ represents the average cumulative rainfall in inches in a town after w weeks. Use the table to determine the value that makes each equation true. Then explain what it means in terms of the problem.

Number of Weeks	Cumulative Rainfall (inches)
4	2
8	6
12	11
16	17
20	24
24	30
28	36
32	41
36	45
40	51
44	55
48	57
52	60

a. $r(w) = 11$

$w = 12$. The average rainfall after the first 12 weeks is 11 inches.

b. $r(w) = 51$

$w = 40$. The average rainfall after 40 weeks is 51 inches.

28. The function $h(w)$ represents the average height in inches of a corn plant w weeks after it has been planted. Use the table to determine the value that makes each equation true. Then explain what it means in terms of the problem.

Number of Weeks After Planting	Height (inches)
1	0
2	2
3	7
4	15
5	24
6	32
7	39
8	46
9	52
10	58
11	63
12	69
13	74

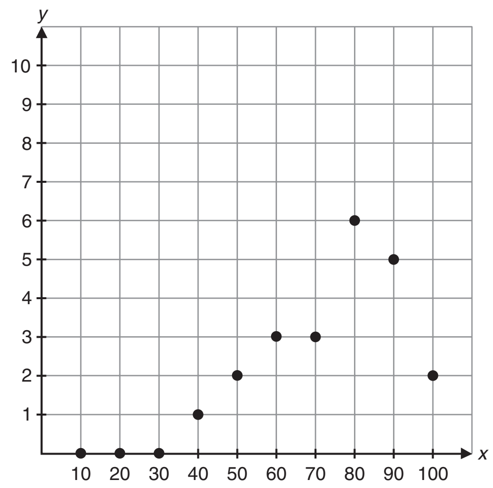
a. $h(w) = 32$

b. $r(w) = 52$

2

Name ______________________ Date ______________

29. The function $N(g)$ represents the number of students in a class who received the grade g. Use the graph to evaluate each function. Then explain what it means in terms of the problem.

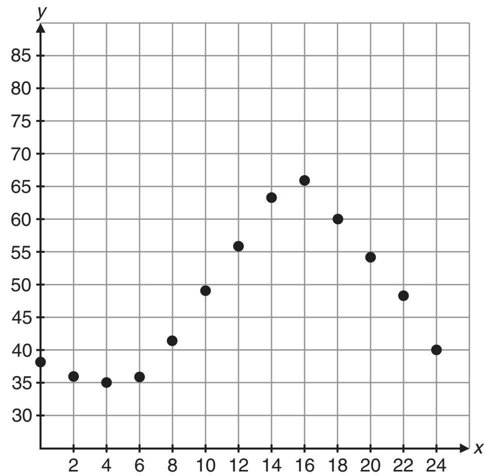


a. What is $N(80)$?

b. What is $N(20)$?

2

30. The function $T(h)$ represents the temperature in degrees Fahrenheit at h hours past midnight. Use the graph to evaluate each function. Then explain what it means in terms of the problem.

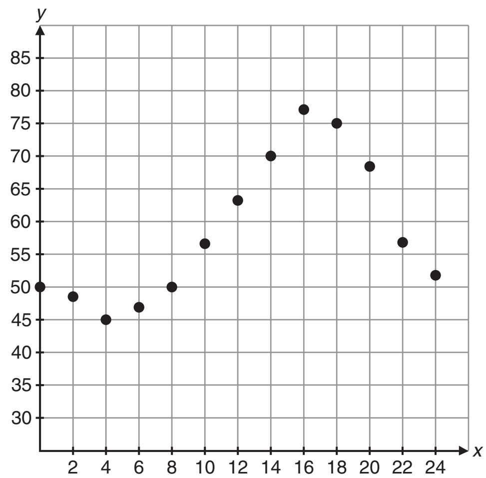


a. What is $T(4)$?

b. What is $T(16)$?

Name ________________________________ Date ______________

31. The function $T(h)$ represents the temperature at h hours past midnight. Use the graph to determine the value that makes each equation true. Then explain what it means in terms of the problem.

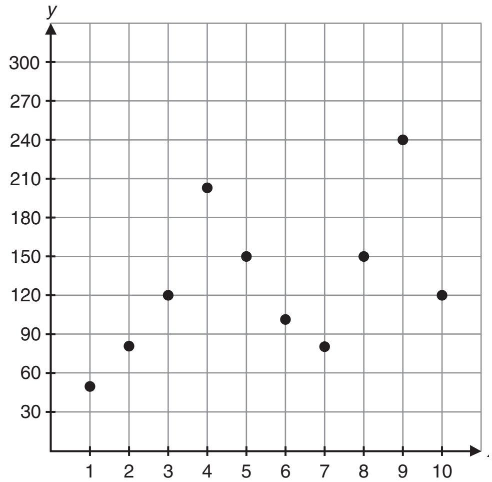


a. $T(h) = 50$

b. $T(h) = 77$

2

32. The function *S*(*h*) represents the amount of merchandise in dollars that a shop sells for each hour that the shop is open during the day. Use the graph to determine the value that makes each equation true. Then explain what it means in terms of the problem.



a. $S(h) = 240$

b. $S(h) = 150$

2

Name ______________________________ Date __________________

Numbers in a Row!
Introduction to Sequences

Vocabulary

Explain how each pair of terms is related by identifying similarities and differences.

1. mathematical sequence and term

2. finite sequence and infinite sequence

3. general term formula and recursive formula

Problem Set

Determine the next two terms of each sequence and describe the sequence in words.

1. 1, 3, 9, 27, . . .

The next two terms are 81 and 243. The sequence is formed by starting at 1 and multiplying by 3 at each step.

2. $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \ldots$

2

3. 3, 5, 7, 9, . . .

4. 16, 7, −2, −11, . . .

Determine the first eight terms of each sequence described.

5. The sequence of the counting numbers divided by two.

$\frac{1}{2}, 1, \frac{3}{2}, 2, \frac{5}{2}, 3, \frac{7}{2}, 4$

6. The sequence of the counting numbers multiplied by 3.

7. The sequence made by squaring each counting number and then subtracting the number from its square.

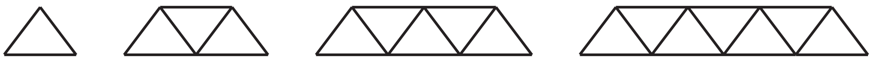
8. The sequence made by squaring each counting number and then adding 2.

Name ______________________________ Date ________________

Each pattern represents a sequence of numbers. Draw the next two figures in the sequence and write the terms of the sequence represented by each pattern.

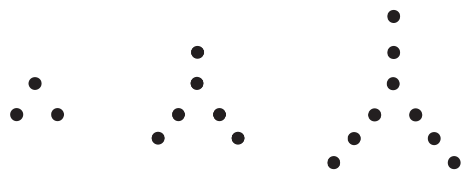
9. 

The numbers in the sequence are 2, 4, 6, 8, 10, 12, … .

10. 

11. 

12.



2

Write a function whose domain is the set of counting numbers to represent each sequence.

13. 1, 4, 9, 16, 25, 36, 49, …

$f(n) = n^2$

14. −1, 0, 1, 2, 3, 4, 5, …

15. 1, 3, 5, 7, 9, 11, 13, …

16. 0, 2, 6, 12, 20, 30, 42, 56, 72, 90, …

Use each explicit formula to write the first four terms and the tenth term of the sequence.

17. $a_n = 5n - 4$

1, 6, 11, 16, … , 46 (10th term), …

18. $a_n = n^2 + 3$

Name ____________________ Date ____________

19. $a_n = \frac{3}{n}$

20. $a_n = \frac{1}{4}(2^n)$

Write an explicit formula for each sequence.

21. 10, 15, 20, 25, . . .

$a_n = 5n + 5$

22. 3, 9, 27, 81, . . .

23. 0, 3, 8, 15, 24, . . .

24. $\frac{3}{2}, \frac{3}{4}, \frac{3}{8}, \frac{3}{16}$

2

Use each recursive formula to write the first four terms of the sequence.

25. $a = \frac{1}{8}, a_n = 2a_{n-1}$

$\frac{1}{8}, \frac{1}{4}, \frac{1}{2}, 1$

26. $a_1 = 5, a_n = 2a_{n-1} - 4$

27. $a_1 = 2, a_n = 3a_{n-1} + 1$

28. $a_1 = 16, a_n = \frac{1}{2}a_{n-1}$

Write a recursive formula for each sequence.

29. 5, 7, 9, 11, 13, 15, . . .

$a_1 = 5, a_n = a_{n-1} + 2$

30. 5, 7, 11, 19, 35, 67, . . .

31. 2, 1, −1, −5, −13, −29, . . .

32. 2, 3, 8, 63, 3968, 15,745,023, . . .

Name ______________________ Date ______________

Adding or Multiplying
Arithmetic and Geometric Sequences

Vocabulary

Define each term in your own words.

1. arithmetic sequence

2. geometric sequence

3. common ratio

4. common difference

Problem Set

Calculate the first four terms of each arithmetic sequence.

1. $a_n = 3n - 1$

   $a_1 = 2, a_2 = 5, a_3 = 8, a_4 = 11$

2. $a_1 = 4, a_n = a_{n-1} + 7$

3. $a_1 = 3, a_n = a_{n-1} - 1$

4. $a_n = 4n + 5$

Determine the initial term and the common difference for each arithmetic sequence.

5. 10, 15, 20, 25, 30, ...

The initial term is 10, and the common difference is 5.

2

6. 0, −2, −4, −6, −8, ...

7. 31, 17, 3, −11, −25, ...

8. $\frac{5}{2}, 5, \frac{15}{2}, 10, \frac{25}{2}, \ldots$

Write a recursive formula for each arithmetic sequence.

9. 4, 12, 20, 28, 36, ...

The initial term is 4, and the common difference is 8.

$\boldsymbol{a_1 = 4, a_n = a_{n-1} + 8}$

10. 10, 2, −6, −14, −22, ...

11. $\frac{15}{2}, 5, \frac{5}{2}, 0, -\frac{5}{2}, \ldots$

Name ______________________________ Date ______________

12. $\frac{1}{3}, 2, \frac{11}{3}, \frac{16}{3}, 7, \ldots$

Write a recursive formula and an explicit formula for each arithmetic sequence.

13. 7, 11, 15, 19, 23, . . .

Recursive: $a_1 = 7, a_n = a_{n-1} + 4$

Explicit: $a_n = 4n + 3$

14. 12, 7, 2, −3, −8, . . .

15. $\frac{17}{5}, 5, \frac{33}{5}, \frac{41}{5}, \frac{49}{5}, \ldots$

16. $\frac{7}{3}, 1, -\frac{1}{3}, -\frac{5}{3}, -3, \ldots$

Calculate the first four terms of each geometric sequence.

17. $a_n = 4 \cdot 3^{n-1}$

$a_1 = 4, a_2 = 12, a_3 = 36, a_4 = 108$

18. $a_1 = 3, a_n = 5a_{n-1}$

19. $a_1 = 5, a_n = 2a_{n-1} - 2$

20. $a_n = 5 \cdot 2^{n+1}$

Determine the initial term and the common ratio of each geometric sequence.

21. 10, 20, 40, 80, 160, ...

The initial term is 10, and the common ratio is 2.

22. 2, −4, 8, −16, 32, ...

23. $3, -1, \frac{1}{3}, -\frac{1}{9}, \frac{1}{27}, \ldots$

24. 100, 50, 25, 12.5, 6.25, ...

Write a recursive formula for each geometric sequence.

25. 4, −8, 16, −32, 64, ...

The initial term is 4, and the common ratio is −2.

$a_1 = 4, a_n = -2a_{n-1}$

26. $-\frac{1}{9}, -\frac{1}{3}, -1, -3, -9, \ldots$

27. $10, 5, \frac{5}{2}, \frac{5}{4}, \frac{5}{8}, \ldots$

28. $20, 4, \frac{4}{5}, \frac{4}{25}, \frac{4}{125}, \ldots$

Name ______________________ Date ____________

Write a recursive formula and an explicit formula for each geometric sequence.

29. $2, -6, 18, -54, 162, \ldots$

Recursive: $a_1 = 2, a_n = -3a_{n-1}$

Explicit: $a_n = 2(-3)^{n-1}$

30. $\frac{1}{16}, \frac{1}{2}, 4, 32, 256, \ldots$

31. $16, 4, 1, \frac{1}{4}, \frac{1}{16}, \ldots$

32. $30, -5, \frac{5}{6}, -\frac{5}{36}, \frac{5}{216}, \ldots$

Classify each sequence as arithmetic, geometric, or neither. If it is arithmetic or geometric, write an explicit formula for the sequence.

33. $128, 64, 32, 16, 8, \ldots$

The sequence is geometric. The explicit formula is $a_n = 128 \cdot \left(\frac{1}{2}\right)^{n-1}$.

34. $16, 27, 38, 49, 60, \ldots$

35. $4, 8, 12, 15, 18, \ldots$

36. $2, 6, 18, 54, 162, \ldots$

2

2

Name ______________________________ Date ________________

Home, Home on the Domains and Ranges
Domains and Ranges of Algebraic Functions

Vocabulary

Provide two examples of each term. The domains and the ranges for each example should be different.

1. domain

2. range

2

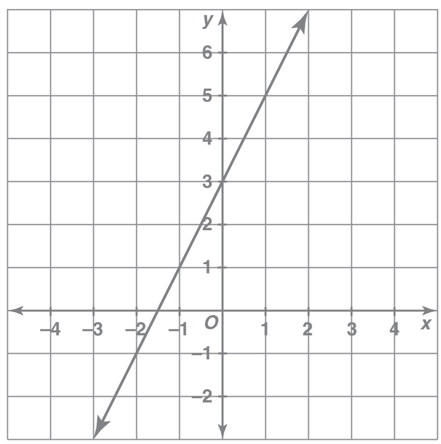
Problem Set

Graph each function. Then determine the domain and the range of the function.

1. $y = 2x + 3$

The domain is all real numbers.

The range is all real numbers.



2. $y = -x - 2$

3. $y = \frac{1}{2}x^2$

4. $y = 1 - x^2$

Name ______________________________ Date ______________

5. $y = 1 + \sqrt{x}$

6. $y = \sqrt{-x}$

7. $y = |x + 1|$

8. $y = 2 - |x|$

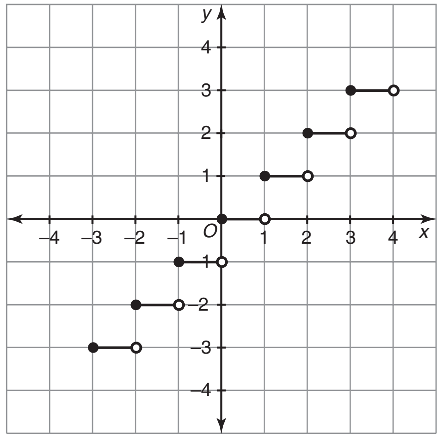
9. $y = 2$

10. $y = -3$

Name ______________________________ Date ________________

Determine the domain and the range of each function.

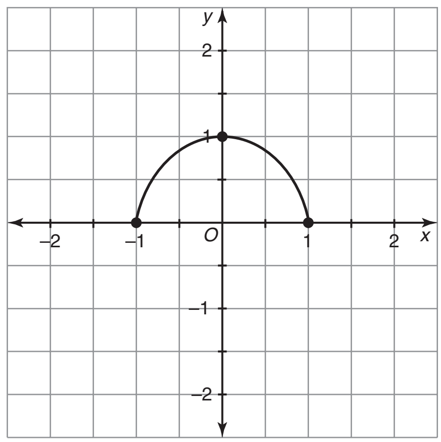
11. The greatest integer function, $f(x) = \overleftrightarrow{x}$, is defined to be the greatest integer less than or equal to x. It is sometimes called the step function. Its graph is shown.



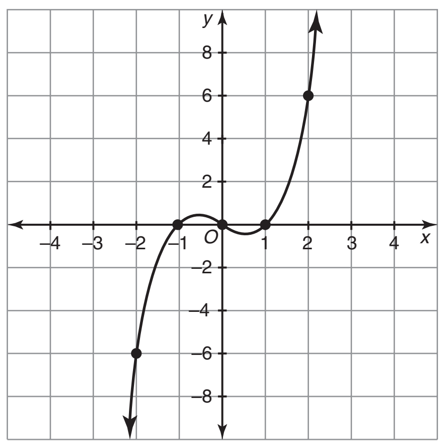
The domain is all real numbers.

The range is all integers, or all positive and negative counting numbers (including 0).

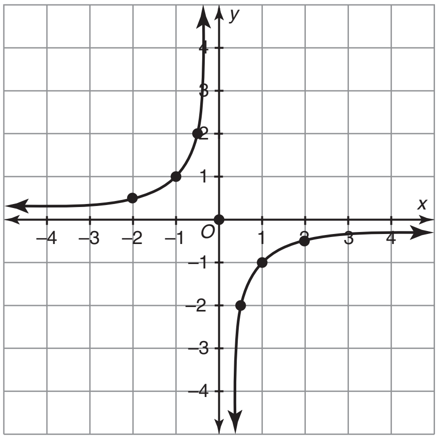
12. The graph of the function $f(x) = \sqrt{1 - x^2}$ is shown.



13. The graph of the function $y = x^3 - x$ is shown.



14. The graph of the function $f(x) = -\frac{1}{x}$ is shown.



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Determine the domain and range of each function. Then determine the domain and range in terms of the problem situation.

15. The commission that a car salesperson makes in dollars can be modeled by the function $f(x) = 0.05x$, where x represents his total sales in dollars.

Domain of the function: all real numbers

Range of the function: all real numbers

Domain of the problem situation: all numbers greater than or equal to 0

Range of the problem situation: all numbers greater than or equal to 0

16. A fruit market sells blueberries by the pound. The cost in dollars can be modeled by the function $f(w) = 7.75w$, where w represents the amount of blueberries in pounds.

Name ______________________ Date ______________

17. A ball is tossed into the air, where it reaches a maximum height of 64 feet, and then it reaches the ground 4 seconds later. The ball's height above the ground in feet can be modeled by the function $h(t) = 64t - 16t^2$, where t is the time in seconds.

18. A single bacterium is placed in a Petri dish, and it divides to form two bacteria after one hour. Each of those bacteria divides, and so on, until after 24 hours the bacteria have used all the food in the dish, and then die. The number of bacteria can be modeled by the function $N(t) = 2^t$, where t is the time in hours.

2

Name ____ Date ______________________

Rocket Man
Extrema and Symmetry

Vocabulary

Write the term that best completes each statement.

1. A(n) ________________ is a point where a graph crosses the *x*-axis.
2. A(n) ________________ divides a graph in half to create two parts that are mirror images of each other.
3. A point on a graph is a(n) ________________ if either all nearby points have a smaller value or all nearby points have a greater value.
4. A(n) ________________ is a point where a graph crosses the *y*-axis.

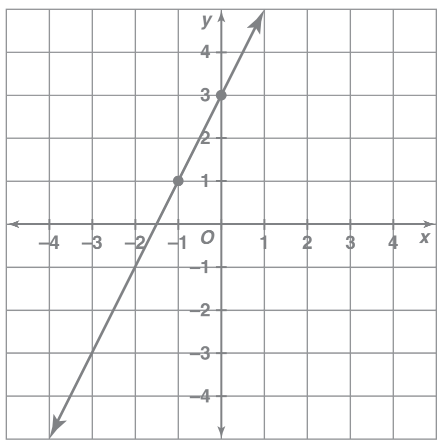
Problem Set

Graph each function. Identify the *x*- and *y*-intercepts of the function.

1. $y = 2x + 3$

   The *x*-intercept is at $-\frac{3}{2}$.

   The *y*-intercept is at 3.



2. $y = 2 - x$

3. $y = 1 - x^2$

4. $y = x^2 - 4$

Name ______________________________ Date ______________

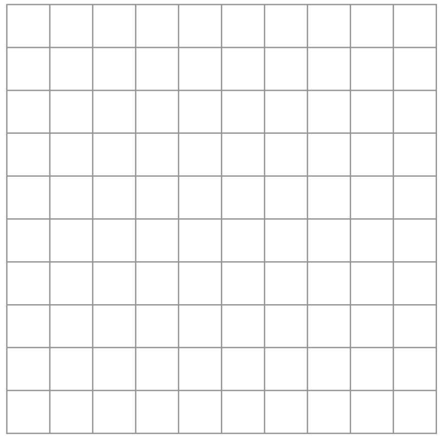
5. $y = |2x - 1|$

6. $y = 4 - |2x|$

7. $y = \sqrt{x - 1}$

2

8. $y = 1 + \sqrt{x}$

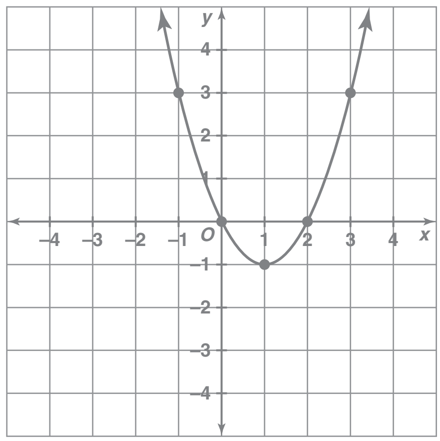


2

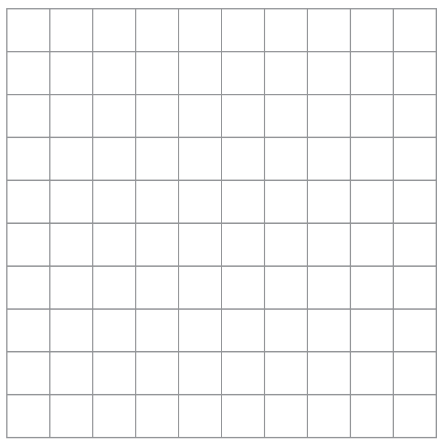
Graph each function. Identify all extreme points of the function, if any exist.

9. $y = x^2 - 2x$

There is an extreme point at (1, −1).



10. $y = -x^2 - 2x + 3$



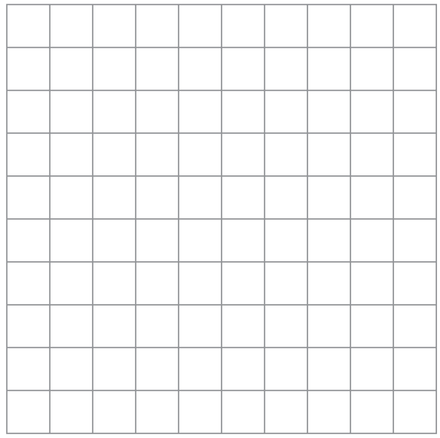
Name ______________________________ Date ______________

11. $y = |x - 2|$

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

13. $y = \frac{16}{x}$

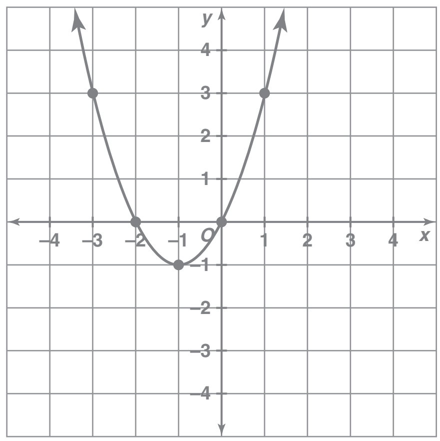
14. $y = 1 - \sqrt{x}$



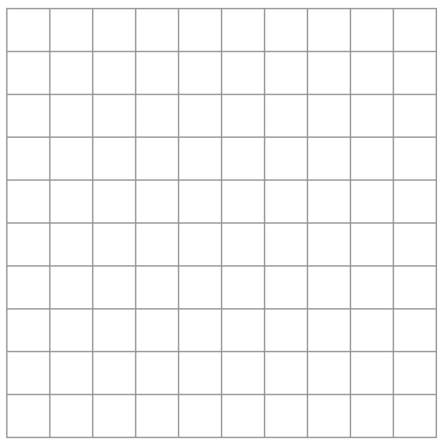
Graph each function. Identify the line of symmetry of the function, if it exists.

15. $y = x^2 + 2x$

The line of symmetry is $x = -1$.



16. $y = -x^2 + 4x - 4$



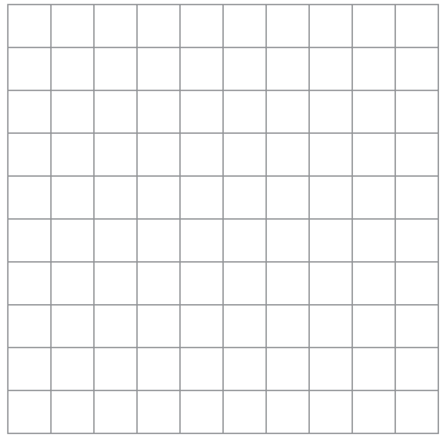
Name ______________________ Date ____________

17. $y = |x + 3|$

18. $y = \frac{1}{2}|x - 1| - 1$

19. $y = \sqrt{x} - 2$

20. $y = -\frac{9}{x}$



Skills Practice

Name ______________________________ Date ________________

Changing Change
Rates of Change of Functions

Vocabulary

Define each term in your own words.

1. average rate of change

2. slope

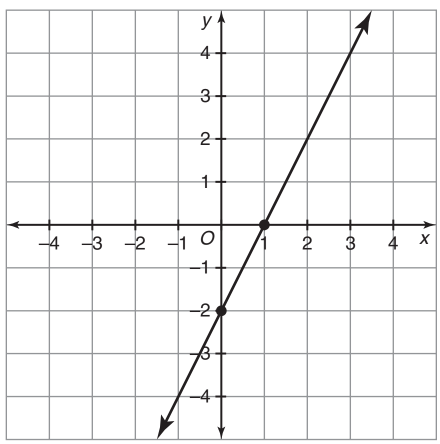
Problem Set

A function and its graph are given. Complete each table by determining the average rate of change between consecutive points. What can you say about the rates of change for each function?

1. $y = 2x - 2$

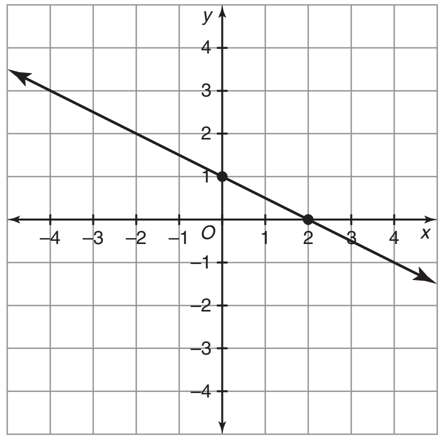
x	y	Δx	Δy	$\frac{\Delta y}{\Delta x}$
−4	−10			
−1	−4	3	6	2
0	−2	1	2	2
2	2	2	4	2
3	4	1	2	2

The rate of change is constant.



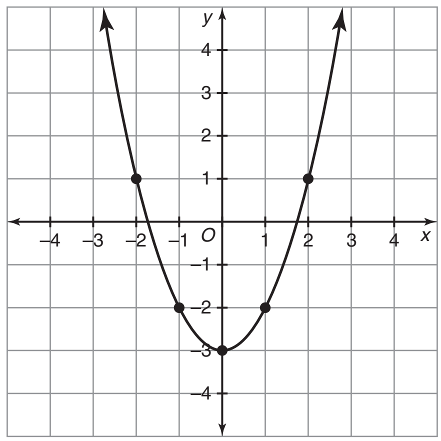
2. $y = -\frac{1}{2}x + 1$

x	y	Δx	Δy	$\frac{\Delta y}{\Delta x}$
−6				
−2				
0				
2				
4				



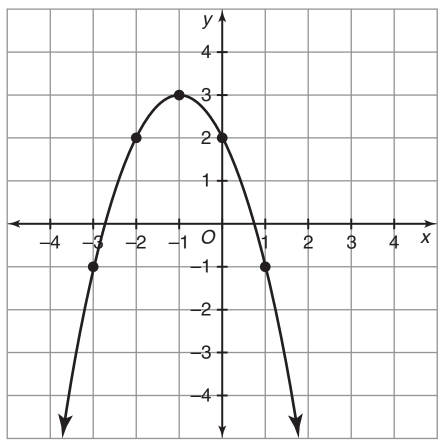
3. $f(x) = x^2 - 3$

x	y	Δx	Δy	$\frac{\Delta y}{\Delta x}$
−2				
−1				
0				
1				
2				



4. $g(x) = 2 - 2x - x^2$

x	y	Δx	Δy	$\frac{\Delta y}{\Delta x}$
−3				
−2				
−1				
0				
1				



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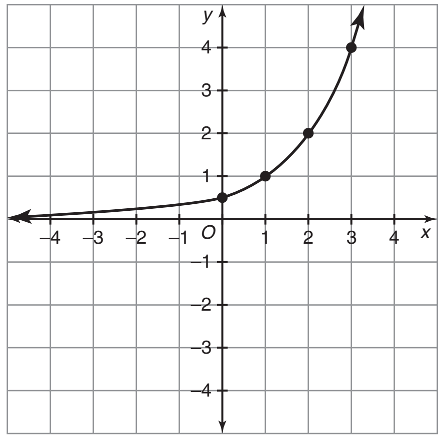
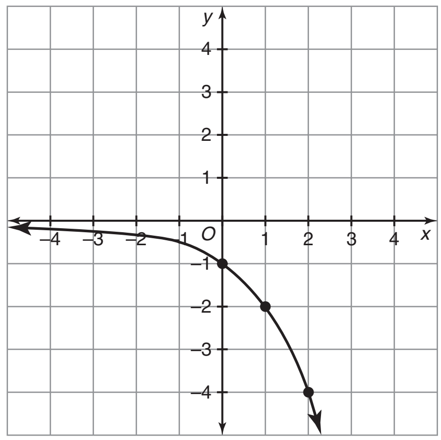
5. $h(x) = 2^{x-1}$

x	y	Δx	Δy	$\frac{\Delta y}{\Delta x}$
−1				
0				
1				
2				
3				



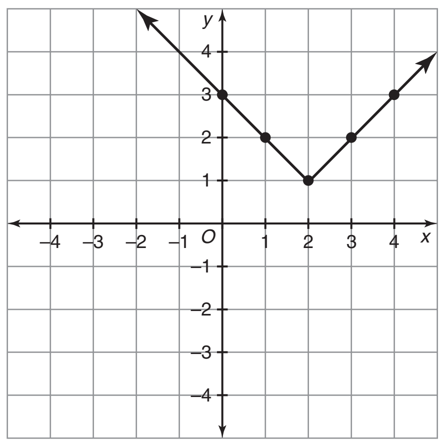
6. $h(x) = -2^{x}$

x	y	Δx	Δy	$\frac{\Delta y}{\Delta x}$
−2				
−1				
0				
1				
2				



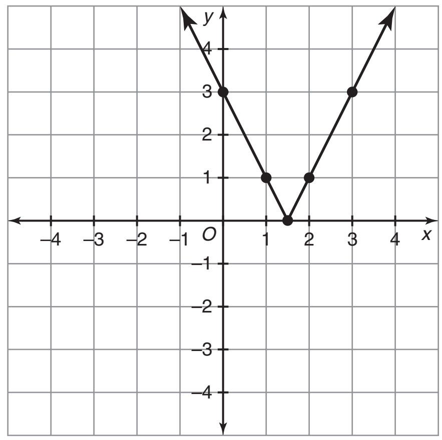
7. $g(x) = |x - 2| + 1$

x	y	Δx	Δy	$\frac{\Delta y}{\Delta x}$
0				
1				
2				
3				
4				



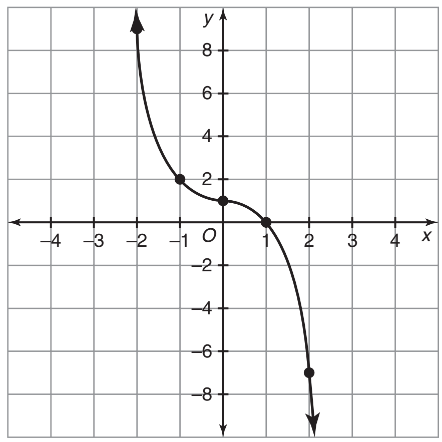
8. $y = |2x - 3|$

x	y	Δx	Δy	$\frac{\Delta y}{\Delta x}$
0				
1				
2				
3				
4				



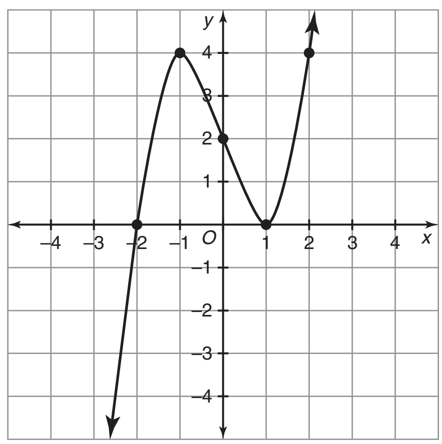
9. $h(x) = 1 - x^3$

x	y	Δx	Δy	$\frac{\Delta y}{\Delta x}$
−2				
−1				
0				
1				
2				



10. $p(x) = x^3 - 3x + 2$

x	y	Δx	Δy	$\frac{\Delta y}{\Delta x}$
−2				
−1				
0				
1				
2				



2