PRE ALGEBRA 2 - PA CORE 8 – COURSE 3

STUDENT WORKBOOK

UNIT 3 - FUNCTIONS

Before

After

Unit 3	Functions	PURPLE	GREEN	RED
4.1	Represent Relationships		7.1, 12.1	
4.2	Relations	1.10, 8.1	7.1, 12.1	3.1
4.3	Functions	8.2	7.2, 12.2	3.3
4.4	Linear Functions	8.1, 8.3	7.3, 12.3	3.4
4.5	Compare Properties of Functions			3.4
4.6	Construct Functions			3.8, 3.9
4.7	Linear and Nonlinear Functions	13.2	12.4	3.2
4.8	Quadratic Functions	13.2	12.4	
4.9	Qualitative Graphs	13.3		

STUDY ISLAND TOPICS

Functions
Linear Vs Nonlinear
Linear Relationships

Name: _____ Period ____

OBJECTIVE:
KEY NOTES:

Lesson 1 Skills Practice

Representing Relationships

1. EXERCISE A fitness instructor exercises about 15 hours per week.

a. Write an equation to find the total number of hours h the instructor exercises in any number of weeks w.

b. Use the equation to determine the total number of hours the instructor will exercise in 9 weeks.

Weeks, w	Total Hours, h
1	15
2	30
3	45
4	60

2. HOUSES A real estate company sells 8 houses per month.

a. Write an equation to find the total number of houses h sold in any number of months m.

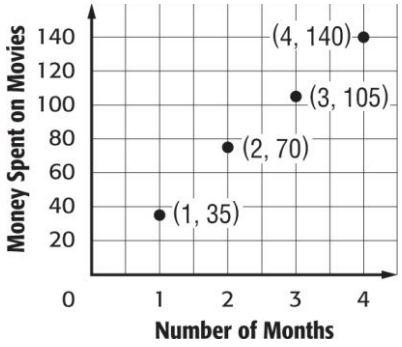
b. Use the equation to determine how many houses are sold in 15 montl

Months, m	Total Houses, h
1	8
2	16
3	24
4	32

3. MOVIES The graph shows the amount of money the Zimmerman family spends on movies each month.

a. Write an equation to find the total amount of money c spent on movies in any number of months m.

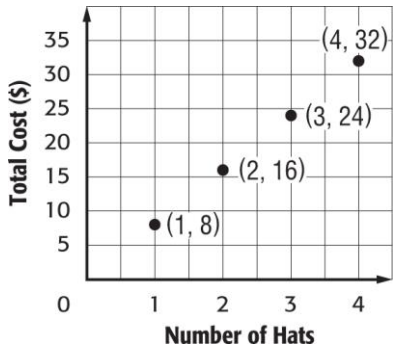
b. Use the equation to determine how much they will spend on movies in one year.



4. SALES The graph shows the total cost of hats that are on sale at Hats Bonanza.

a. Write an equation to find the total cost c of any number of hats h.

b. Use the equation to find the cost of 30 hats.



Lesson 1 Problem-Solving Practice

Representing Relationships

1. MEASUREMENT Use the table to write an equation to find the number of inches *i* in any number of meters *m*. Use the equation to find the number of inches in 9 meters.

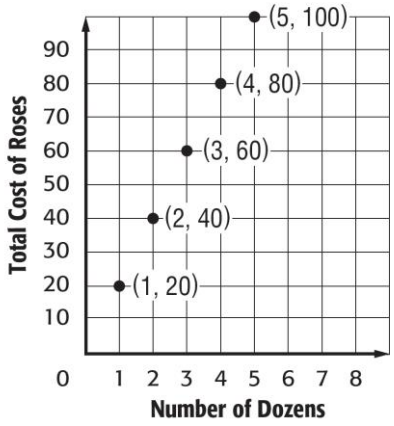
Meters, *m*	Inches, *i*
1	39
2	78
3	117
4	156

2. TOOLS The table shows the total cost for a band saw and extra blades. Write an equation to find the total cost *c* of a band saw with any number of extra blades *e*. Use the equation to find the cost of a band saw with 10 extra blades.

Number of Extra Blades	Total Cost ($)
0	150
1	154
2	158
3	162

3. AQUARIUM An aquarium costs $85 plus $2 per fish. Write an equation to find the cost *c* of an aquarium plus any number of fish *f*. Make a table to find the cost of an aquarium plus 3, 4, 5, or 6 fish.

4. SALES A florist sells roses by the dozen. Write an equation to find the total cost *c* of *r* dozens of roses.



5. BOATING Boat rentals are $50 plus $4 per hour. Write an equation to find the total cost *c* to rent a boat for any number of hours *h*. Make a table to find the cost of renting a boat for 4, 5, 6, or 7 hours.

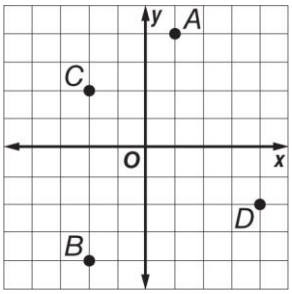
6. SWIMMING Private swimming lessons cost $30 per visit plus $3 per child in the group. Write an equation to find the total cost *t* of a swimming lesson for any number of children *c*. Make a table to find the cost of a lesson for 1, 2, 3, or 4 children.

OBJECTIVE:
KEY NOTES:

Lesson 2 Skills Practice

Relations

Name the ordered pair for each point.



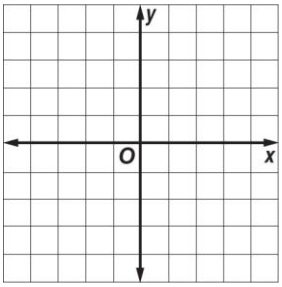
1. *A*

2. *B*

3. *C*

4. *D*

Graph each ordered pair on a coordinate plane.



5. (3, 3)

6. (1, –1)

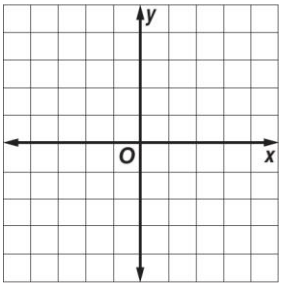
7. (–4, 2)

8. (–4, –3)

Express each relation as a table and a graph. Then state the domain and range.

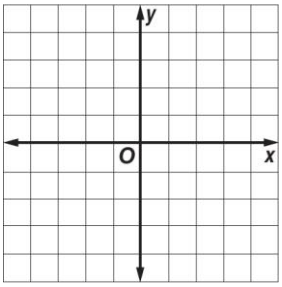
9. {(4, –2), (–1, 1), (2, –3), (3, 0)}

x	*y*



10. {(3, 4), (1, –2), (4, –1), (2, 2)}

x	*y*



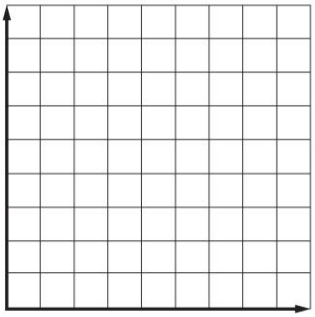
Lesson 2 Problem-Solving Practice

Relations

1. MONEY The Happy Place charges $30 per hour for parties. Make a table of ordered pairs in which the *x*-coordinate represents the hours and the *y*-coordinate represents the total cost for 2, 3, 4, and 5 hours.

x	*y*

2. Graph the ordered pairs from Exercise 1 and state the domain and range.



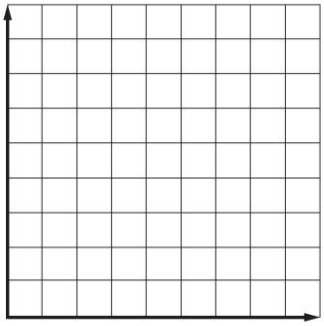
3. CAR RENTALS The ABC Car Rental Company charges a flat rate $58 per day. Make a table of ordered pairs in which the *x*-coordinate represents the number of days and the *y*-coordinate represents the total cost for 1, 3, 5, and 7 days.

x	*y*

4. PRODUCE A company that sells produce fills 350 boxes of squash per day. Make a table of ordered pairs in which the *x*-coordinate represents the number of days and the *y*-coordinate represents the number of boxes filled in 1, 2, 3, and 4 days.

x	*y*

5. Graph the ordered pairs from Exercise 4 and state the domain and range.



6. BABIES Shaqueem's baby brother drinks 4 ounces of formula every 3 hours. Make a table of ordered pairs in which the *x*-coordinate represents the number of hours and the *y*-coordinate represents the total number of ounces in 3, 6, 9, and 12 hours.

x	*y*

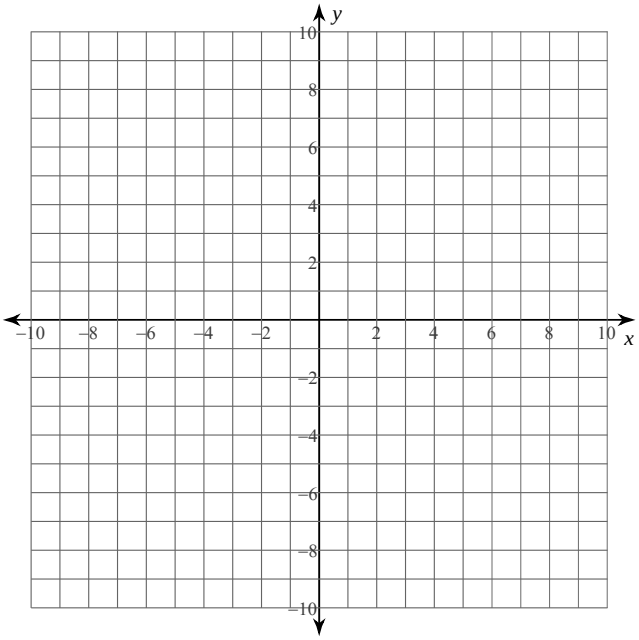
 Name_____

Points in the Coordinate Plane

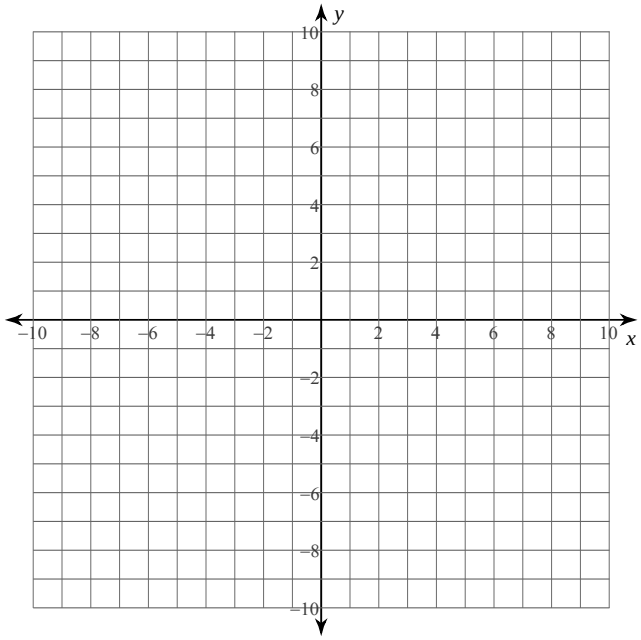
Date_____ Period____

Plot each point.

1) $J(5, 10)$ $I(1, 9)$ $H(6, -9)$
$G(-6, 8)$ $F(9, 0)$ $E(-6, 0)$
$D(-8, -4)$ $C(5, 0)$ $B(-1, -1)$
$A(-8, -1)$

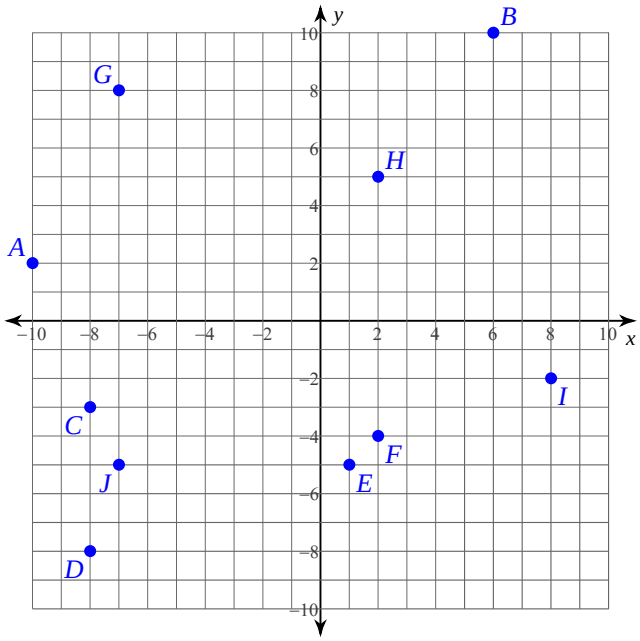


2) $A(7, 10)$ $B(0, 4)$ $C(-1, 10)$
$D(-6, -6)$ $E(10, 0)$ $F(9, 7)$
$G(-3, -4)$ $H(-4, -9)$ $I(4, 1)$
$J(7, -9)$

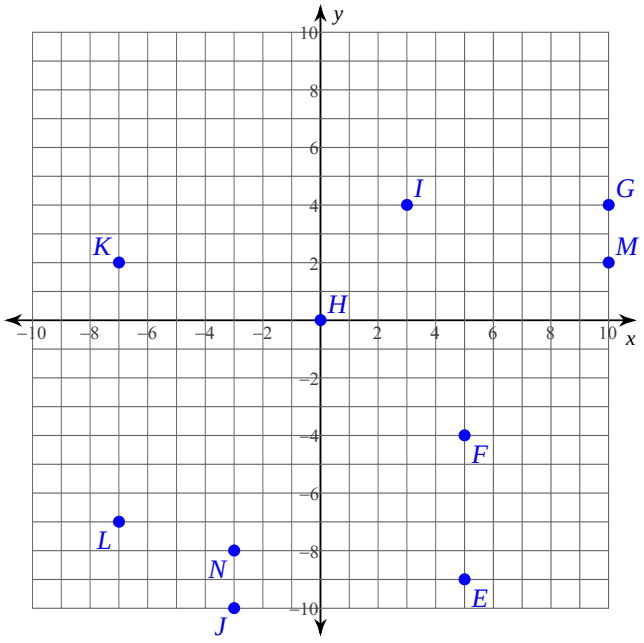


State the coordinates of each point.

3)



4)



State the quadrant or axis that each point lies in.

5) $L(-2, 1)$ $K(-3, -2)$ $J(3, 1)$

6) $T(-3, 5)$ $U(1, 0)$ $V(-5, 5)$

7) $S(5, -7)$ $T(7, 2)$ $U(-5, 4)$

8) $R(7, 0)$ $Q(8, -1)$ $P(3, 0)$

Critical thinking questions:

9) State the coordinates of the endpoints of a line segment that intersects the y-axis.

10) State the coordinates of the endpoints of a line segment that is not parallel to either axis, and does not intersect either axis.

OBJECTIVE:
KEY NOTES:

Lesson 3 Skills Practice

Functions

Find each function value.

1. $f(2)$ if $f(x) = x + 4$

2. $f(9)$ if $f(x) = x - 8$

3. $f(3)$ if $f(x) = 2x + 2$

4. $f(6)$ if $f(x) = 2x - 5$

5. $f(-7)$ if $f(x) = 3x + 6$

6. $f(8)$ if $f(x) = 3x - 10$

7. $f(-5)$ if $f(x) = 4x + 2$

8. $f(-3)$ if $f(x) = -4x - 4$

9. $f(-4)$ if $f(x) = -5x - 3$

Choose four values for *x* to make a function table for each function. Then state the domain and range of the function.

10. $f(x) = x + 7$

x	*x* +7	*f*(*x*)

11. $f(x) = x - 13$

x	*x* – 13	*f*(*x*)

12. $f(x) = 2x + 8$

x	2*x* + 8	*f*(*x*)

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

x	2*x* – 3	*f*(*x*)

14. $f(x) = 3x + 4$

x	3*x* + 4	*f*(*x*)

15. $f(x) = 7 - 3x$

x	7 – 3*x*	*f*(*x*)

16. $f(x) = 4x + 5$

x	4*x* +5	*f*(*x*)

17. $f(x) = 1 - 4x$

x	*x* – 10	*f*(*x*)

18. $f(x) = 6x - 2$

x	6*x* – 2	*f*(*x*)

Lesson 3 Problem-Solving Practice

Functions

1. JOBS Strom works as a valet at the Westside Mall. He makes $48 per day plus $1 for each car that he parks. The total amount that Strom earns in one day can be found using the function $f(x) = x + 48$, where x represents the number of cars that Strom parked. Make a function table to show the total amount that Strom makes in one day if he parks 25 cars, 30 cars, 35 cars, and 40 cars.

x	$x + 48$	$f(x)$

2. PLUMBING Rico's Plumbing Service charges $80 for a service call plus $65 per hour for labor. The total charge can be found using the function $f(x) = 65x + 80$, where x represents the number of hours of labor. Make a function table to show the total amount that Rico's Plumbing Service charges if a job takes 1 hour, 2 hours, 3 hours, and 4 hours.

x	$65x + 80$	$f(x)$

3. GEOMETRY The perimeter of an equilateral triangle equals 3 times the length of one side. Write a function using two variables for this situation. Find the perimeter of an equilateral triangle with sides 18 inches.

4. HEALTH CLUB Courtney belongs to a health club that charges a monthly fee of $20, plus $85 to join. Write a function to represent her costs. How much has she paid after six months?

5. LIBRARY FINES The amount that Sunrise Library charges for an overdue book is $0.25 per day plus a $1 service charge. Write a function using two variables for this situation.

6. LIBRARY FINES Explain how to find the amount of the fine the library in Exercise 5 will charge for a book that is overdue by 12 days. Then find the amount.

Lesson 4 Skills Practice

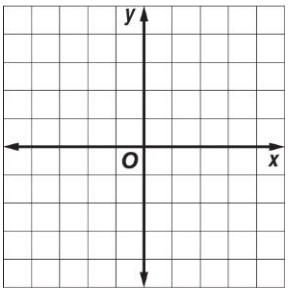
OBJECTIVE:
KEY NOTES:

Linear Functions

Complete the function table. Then graph the function.

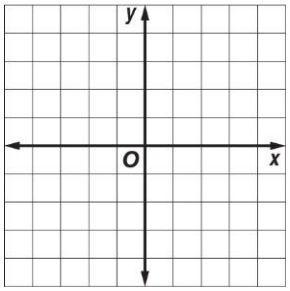
1. $y = x + 4$

x	$x + 4$	y	(x, y)
–2			
–1			
0			
1			



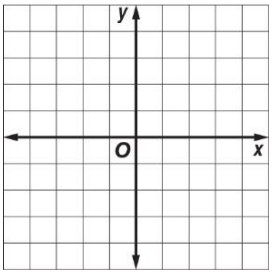
2. $y = 2x - 1$

x	$2x - 1$	y	(x, y)
–1			
0			
1			
2			

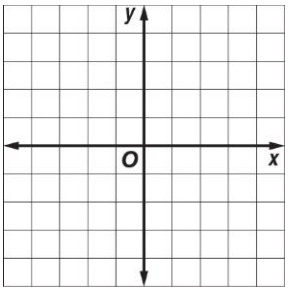


Graph each function.

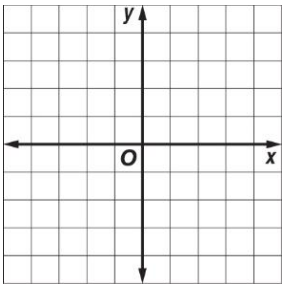
3. $y = x - 6$



4. $y = 2x - 3$



5. $y = 1 - x$

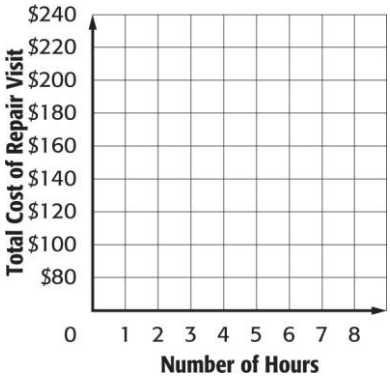


6. REPAIRS An appliance repairman charges $60 for a service call plus an additional $40 per hour to repair appliances.

a. Write a function to represent the situation.

b. Make a function table to find the total cost for 1, 2, 3, or 4 hours of work on an appliance.

x	1	2	3	4

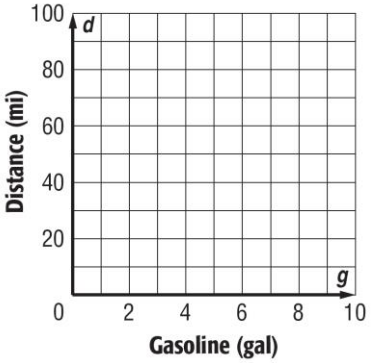


c. Graph the function. Is the function continuous or discrete? Explain.

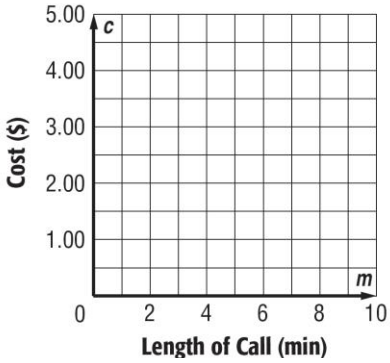
Lesson 4 Problem-Solving Practice

Linear Functions

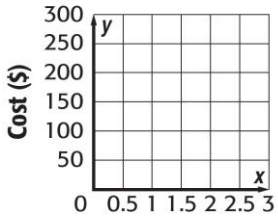
1. FUEL CONSUMPTION The function $d = 18g$ describes the distance d that Rick can drive his truck on g gallons of gasoline. Graph this function. Why is it sufficient to graph this function in the upper right quadrant only? How far can Rick drive on 2.5 gallons of gasoline?



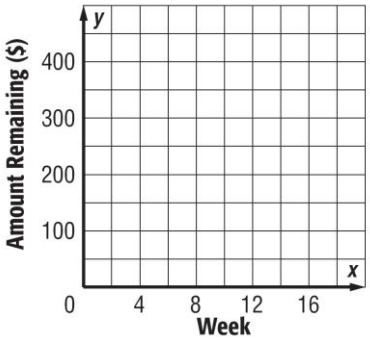
2. HOTELS The function $c = 0.5m + 1$describes the cost c in dollars of a phone call that lasts m minutes made from a room at the Shady Tree Hotel. Graph the function. Use the graph to determine how much a 7-minute call will cost.



3. A computer store charges $45 for materials and $50 an hour for service to install two new programs and a connection. The cost $C(h)$ is a function of the number of hours h it takes to do the job. Graph the function $C(h) = 45 + 50h$. How much will a 3-hour installation cost?

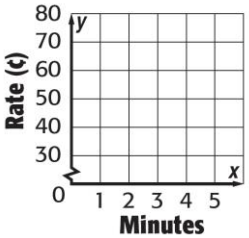


4. GIFTS Jonah received $300 in cash gifts for his fourteenth birthday. The function $y = 300 – 25x$ describes the amount y remaining after x weeks if Jonah spends $25 each week. Graph the function and determine the amount remaining after 9 weeks.



5. GIFTS Explain how you can use your graph in Exercise 4 to determine during which week the amount remaining will fall below $190. Then find the week.

6. Ron got a cell phone rate of $C(a) = 0.22 + 0.10a$. Graph the cost per minute. How much will a five-minute call cost?

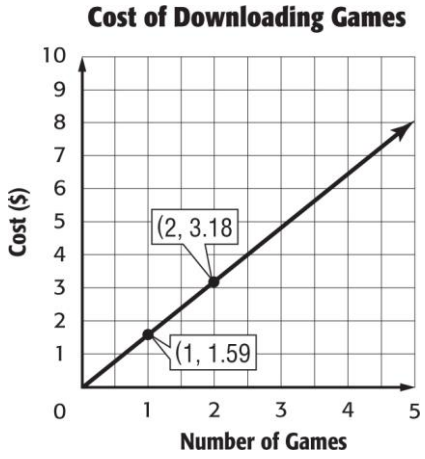


OBJECTIVE:
KEY NOTES:

Lesson 5 Skills Practice

Compare Properties of Functions

1. Cassie is downloading music and games onto her phone. It costs $0.99 to download a song to her phone. The costs of downloading games are shown in the graph. Compare the functions for each kind of download by comparing the costs.



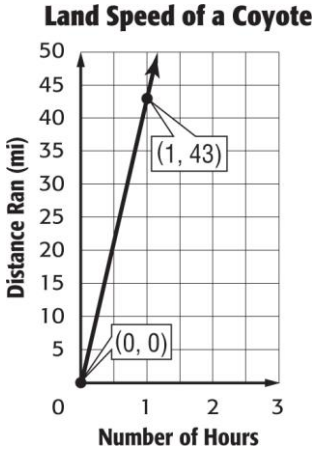
2. The number of gallons y a pool drains in x minutes is represented by the function $y = 20x$. The table shows the time it takes to fill up a pool. Compare the functions for each process by comparing the times.

Number of Minutes	Number of Gallons
1	15
2	30
3	45

3. The speeds of a coyote and giraffe are shown in the graph and table below.

a. Compare the functions by comparing the rates of change.

b. How much farther does a coyote run than a giraffe after 3 hours



Land Speed of a Giraffe	
Number of Hours	**Distance Ran (mi)**
0.5	16
1	32
1.5	48

Lesson 5 Problem-Solving Practice

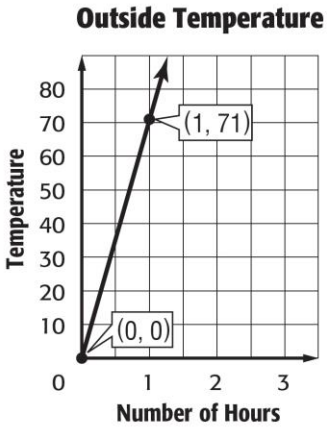
Compare Properties of Functions

1. Anne kept track of the number of steps she took in a day using a pedometer. The average number of steps she took y per hour x can be represented by the function $y = 700x$. The table below shows the number of steps per hour that Elyse walked. Compare the functions for each person by comparing the number of steps.

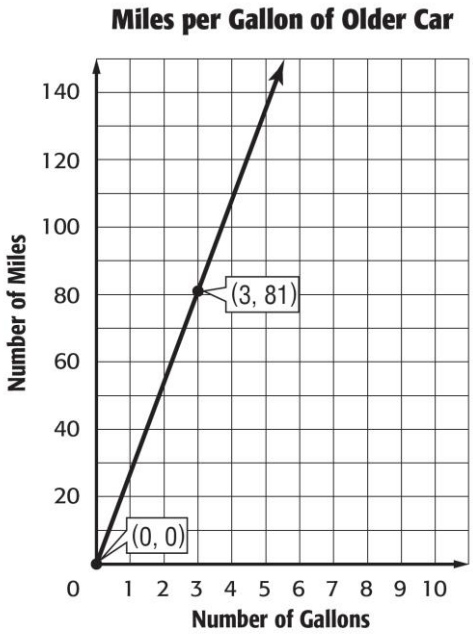
Number of Hours	Number of Steps
1	575
2	1,150
3	1,725

2. For every computer that is sold, Kendall receives $250 in commissions. The amount of commissions that Peter receives can be represented by the function $y = 225x$ where y is his commission and x is the number of computers sold. How much more does Kendall receive in commissions than Peter if they both sell 5 computers?

3. Chinook winds are warm dry winds that blow down the side of the mountain that causes drastic temperature changes. The graph shows the outside temperature change caused from chinook winds after a number of hours. In another location, the temperature y after x hours can be represented by the function $y = 68x$. Compare the functions by comparing the temperatures.



4. A new car gets 33 miles per gallon of gas. The graph shows the number of miles y that an older car gets per gallon x of gas. Compare the miles per gallon for each car.



OBJECTIVE:
KEY NOTES:

Lesson 6 Skills Practice

Construct Functions

1. When Charlotte planted her tomato plant, it grew 3 inches in one week. After 5 weeks, the tomato plant was 23 inches tall. Assume the relationship is linear. Find and interpret the rate of change and the initial value.

2. The total cost of renting a vacation home includes a deposit and a daily rental fee of $125. A family rents a vacation home for 5 days and pays $700. Assume the relationship is linear. Find and interpret the rate of change and the initial value.

3. In order to enter the state fair, there is an admission cost. Ea game is $3. Steven went to the state fair, played 4 games an spent a total of $20 on admission and games. Assume the relationship is linear. Find and interpret the rate of change a the initial value.

4. After writing part of his novel, Thomas is now writing 16 ages per week. After 4 weeks, he has written 85 pages. Assume the relationship is linear. Find and interpret the rate of change and the initial value.

5. A photographer charges $20 for an 8 × 10 photo plus a sit fee. Luann spent $55 on two 8 × 10 photographs and the sitting fee. Assume the relationship is linear. Find and interpret the rate of change and the initial value.

6. To perform car maintenance, a mechanic charges for parts and $45 an hour for labor. The total cost that Terri spent for 2 hour of car maintenance is $125. Assume the relationship is linear. Find and interpret the rate of change and the initial value.

Lesson 6 Problem-Solving Practice

Construct Functions

1. An education association wants to rent a cotton candy machine for a carnival. There is a deposit to rent it plus an additional $8 per hour. The total cost to rent the machine for 5 hours is $115. Assume the relationship is linear. Find and interpret the rate of change and the initial value.	**2.** Mr. Dodson is having the exterior of his house painted. The painters charge $35 per hour plus the cost of materials. After 20 hours of work, Mr. Dodson owes the painters $840. Assume the relationship is linear. Find and interpret the rate of change and the initial value.
3. Before a movie began, a theater had people waiting in the seats. During each of 4 movie trailers, 7 more people came into the theater. When the movie started 82 people were in the theater. Assume the relationship is linear. Find and interpret the rate of change and the initial value.	**4.** The Art Club collected $15 from each of its 17 members for dues. It then had $300 in its account. Assume the relationship is linear. Find and interpret the rate of change and the initial value.
5. The population of DeSoto rose an average of 142 people for each of 5 years. It then had 5,428 people. Assume the relationship is linear. Find and interpret the rate of change and the initial value.	**6.** Ling starts out with a certain number of baseball cards and plans to collect 8 each month. At the end of a year, he has 109 baseball cards. Assume the relationship is linear. Find and interpret the rate of change and the initial value.

OBJECTIVE:
KEY NOTES:

Lesson 7 Skills Practice

Linear and Nonlinear Functions

Determine whether each table represents a *linear* or a *nonlinear*function. Explain.

1.

x	1	2	3	4
y	8	12	16	20

2.

x	0	2	4	6
y	5	3	0	–4

3

x	–3	–5	–7	–9
y	5	9	13	17

4.

x	3	1	0	–2
y	7	7	7	7

5.

x	3	0	–3	–6
y	1	6	11	16

6.

x	–1	0	1	2
y	–2	0	2	4

7.

x	1	2	3	4
y	5	7	9	11

8.

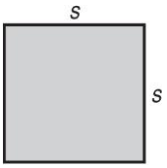
x	–2	0	2	4
y	0	1	3	9

Lesson 7 Problem-Solving Practice

Linear and Nonlinear Functions

GEOMETRY For Exercises 1 and 2, use the following information.

Recall that the perimeter of a square is equal to 4 times the length of one of its sides, and the area of a square is equal to the square of one of its sides.



1. Write a function for the perimeter of the square. Is the perimeter of a square a linear or nonlinear function of the length of one of its sides? Explain.

2. Write a function for the area of the square. Is the area of a square a linear or nonlinear function of the length of one of its sides? Explain.

3. BUSINESS The Devon Tool Company uses the equation $p = 150t$ to calculate the gross profit p the company makes, in dollars, when it sells t tools. Is the gross profit a linear or nonlinear function of the number of tools sold? Explain.

4. GRAVITY A camera is accidentally dropped from a balloon at a height of 300 feet. The height of the camera after falling for t seconds is given by $h = 300 - 16t^2$. Is the height of the camera a linear or nonlinear function of the time it takes to fall? Explain.

5. LONG DISTANCE The table shows the charge for a long-distance call as a function of the number of minutes the call lasts. Is the charge a linear or nonlinear function of the number of minutes? Explain.

Minutes	1	2	3	4
Cost (¢)	5	10	15	20

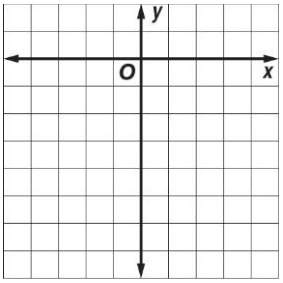
6. DRIVING The table shows the cost of a speeding ticket as a function of the speed of the car. Is the cost a linear or nonlinear function of the car's speed? Explain.

Speed (mph)	70	80	90	100
Cost ($)	25	50	150	300

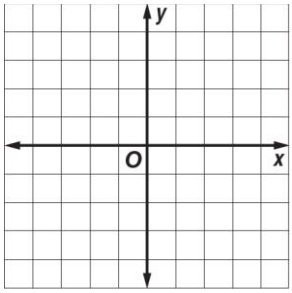
Lesson 8 Skills Practice

Quadratic Functions

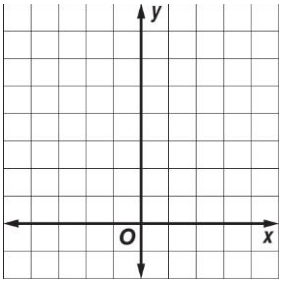
1. $y = -4x^2$



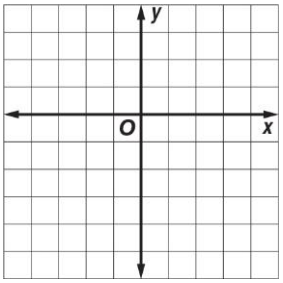
2. $y = 6x^2$



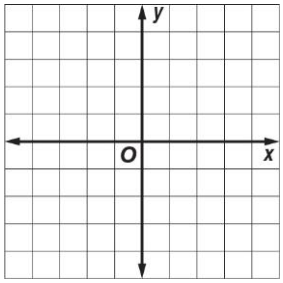
3. $y = x^2 + 4$



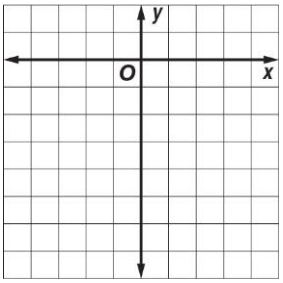
4. $y = x^2 - 5$



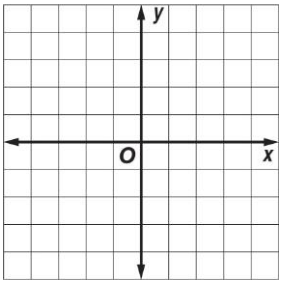
5. $y = -x^2 + 3$



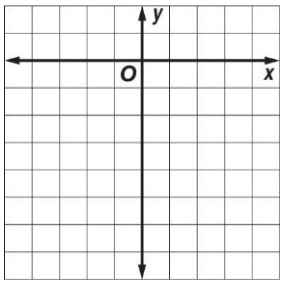
6. $y = -x^2 - 1$



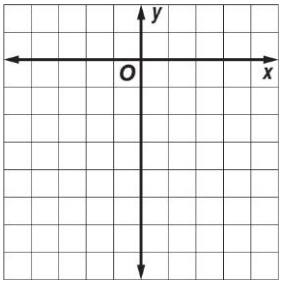
7. $y = 2x^2 - 3$



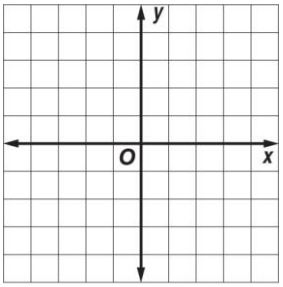
8. $y = -2x^2 + 1$



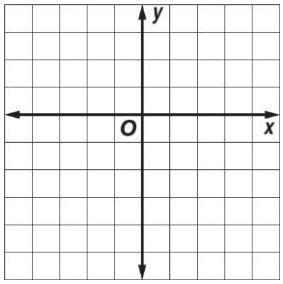
9. $y = -2x^2 - 2$



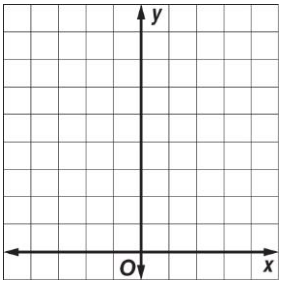
10. $y = 3x^2 + 1$



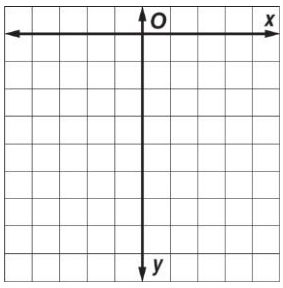
11. $y = -3x^2 + 3$



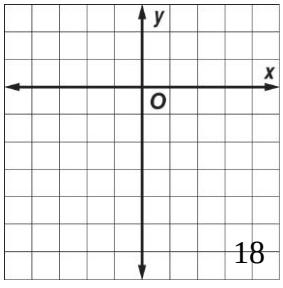
12. $y = 5x^2 + 2$



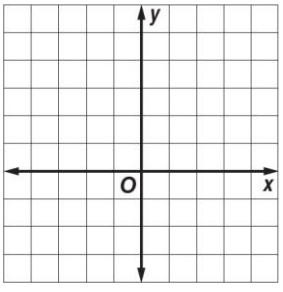
13. $y = -x^2 - 1$



14. $y = -6x^2 + 1$



15. $y = 3x^2 - 2$



Lesson 8 Problem-Solving

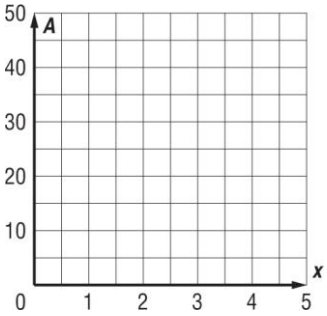
OBJECTIVE:
KEY NOTES:

Quadratic Functions

GEOMETRY For Exercises 1–3, use the following information.

The quadratic equation $A = 6x^2$ models the area of a triangle with base $3x$ and height $4x$.

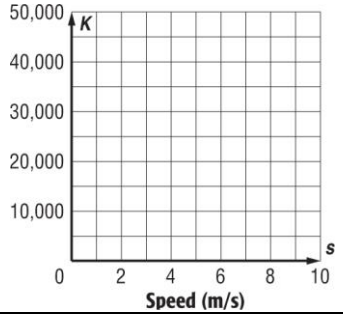
1. Graph the equation. Explain why you only need to graph the function in the upper right quadrant.



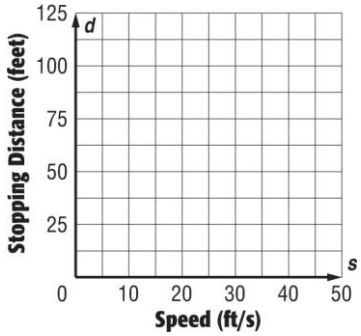
2. Explain how to find the area of the triangle when $x = 3$ inches. Then find the area.

3. Explain how to use your graph to determine the value of x when the area is 24 square inches. Then find the base and height of the triangle when its area is 24 square inches.

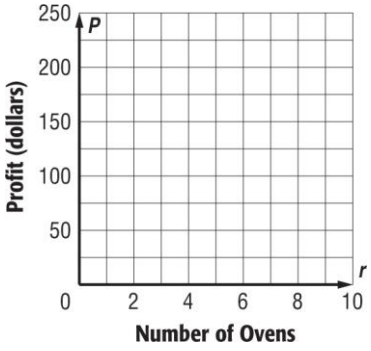
4. PHYSICS The quadratic equation $K = 500s^2$ models the kinetic energy in joules of a 1,000-kilogram car moving at a speed of s meters per second. Graph this function. Then use your graph to estimate the kinetic energy at a speed of 8 meters per second.



5. CARS The quadratic equation $d = \frac{s^2}{20}$ models the stopping distance in feet of a car moving at a speed of s feet per second. Graph this function. Then use your graph to estimate the stopping distance at a speed of 40 feet per second.



6. BUSINESS The quadratic equation $p = 50 + 2r^2$ models the gross profit made by a factory that produces r ovens. Graph this function. Then use your graph to estimate the profit for 5 ovens.

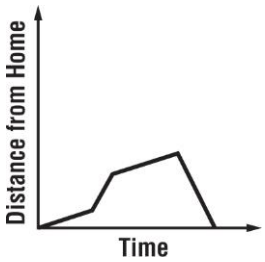


Lesson 9 Skills Practice

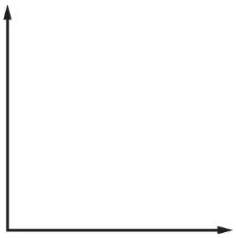
OBJECTIVE:
KEY NOTES:

Qualitative Graphs

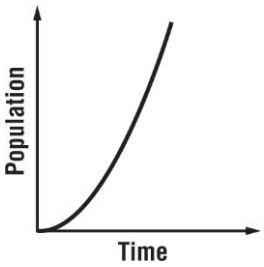
1. The graph below displays the distance Bryan was from home as he ran in preparation for a marathon. Describe the change in distance over time.



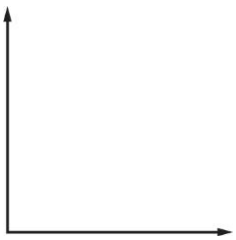
3. An oven is being preheated in order to bake a cake. Sketch a qualitative graph to represent the temperature of the oven over time.



2. The graph below displays the population of bacteria in a dish. Describe the change in population over time.



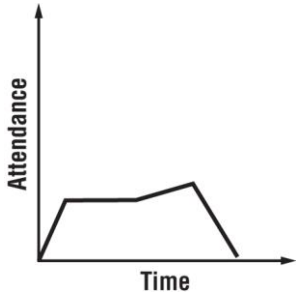
4. A well is being dug on a piece of land. The team digs at a constant rate, takes a break for lunch, then continues digger at a slower constant rate. Sketch a qualitative graph that shows the depth of the well over time.



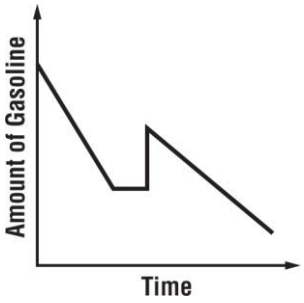
Lesson 9 Problem-Solving Practice

Qualitative Graphs

1. The graph below displays the attendance at the state fair over time. Describe the change in attendance over time.



2. The graph below displays the amount of gasoline in a vehicle over time. Describe the change in the amount of gasoline over time.



3. Charles received a loan and is paying it off in monthly installments. Sketch a qualitative graph to represent the balance of the amount owed over time.

4. A hot air balloon begins on the ground and rises. It floats along and then returns to the ground steadily. Sketch a qualitative graph to represent the height over time.

Name_____

Evaluating Functions

Date_____ Period____

Evaluate each function.

1) $h(t) = |t + 2| + 3$; Find $h(6)$

2) $g(a) = 3^{3a-2}$; Find $g(1)$

3) $w(t) = -2t + 1$; Find $w(-7)$

4) $g(x) = 3x - 3$; Find $g(-6)$

5) $h(n) = -2n^2 + 4$; Find $h(4)$

6) $h(t) = -2 \cdot 5^{-t-1}$; Find $h(-2)$

7) $f(x) = x^2 - 3x$; Find $f(-8)$

8) $p(a) = -4^{3a}$; Find $p(-1)$

9) $p(t) = 4t - 5$; Find $p(t - 2)$

10) $g(a) = 4a$; Find $g(2a)$

11) $w(n) = 4n + 2$; Find $w(3n)$

12) $w(a) = a + 3$; Find $w(a + 4)$

13) $h(x) = 4x - 2$; Find $h(x + 2)$

14) $k(a) = -4^{3a+2}$; Find $k(a - 2)$

15) $g(n) = n^3 - 5n^2$; Find $g(-4n)$

16) $f(n) = n^2 - 2n$; Find $f(n^2)$

17) $p(a) = a^3 - 5$; Find $p(x - 4)$

18) $h(t) = 2 \cdot 3^{t+3}$; Find $h(4 + t)$