

3rd Grade Functions and Relationships

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions by:

[3] F&R-1 identifying a missing element in a pattern up to the next three terms (identifying a number using addition or subtraction or objects); or explaining how missing elements could be found (M4.1.1)

1. Complete the pattern.

___, 4, 6, 8, ___, 12, 14, ___

Explain how you found the missing numbers.

2. Find the next three terms in this pattern.

22 , 19 , 16 , 13 , _____ , _____ , _____ ...

[3] F&R-2 & 3 (L) Expressing a generalization of a pattern using words (M4.1.1 & M4.1.2) and using manipulatives, including a calculator, as tools when describing, extending, or representing patterns (M4.1.1 & M4.1.3) (See answer key)

Modeling and Solving Equations and Equalities: The student demonstrates algebraic thinking by:

[3] F&R-4 Using an open number sentence (addition or subtraction) to solve for an unknown represented by a box or circle (e.g., $5+ \square=16$, $-7=4$, $5+2=$) (M4.1.4)

1. What number makes this number sentence true?

$$5 + \square = 7$$

- a. 12
- b. 6
- c. 3
- d. 2

[3] F&R-5 Using appropriate vocabulary or symbols for greater than, less than, or equal to (M4.1.4)

1. Which symbol makes this a true statement?

$$4 + 8 \square 12$$

- a. <
- b. >
- c. =

2. What symbol makes this number sentence true?

$$7 + 4 \square 14$$

- a. <
- b. >
- c. =

3. What symbol makes this number sentence true?

$$20 + 7 \square 37$$

- a. <
- b. >
- c. =

3rd Grade Functions and Relationships Answer Key

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions by:

[3] F&R-1 identifying a missing element in a pattern up to the next three terms (identifying a number using addition or subtraction or objects); or explaining how missing elements could be found (M4.1.1)

1. Complete the pattern.

2, 4, 6, 8, 10, 12, 14, 16

Explain how you found the missing numbers.

Answer:

2,4,6,8,10,12,14,16

Possible answers may include:

Set of even numbers

Add 2

Skip count by 2

Multiples of 2

2. Find the next three terms in this pattern.

22, 19, 16, 13, 10, 7, 4 ...

[3] F&R-2 & 3 (L) Expressing a generalization of a pattern using words (M4.1.1 & M4.1.2) and using manipulatives, including a calculator, as tools when describing, extending, or representing patterns (M4.1.1 & M4.1.3)

Note to teachers

Introduction:

Student uses blocks to build a sequenced pattern, e.g.,

First element: one block

Second element: two blocks

Third element: three blocks

Etc.

Student explains (verbally or in writing) how the pattern grows and generalizes an explanation of the pattern.

Build more complicated patterns with blocks such as staircase numbers, building square numbers, base ten patterns, etc. Include patterns that are not number based. Student builds the beginning pattern element with specific directions, then expands it as he or she

understands the pattern. It is important that student can generalize the explanation for pattern growth and clearly explain his or her thinking.

Use a calculator to extend number patterns such as multiples or repeated addition or subtraction. Student explains the pattern.

Explore and explain diverse patterns using many different manipulatives.

Suggested resource: NCTM *Principles and Standards for School Mathematics*, <http://www.mathcats.com>, Carol Greenes and Carol Findell algebra for primary grades, Thomas Carpenter et al *Thinking Algebraically*

Modeling and Solving Equations and Equalities: The student demonstrates algebraic thinking by:

[3] F&R-4 Using an open number sentence (addition or subtraction) to solve for an unknown represented by a box or circle (e.g., $5+=16$, $-7=4$, $5+2=$) (M4.1.4)

1. What number makes this number sentence true?

$$5 + \square = 7$$

- a. 12
- b. 6
- c. 3
- d. 2***

[3] F&R-5 Using appropriate vocabulary or symbols for greater than, less than, or equal to (M4.1.4)

1. Which symbol makes this a true statement?

$$4 + 8 \square 12$$

- a. <
- b. >
- c. =***

2. What symbol makes this number sentence true?

$$7 + 4 \square 14$$

- a. $<^*$
- b. $>$
- c. $=$

3. What symbol makes this number sentence true?

$$20 + 7 \square 37$$

- a. $<^*$
- b. $>$
- c. $=$

4th Grade Functions and Relationships

Describing Functions and Patterns: The student demonstrates conceptual understanding of functions, patterns, or sequences by:

[4] F&R-1 Extending patterns that use addition, subtraction, multiplication, or symbols, up to 10 terms, represented by models (function machine), tables, sequences, or in problem situations (M4.2.1)

1. Extend this multiplication pattern to the 5th term.

$$4 * 2 = 8$$

$$4 * 20 = 80$$

$$4 * 200 = \underline{\hspace{2cm}}$$

$$4 * \underline{\hspace{1cm}} = \underline{\hspace{2cm}}$$

$$4 * \underline{\hspace{1cm}} = \underline{\hspace{2cm}}$$

[4] F&R- 2 (L) Using rules to express the generalization of a pattern using words, lists, or tables (M4.2.4)

1. Figure out the pattern and the rule used below, then fill in the blanks.

<u>In</u>	<u>Out</u>
7	21

<u> </u>	6
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4	12
---	----

<u> </u>	18
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Rule: _____

[4] F&R-3 (L) Using manipulatives, including a calculator, as tools when describing, extending, or representing a number sequence (M4.2.1 &M4.2.3)



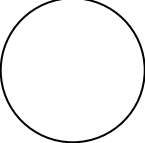

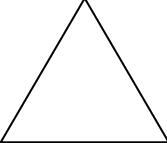
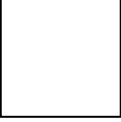
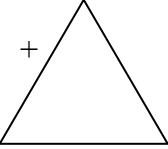
Ideas on the answer sheet.

Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[4] F&R-4 Using an open number sentence (addition, subtraction or multiplication) to solve for an unknown represented by a box or circle (e.g., $9 \cdot = 36$, $\cdot 8 = 56$, $3 \cdot 6 =$) (M4.2.5)

1. Each dog needs 8 booties for a dog mushing trip. One musher has 12 dogs. How many booties are needed for the trip? Write an open number sentence for this story and solve it.

2. Mattie was playing a game with her little sister. She covered the same number with the same shape. Figure out the numbers that are hidden.

	+		=	8
	+		=	
	+		=	11

4th Grade Functions and Relationships Answer Key

Describing Functions and Patterns: The student demonstrates conceptual understanding of functions, patterns, or sequences by:

[4] F&R-1 Extending patterns that use addition, subtraction, multiplication, or symbols, up to 10 terms, represented by models (function machine), tables, sequences, or in problem situations (M4.2.1)

1. Extend this multiplication pattern to the 5th term.

$$4 * 2 = 8$$

$$4 * 20 = 80$$

$$4 * 200 = \underline{800}$$

$$4 * \underline{2000} = \underline{8000}$$

$$4 * \underline{20,000} = \underline{80,000}$$

[4] F&R- 2 (L) Using rules to express the generalization of a pattern using words, lists, or tables (M4.2.4)

1. Figure out the pattern and the rule used below, then fill in the blanks.

<u>In</u>	<u>Out</u>
7	21

<u>2</u>	6
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4	12
---	----

<u>6</u>	18
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Rule:

Multiply by 3

[4] F&R-3 (L) Using manipulatives, including a calculator, as tools when describing, extending, or representing a number sequence (M4.2.1 &M4.2.3)

Introduction:

Student uses blocks to build a sequenced number pattern.

First element: two blocks in a row

Second element: four blocks in a row

Third element: six blocks in a row

Etc.

Student explains (verbally or in writing) how this simple pattern grows and generalizes an explanation of the pattern. What would the tenth element be?

Build more complicated patterns with blocks such as staircase numbers, square numbers, base ten patterns, etc. Student builds the beginning pattern element from specific directions, then expands it independently. It is important that the student can generalize the explanation for pattern growth and clearly explain the thinking.

Use a calculator to extend number patterns such as multiples or repeated addition or subtraction. Student explains the pattern.

Explore and explain diverse patterns using many different manipulatives. One resource is AIMS supplementary math problem-solving books.

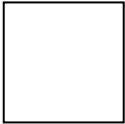
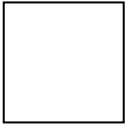
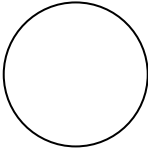
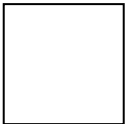
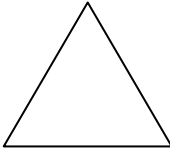
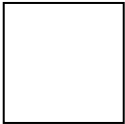
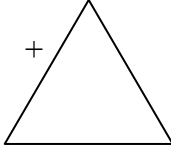
Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[4] F&R-4 Using an open number sentence (addition, subtraction or multiplication) to solve for an unknown represented by a box or circle (e.g., $9 \cdot = 36$, $\cdot 8=56$, $3 \cdot 6=$) (M4.2.5)

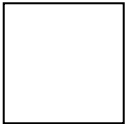
1. Each dog needs 8 booties for a dog mushing trip. One musher has 12 dogs. How many booties are needed for the trip? Write an open number sentence for this story and solve it.

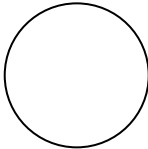
Answer: $(8 \times 12) = 96$

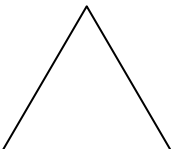
2. Mattie was playing a game with her little sister. She covered the same number with the same shape. Figure out the numbers that are hidden.

	+		=	8
	+		=	
	+		=	11

Answers:

 = **4**

 = **3**

 = **7**

5th Grade Functions and Relationships

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences by:

[5] F&R–1 & 2

- Extending patterns that use addition, subtraction, multiplication, division or symbols, up to 10 terms, represented by models (function machines), tables, sequences, or in problem situations (M4.2.1)
- Using rules to express the generalization of a pattern using words, lists, or tables (M4.2.4)

1. What are the next two numbers in the series below?

a. 35, 42, 49, 56, _____, _____

b. 16, 24, 32, 40, _____, _____

c. 1, 5, 25, 125, _____, _____

d. 1, 3, 9, 27, _____, _____

e. 1, 4, 9, 16, _____, _____

Explain in words what rules each of the patterns above follows:

a. _____

b. _____

c. _____

d. _____

e. _____

2. Kim needs \$100 to buy a new bike. She decides to save her money. The first week she saves \$1.00. The second week she saves \$2.00. The third week she saves \$4.00, and on the fourth week she saves \$8.00. If Kim continues saving with this pattern, which week will she have enough money to buy the bike?

Show your work. You may want to put your numbers in a table to help you see a pattern.

- a. week 8
- b. week 9
- c. week 6
- d. week 7

3. Explain the pattern you found in the above problem.

[5] F&R-3 Identifying or applying addition or subtraction patterns to find missing values in a function (M4.1.2)

1. Find the missing numbers in these patterns:

- a. 58, _____, 64, 67, 70, _____, _____
- b. _____, 16, 22, 28, _____, 40
- c. 157, 140, _____, 106, 89, _____

[5] F&R-4 (L) Using manipulatives, including a calculator, as tools when describing, extending, or representing a number sequence (M4.2.1 & M4.2.3)

Make sure students can use a calculator and other manipulatives to help when extending the above patterns. Assess this by observation.

Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[5] F&R–5 Using an open number sentence (addition, subtraction, multiplication, or division) to solve for an unknown represented by a box or circle (e.g., $256 \div 8$, $\div 8 = 56$, $36 \div 3 =$) (M4.2.5)

Solve to find the missing number in each of these equations.

1. $\square \times 111 = 888$

2. $(79 + 16) \div \square = 19$

3. $(\square + 10) \times 7 = 630$

4. $15 \times 6 = 3 \times \square$

5. $450 \div 50 = \square \div 8$

6. $256 \div \square = 8$

5th Grade Functions and Relationships

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences by:

[5] F&R–1 & 2

- Extending patterns that use addition, subtraction, multiplication, division or symbols, up to 10 terms, represented by models (function machines), tables, sequences, or in problem situations (M4.2.1)
- Using rules to express the generalization of a pattern using words, lists, or tables (M4.2.4)

1. What are the next two numbers in the series below?

- a. 42, 49, 56, 63, 70
- b. 24, 32, 40, 48, 56
- c. 5, 25, 125, 625, 3125
- d. 3, 9, 27, 81, 243
- e. 4, 9, 16, 25, 36

Explain in words what rules each of the patterns above follows:

- a. Add seven to the previous number or $(n+1)7$
- b. Add eight to the previous number or $(n+1)8$
- c. Multiply the previous number by 5 or 5^n
- d. Multiply the previous number by 3 or 3^n
- e. All of the perfect squares or n^2

2. Kim needs \$100 to buy a new bike. She decides to save her money. The first week she saves \$1.00. The second week she saves \$2.00. The third week she saves \$4.00, and on the fourth week she saves \$8.00. If Kim continues saving with this pattern, which week will she have enough money to buy the bike?

Show your work. You may want to put your numbers in a table to help you see a pattern.

<i>Week 1</i>	<i>1</i>
<i>Week 2</i>	<i>1+2 =3</i>
<i>Week 3</i>	<i>3+4 =7</i>
<i>Week 4</i>	<i>7+8 =15</i>
<i>Week 5</i>	<i>15+16 =31</i>
<i>Week 6</i>	<i>31+32 =63</i>
<i>Week 7</i>	<i>63 +64 =127</i>

- a. week 8
- b. week 9
- c. week 6
- d. week 7***

3. Explain the pattern you found in the above problem.

Each week she saved double the amount she saved the previous week, which was added to the total already saved.

[5] F&R-3 Identifying or applying addition or subtraction patterns to find missing values in a function (M4.1.2)

1. Find the missing numbers in these patterns:

- a. 58, 61, 64, 67, 70, 73, 76
- b. 10, 16, 22, 28, 34, 40
- c. 157, 140, 123, 106, 89, 72

[5] F&R–4 (L) Using manipulatives, including a calculator, as tools when describing, extending, or representing a number sequence (M4.2.1 & M4.2.3)

Make sure students can use a calculator and other manipulatives to help when extending the above patterns. Assess this by observation.

Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[5] F&R–5 Using an open number sentence (addition, subtraction, multiplication, or division) to solve for an unknown represented by a box or circle (e.g., $256 \div =8$, $\div 8=56$, $36 \div 3=$) (M4.2.5)

Solve to find the missing number in each of these equations.

1. $8 \times 111 = 888$

2. $(79 + 16) \div 5 = 19$

3. $(80 + 10) \times 7 = 630$

4. $15 \times 6 = 3 \times 30$

5. $450 \div 50 = 72 \div 8$

6. $256 \div 42 = 8$

6th Grade Functions and Relationships

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences by:

[6] F&R-1 Extending patterns (found in the number system, formed by multiples, factors, perfect squares up to 100, powers of ten), up to 10 terms, represented in tables, sequences, or in problem situations (M4.2.1)

1. Extend these patterns:

a. 1, 4, 9, 16, 25, 36, , ,

b. 1, 4, 16, 64, , ,

c. 1, 4, 7, 10, , ,

d. 10, 11, 12, 20, 21, , ,

2. Extend the pattern in this table:

22	2
44	4
66	6

[6] F&R-2 Using rules to express the generalization of a pattern using words, lists, or tables, with or without variables (M4.2.4)

1. What is the 10th term in the following pattern?

3, 102, 6, 104, 9, 106 ...

Explain the pattern in words:

2. Write the next three terms in the following pattern and write a general explanation of the pattern: 4, 12, 36, 108, _____, _____, _____

3. Kira is setting up tables for the Christmas potluck. If she uses 7 tables, she can seat 42 people; if she uses 9 tables, she can seat 54 people. Help Kira by finding a math rule to describe any pattern you see.

[6] F&R-3 Identifying or applying multiplication or division patterns to find missing values in a function (M4.2.2)

1. Complete the pattern by finding the missing numbers.

$$n \times 30 = 60 \quad n = \underline{\quad}$$

$$20 \times n = 600 \quad n = \underline{\quad}$$

$$200 \times 30 = n \quad n = \underline{\quad}$$

$$2,000 \times n = 60,000 \quad n = \underline{\quad}$$

2. Complete the pattern by finding the missing numbers.

$$11 \div n = 1 \quad n = \underline{\quad}$$

$$121 \div 11 = n \quad n = \underline{\quad}$$

$$1331 \div n = 121 \quad n = \underline{\quad}$$

$$14641 \div n = 1331 \quad n = \underline{\quad}$$

3. Describe the following pattern in words: 1134, 378, 126, 42...

4. Figure out the pattern and describe it in words.

input	2	1	$\frac{1}{2}$	$\frac{1}{4}$
output	-4	-2	-1	$-\frac{1}{2}$

[6] F&R-4 (L) Using manipulatives, including a calculator, as tools when describing, extending, or representing a number sequence (M4.2.1 & M 4.2.3)

1. Use manipulatives including calculators, pattern blocks, drawings, or classroom objects to illustrate, extend and describe the patterns from [6] F&R-1 above, then describe what functions you performed on your calculator to find the next terms.
2. Use pattern blocks, drawings, and classroom objects to have the students develop and solve patterns. Use the patterns above and have the students use calculators to continue each pattern to the 10th term.

Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[6] F&R-5 Solving for an unknown represented by a letter (addition, subtraction, multiplication, or division) (e.g., $3 \cdot n = 15$, $n - 5 = 12$) (M4.2.5)

Solve each of the unknowns in the equations below:

1. $4 \cdot n = 672$
 - a. 42
 - b. 168
 - c. 668
 - d. 2688
2. $x - 76 = 102$
 - a. 26
 - b. 34
 - c. 36
 - d. 178

3. $\frac{8}{r} = 96$

- a. $\frac{1}{12}$
- b. 12
- c. 88
- d. 104

4. $750 + y = 805$

- a. 45
- b. 50
- c. 55
- d. 1555

5. What number makes this a true number statement?

$$\frac{4}{7} = \frac{\quad}{28}$$

- a. 7
- b. 16
- c. 21
- d. 28

6th Grade Functions and Relationships Answer Key

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences by:

[6] F&R-1 Extending patterns (found in the number system, formed by multiples, factors, perfect squares up to 100, powers of ten), up to 10 terms, represented in tables, sequences, or in problem situations (M4.2.1)

1. Extend these patterns:

- a. 1, 4, 9, 16, 25, 36, 49, 64, 81
- b. 1, 4, 16, 64, 256, 1,024, 4,096
- c. 1, 4, 7, 10, 13, 16, 19
- d. 10, 11, 12, 20, 21, 22, 30, 31

2. Extend the pattern in this table:

22	2
44	4
66	6
88	8
<i>110</i>	<i>10</i>
<i>132</i>	<i>12</i>

[6] F&R-2 Using rules to express the generalization of a pattern using words, lists, or tables, with or without variables (M4.2.4)

1. What is the 10th term in the following pattern?

3, 102, 6, 104, 9, 106 ...*110*

Explain the pattern in words: *This pattern is a list within a list. Every other number in the list starting with the first number, 3, is a multiple of 3. Every other number in the list starting with the second number, 102, is two more than the previous number.*

2. Write the next three terms in the following pattern and write a general explanation of the pattern: 4, 12, 36, 108, **324, 972, 2916**

Beginning with the 4, multiply each number by 3 to get the next number.

3. Kira is setting up tables for the Christmas potluck. If she uses 7 tables, she can seat 42 people; if she uses 9 tables, she can seat 54 people. Help Kira by finding a math rule to describe any pattern you see.

Every table can seat 6 people.

[6] F&R-3 Identifying or applying multiplication or division patterns to find missing values in a function (M4.2.2)

1. Complete the pattern by finding the missing numbers.

$n \times 30 = 60$	$n = 2$
$20 \times n = 600$	$n = 30$
$200 \times 30 = n$	$n = 6,000$
$2,000 \times n = 60,000$	$n = 600$

2. Complete the pattern by finding the missing numbers.

$11 \div 11 = n$	$n = 1$
$n \div 11 = 11$	$n = 121$
$1331 \div n = 121$	$n = 11$
$14641 \div 11 = n$	$n = 1,331$

3. Describe the following pattern in words: 1134, 378, 126, 42...

Beginning with 1,134, find the next term by dividing by 3.

4. Figure out the pattern and describe it in words.

input	2	1	$\frac{1}{2}$	$\frac{1}{4}$
output	-4	-2	-1	$-\frac{1}{2}$

Multiply the input number by -2 to get the output number.

[6] F&R-4 (L) Using manipulatives, including a calculator, as tools when describing, extending, or representing a number sequence (M4.2.1 & M 4.2.3)

1. Use manipulatives including calculators, pattern blocks, drawings, or classroom objects to illustrate, extend and describe the patterns from [6] F&R-1 above, then describe what functions you performed on your calculator to find the next terms.
2. Use pattern blocks, drawings, and classroom objects to have the students develop and solve patterns. Use the patterns above and have the students use calculators to continue each pattern to the 10th term.

Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[6] F&R-5 Solving for an unknown represented by a letter (addition, subtraction, multiplication, or division) (e.g., $3 \cdot n = 15$, $n - 5 = 12$) (M4.2.5)

Solve each of the unknowns in the equations below:

1. $4 \cdot n = 672$
 - a. 42
 - b. 168***
 - c. 668
 - d. 2688
2. $x - 76 = 102$
 - a. 26
 - b. 34
 - c. 36
 - d. 178***

3. $\frac{8}{r} = 96$

- a. $\frac{1}{12}$ *
- b. 12
- c. 88
- d. 104

4) $750 + y = 805$

- a. 45
- b. 50
- c. **55***
- d. 1555

5. What number makes this a true number statement?

$$\frac{4}{7} = \frac{\quad}{28}$$

- a. 7
- b. **16***
- c. 21
- d. 28

7th Grade Functions and Relationships

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences including those represented in real-world situations by:

[7] F&R-1 Describing or extending patterns (linear), up to ten terms, represented in tables, sequences, or in problem situations (M4.3.1)

1. Consider these patterns, choose the correct pattern description, and find the next five terms of each.

_____ 323, 330, 337, 344, 351, _____, _____, _____, _____, _____

_____ .4x, .8x, 1.6x, 3.2x, 6.4x, _____, _____, _____, _____, _____

_____ .0001, .001, .01, .1, 1, 10, _____, _____, _____, _____, _____

_____ 108, 96, 84, 72, 60, _____, _____, _____, _____, _____

- a. multiply each previous term by 10
 - b. subtract 12 from each previous term
 - c. add 7 to each previous term
 - d. multiply each previous term by 2
2. Figure out the pattern used and complete the table below. Use 18, 54, and 27 for the answer choices.

108	9
108	10.8
108	13.5
108	a.
108	b.
108	c.

18
54
27

[7] F&R-2 Generalizing relationships (linear) using a table of ordered pairs, a function, or an equation (M4.3.4)

1. Melvin owns a snow machine shop and sells 5 different models of sleds. Melvin pays for the cost of the machines and shipping and then sells them at a higher price. The table below shows the cost and the selling price of each machine. What rule does Melvin use to calculate the selling price?

	Cost of machine	Selling price
Model #1	\$2,500	\$3,500
Model #2	\$3,200	\$4,480
Model #3	\$3,800	\$5,320
Model #4	\$4,200	\$5,880
Model #5	\$4,800	\$6,720

- a. \$1000 + the cost = the selling price
- b. (The cost x 10%) + the cost = the selling price
- c. (The cost x 20%) + the cost = the selling price
- d. (The cost x 40 %) + the cost = the selling price

2. Consider this equation and the unfinished ordered pairs. Then answer true or false to the questions below.

$$X + Y = 9$$

X	Y
3	a
b	5
c	-1

- True False a = -6
- True False a = 6
- True False b = -4
- True False b = 4
- True False c = 10
- True False c = 8

[7] F&R-3 Describing in words how a change in one variable in a formula affects the remaining variables (how changing the length affects the area of a quadrilateral) (M4.3.2)

1. Consider this formula and then answer the true and false questions below.

$$A = \frac{1}{2}bh$$

- | | | |
|------|-------|--|
| True | False | When you double the height, the area is doubled. |
| True | False | When you divide the base by 2, the area is doubled. |
| True | False | When the base is divided by 2, the area is divided by 2. |

2. Describe in writing how the area of a triangle is affected when this variable is changed.

$A = \frac{1}{2}bh$ when the height is 5 centimeters and then is changed to 10 centimeters.

3. Describe in writing how the area of a rectangle is affected when this variable is changed.

$A=lw$ when the length is 3 centimeters and is changed to 1.5 centimeters.

[7] F&R-4 (L) Using a calculator as a tool when describing, extending, or representing patterns (M4.3.3)

1. Use a calculator to extend these patterns, then describe the pattern and what functions you performed on your calculator to find the next terms.

a. 1, 4, 9, 16, 25, 36, 49, _____ , _____ , _____ , _____ , _____ ...

b. 1, 8, 27, 64, 125, 216, _____ , _____ , _____ , _____ , _____ ...

Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[7] F&R-5 Evaluating algebraic expressions (M4.3.5)

1. If $t = 11$ and $s = 5$, evaluate the following expression: $3t - 5s$

- a. 8
- b. 4
- c. -11
- d. 23

2. Evaluate this expression if $x = 7$ and $y = 3$:

$$7y - 2x$$

- a. 42
- b. 14
- c. 7
- d. 5

3. Evaluate this expression if $p=0$ and $s = -4$:

$$2s + 3p - 4(p-s)$$

- a. 16
- b. -32
- c. -12
- d. 32

[7] F&R-6 Solving or identifying solutions to one-step linear equations of the form $x \pm a=b$ or $ax=b$, where a and b are whole numbers, translating a story problem into an equation of similar form, or translating a story problem into an equation of similar form and solving it (M4.3.5)

1. Solve this equation, show your work, and choose the best answer: $5x + 8 = 18$

- a. $x = 2$
- b. $x = 5 \frac{1}{5}$
- c. $x = 5$
- d. $x = \frac{1}{2}$

2. Dennis has decided to save his money since he just got a job cleaning fish for the summer. He currently has \$157 in his account. He plans to work at the docks for 6 hours each day. He charges \$1/fish and he cleans 12 fish each hour on the average. Using this information, answer the questions below:

- a. How much will Dennis make (on average) each hour?
- b. How much will Dennis make (on average) each day?
- c. At the end of one week how much will he have made?
- d. If he deposits his earnings at the end of each week, how much will he have in the bank at the end of the first week?
- e. If the summer fish season lasts 6 weeks, how much will he have in his savings at the end of each week and at the end of the summer? Make a table to figure out the values.

7th Grade Functions and Relationships Answer Key

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences including those represented in real-world situations by:

[7] F&R-1 Describing or extending patterns (linear), up to ten terms, represented in tables, sequences, or in problem situations (M4.3.1)

1. Consider these patterns, choose the correct pattern description, and find the next five terms of each.

c 323, 330, 337, 344, 351, 358, 365, 372, 379, 386

d .4x, .8x, 1.6x, 3.2x, 6.4x, 12.8, 25.6, 51.2, 102.4, 204.8

a .0001, .001, .01, .1, 1, 10, 100, 1000, 10,000, 100,000, 1,000,000

b 108, 96, 84, 72, 60, 48, 36, 24, 12, 0

- a. multiply each previous term by 10
- b. subtract 12 from each previous term
- c. add 7 to each previous term
- d. multiply each previous term by 2

2. Figure out the pattern used and complete the table below. Use 18, 54, and 27 for the answer choices.

108	9
108	10.8
108	13.5
108	a. 18
108	b. 27
108	c. 54

18
54
27

The pattern is: Divide 108 by 12, then 10, then 8, then by each descending even number.

[7] F&R-2 Generalizing relationships (linear) using a table of ordered pairs, a function, or an equation (M4.3.4)

1. Melvin owns a snow machine shop and sells 5 different models of sleds. Melvin pays for the cost of the machines and shipping and then sells them at a higher price. The table below shows the cost and the selling price of each machine. What rule does Melvin use to calculate the selling price?

	Cost of machine	Selling price
Model #1	\$2,500	\$3,500
Model #2	\$3,200	\$4,480
Model #3	\$3,800	\$5,320
Model #4	\$4,200	\$5,880
Model #5	\$4,800	\$6,720

- a. \$1000 + the cost = the selling price
- b. (The cost x 10%) + the cost = the selling price
- c. (The cost x 20%) + the cost = the selling price
- d. (The cost x 40 %) + the cost = the selling price***

2. Consider this equation and the unfinished ordered pairs. Then answer true or false to the questions below.

$$X + Y = 9$$

X	Y
3	a
b	5
c	-1

- True **False*** a = -6
- True*** False a = 6
- True **False*** b = -4
- True*** False b = 4
- True*** False c = 10
- True **False*** c = 8

[7] F&R-3 Describing in words how a change in one variable in a formula affects the remaining variables (how changing the length affects the area of a quadrilateral) (M4.3.2)

1. Consider this formula and then answer the true and false questions below.

$$A = \frac{1}{2}bh$$

- | | | |
|--------------|---------------|--|
| True* | False | When you double the height, the area is doubled. |
| True | False* | When you divide the base by 2, the area is doubled. |
| True* | False | When the base is divided by 2, the area is divided by 2. |

2. Describe in writing how the area of a triangle is affected when this variable is changed.

$A = \frac{1}{2}bh$ when the height is 5 centimeters and then is changed to 10 centimeters.

The area of the triangle is doubled.

3. Describe in writing how the area of a rectangle is affected when this variable is changed.

$A=lw$ when the length is 3 centimeters and is changed to 1.5 centimeters.

The area of the rectangle is half of the original.

[7] F&R-4 (L) Using a calculator as a tool when describing, extending, or representing patterns (M4.3.3)

1. Use a calculator to extend these patterns, then describe the pattern and what functions you performed on your calculator to find the next terms.

a. 1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144 ...the pattern is n squared.

b. 1, 8, 27, 64, 125, 216, 343, 512, 729, 1000, 1331 ...the pattern is n cubed

Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[7] F&R-5 Evaluating algebraic expressions (M4.3.5)

1. If $t = 11$ and $s = 5$, evaluate the following expression: $3t - 5s$

a. 8^*

b. 4

c. -11

d. 23

2. Evaluate this expression if $x = 7$ and $y = 3$: $7y - 2x$

a. 42

b. 14

c. 7^*

d. 5

3. Evaluate this expression if $p=0$ and $s = -4$: $2s + 3p - 4(p-s)$

a. 16

b. -24^*

c. -12

d. 32

[7] F&R-6 Solving or identifying solutions to one-step linear equations of the form $x \pm a = b$ or $ax = b$, where a and b are whole numbers, translating a story problem into an equation of similar form, or translating a story problem into an equation of similar form and solving it (M4.3.5)

1. Solve this equation, show your work, and choose the best answer: $5x + 8 = 18$

a. $x = 2$ * $5x + 8 - 8 = 18 - 8$ $5x = 10$ $5x/5 = 10/5$ $x = 2$

b. $x = 5 \frac{1}{5}$

c. $x = 5$

d. $x = \frac{1}{2}$

2. Dennis has decided to save his money since he just got a job cleaning fish for the summer. He currently has \$157 in his account. He plans to work at the docks for 6 hours each day. He charges \$1/fish and he cleans 12 fish each hour on the average. Using this information, answer the question below:

a. How much will Dennis make (on average) each hour? **\$12/hour**

b. How much will Dennis make (on average) each day? **\$72/day**

c. At the end of one week how much will he have made
\$504/WEEK (7 X \$72)

d. If he deposits his earnings at the end of each week, how much will he have in the bank at the end of the first week?
\$661 (\$504 + \$157)

e. If the summer fish season lasts 6 weeks, how much will he have in his savings at the end of each week and at the end of the summer? Make a table to figure out the values.

Week 1	661
Week 2	1165
Week 3	1669
Week 4	2173
Week 5	2677
Week 6	3181

8th Grade Functions and Relationships

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences including those represented in real-world situations by:

[8] F&R-1 Describing or extending patterns (linear), up to the n th term, represented in, tables, sequences, graphs, or in problem situations (M4.3.1)

1. Write the next three numbers in the sequence.

2, 10, 50, 250, _____, _____, _____.

2. Fill in the table with numbers that follow the previous pattern.

X	Y
7	28
8	32
9	36
	100
	156

3. Which of the tables below shows the results of dividing X by 12?

a.

X	Y
12	24
6	18
2	14

b.

X	Y
12	0
6	-6
2	-10

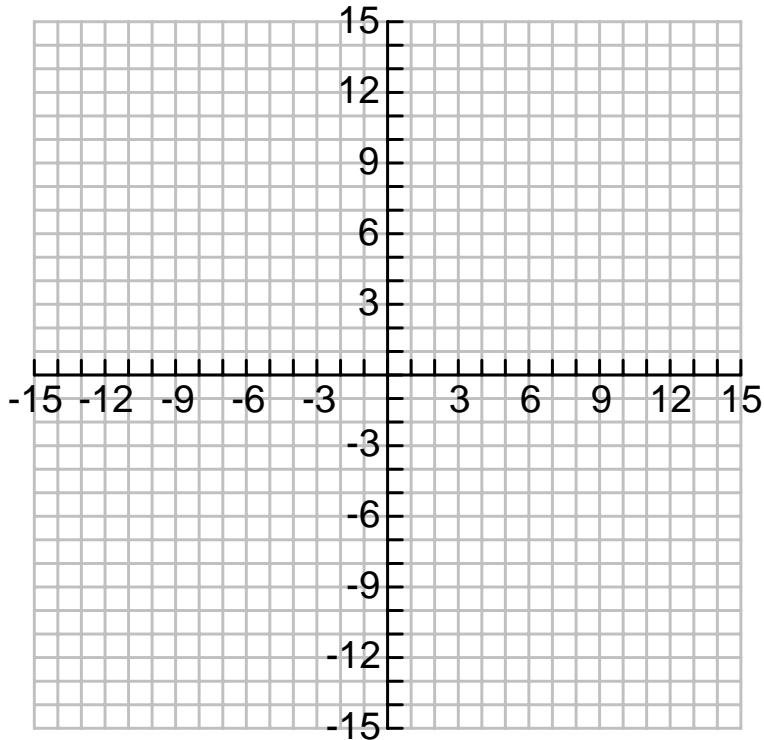
c.

X	Y
12	144
6	72
2	24

d.

X	Y
12	1
6	1/2
2	1/6

[8] F&R-2 Generalizing relationships (linear) using a table of ordered pairs, a graph, or an equation (M4.3.4)



1. Find ordered pairs that solve the equation $y = 2x$. Then graph this equation using the ordered pairs. (Show your work.)

x	y
1	
	4
3	
4	

[8] F&R-3 Describing in words how a change in one variable in a formula affects the remaining variables (how changing the length affects the area of quadrilaterals or volume of a rectangular prism) (M4.3.2)

1. The old gravel pit pond which measures approximately 20 feet long, 30 feet wide, and 8 feet deep was dredged to provide more gravel. The new dimensions are 40 feet long, 30 feet wide and 8 feet deep. How much larger is the new volume compared to the old volume? Describe how the increase in length affects the volume of the gravel pit.

- a. 20 ft^3
- b. 480 ft^3
- c. 4800 ft^3
- d. 9600 ft^3

Description:

Halley wants to enlarge her prize-winning 8-inch-by-10-inch photograph.

- 2. If the shorter side increases to 24 inches, how does the longer side change?
- 3. What is the area of Halley's original photograph?
- 4. What is the area of the enlarged photograph?
- 5. How does the photograph's area change?
 - a. It increases by a factor of 6.
 - b. It increases by a factor of 2.
 - c. It increases by a factor of 3.
 - d. It increases by a factor of 9.

[8] F&R-4 (L) Using a calculator as a tool when describing, extending, or representing patterns (M4.3.3)

Local: Use a calculator to extend these patterns, then describe the pattern and what functions you performed on your calculator to find the next terms.

1. Write the next three terms in the following pattern:

3, 12, 48, 192, _____, _____, _____

Description:

2. Write the next three terms in the following pattern:

.2, 1, 5, 25, _____, _____, _____

Description:

3. Write the next three terms in the following pattern:

$$12 \times 111 = 1332$$

$$13 \times 111 = 1443$$

$$14 \times 111 = \underline{\hspace{2cm}}$$

$$15 \times 111 = \underline{\hspace{2cm}}$$

$$16 \times 111 = \underline{\hspace{2cm}}$$

4. What is the 7th term in the following pattern?

$\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \dots$ _____

Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[8] F&R-5 Translating a written phrase to an algebraic expression (M4.3.5)

1. Choose the number sentence that means “2 more than 2 times a number.”
 - a. $2 + 2n$
 - b. $2 / 2n$
 - c. $2(2n)$
 - d. $2 - 2n$

[8] F&R-6 Solving or identifying solutions to two-step linear equations of the form $ax \pm b = c$, where a , b and c are rational numbers, and $a \neq 0$, translating a story problem into an equation of similar form, or translating a story problem into an equation of similar form and solving it (M4.3.5)

1. On a class trip, Elise brings \$30 to the Sea Life Center. She spends \$18 on gifts and purchases three corn dogs, and then she has spent all of her money. Which equation can you use to find the cost of a corn dog?
 - a. $3x = 30 + 18$
 - b. $3x + 18 = 30$
 - c. $3 + 18x = 30$
 - d. $30x = 3 + 18$

2. Frank was given 2 bags of dimes and 8 loose pennies as payment for his work. He knows that he was supposed to be paid \$4.28. Write an equation that will show how many dimes are in each bag. (Each bag has the same number of dimes.) Then solve the equation.

3. Choose the correct solution for the equation: $5x + 8 = 43$

- a. $x = 10$
- b. $x = 7$
- c. $x = 175$
- d. $x = 5$

4. Choose the correct solution for the equation: $x/2 - 12 = 24$

- a. $x = 18$
- b. $x = 24$
- c. $x = 6$
- d. $x = 72$

8th Grade Functions and Relationships Answer Key

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences including those represented in real-world situations by:

[8] F&R-1 Describing or extending patterns (linear), up to the n th term, represented in, tables, sequences, graphs, or in problem situations (M4.3.1)

1. Write the next three numbers in the sequence.

2, 10, 50, 250, 1250, 6250, 31,250 .

2. Fill in the table with numbers that follow the previous pattern.

X	Y
7	28
8	32
9	36
25	100
39	156

3. Which of the tables below shows the results of dividing X by 12?

a.

X	Y
12	24
6	18
2	14

b.

X	Y
12	0
6	-6
2	-10

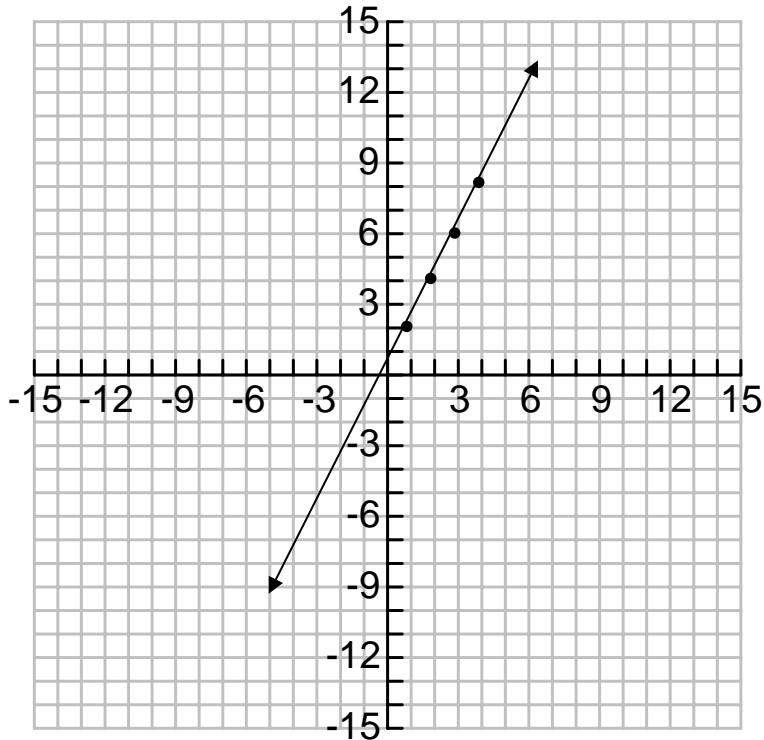
c.

X	Y
12	144
6	72
2	24

**d.*

X	Y
12	1
6	1/2
2	1/6

[8] F&R-2 Generalizing relationships (linear) using a table of ordered pairs, a graph, or an equation (M4.3.4)



1. Find ordered pairs that solve the equation $y = 2x$. Then graph this equation using the ordered pairs. (Show your work.)

x	y
1	2
2	4
3	6
4	8

[8] F&R-3 Describing in words how a change in one variable in a formula affects the remaining variables (how changing the length affects the area of quadrilaterals or volume of a rectangular prism) (M4.3.2)

1. The old gravel pit pond which measures approximately 20 feet long, 30 feet wide, and 8 feet deep was dredged to provide more gravel. The new dimensions are 40 feet long, 30 feet wide and 8 feet deep. How much larger is the new volume compared to the old volume? Describe how the increase in length affects the volume of the gravel pit.

a. 20 ft^3

Original pit: $20 \times 30 \times 8 = 4800 \text{ ft}^3$

b. 480 ft^3

New pit: $40 \times 30 \times 8 = 9600 \text{ ft}^3$

c. $4800 \text{ ft}^3 *$

Difference is $9600 - 4800 = 4800 \text{ ft}^3$

d. 9600 ft^3

Description: Doubling one dimension doubles the volume.

Halley wants to enlarge her prize-winning 8-inch-by-10-inch photograph.

2. If the shorter side increases to 24 inches, how does the longer side change?

The longer side increases to 30 inches.

3. What is the area of Halley's original photograph?

80 in^2

4. What is the area of the enlarged photograph?

720 in^2

5. How does the photograph's area change?

a. It increases by a factor of 6.

b. It increases by a factor of 2.

c. It increases by a factor of 3.

d. It increases by a factor of 9.*

[8] F&R-4 (L) Using a calculator as a tool when describing, extending, or representing patterns (M4.3.3)

Local: Use a calculator to extend these patterns, then describe the pattern and what functions you performed on your calculator to find the next terms.

1. Write the next three terms in the following pattern:

3, 12, 48, 192, 768, 3,072, 12,288

Description: *Multiply the previous term by 4.*

2. Write the next three terms in the following pattern:

.2, 1, 5, 25, 125, 625, 3,125

Description: *Multiply the previous term by 5.*

3. Write the next three terms in the following pattern:

$$12 \times 111 = 1332$$

$$13 \times 111 = 1443$$

$$14 \times 111 = \mathbf{1554}$$

$$15 \times 111 = \mathbf{1665}$$

$$16 \times 111 = \mathbf{1776}$$

4. What is the 7th term in the following pattern?

$$\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16} \dots \frac{1}{128}$$

Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[8] F&R-5 Translating a written phrase to an algebraic expression (M4.3.5)

1. Choose the number sentence that means “2 more than 2 times a number.”

a. $2 + 2n$ *

b. $2 / 2n$

c. $2(2n)$

d. $2 - 2n$

[8] F&R-6 Solving or identifying solutions to two-step linear equations of the form $ax \pm b = c$, where a, b and c are rational numbers, and $a \neq 0$, translating a story problem into an equation of similar form, or translating a story problem into an equation of similar form and solving it (M4.3.5)

1. On a class trip, Elise brings \$30 to the Sea Life Center. She spends \$18 on gifts and purchases three corn dogs, and then she has spent all of her money. Which equation can you use to find the cost of a corn dog?

a. $3x = 30 + 18$

b. $3x + 18 = 30$ *

c. $3 + 18x = 30$

d. $30x = 3 + 18$

2. Frank was given 2 bags of dimes and 8 loose pennies as payment for his work. He knows that he was supposed to be paid \$4.28. Write an equation that will show how many dimes are in each bag. (Each bag has the same number of dimes.) Then solve the equation.

$2b + .08 = 4.28$

$2b = 4.20$

$b = 2.10 = 21 \text{ dimes}$

3. Choose the correct solution for the equation: $5x + 8 = 43$

a. $x = 10$

b. $x = 7^*$

c. $x = 175$

d. $x = 5$

4. Choose the correct solution for the equation: $x/2 - 12 = 24$

a. $x = 18$

b. $x = 24$

c. $x = 6$

d. $x = 72^*$

9th Grade Functions and Relationships

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences including those represented in real-world situations by:

[9] F&R-1 Describing or extending patterns (families of functions: linear, quadratic, absolute value), up to the n th term, represented in tables, sequences, graphs, or in problem situations (M4.4.1)

1. Complete the tables.

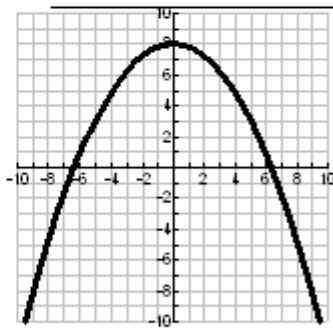
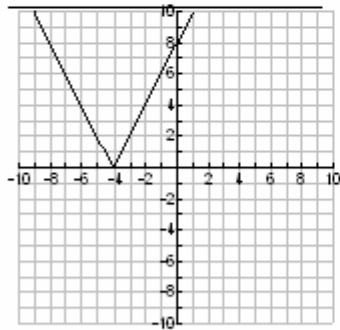
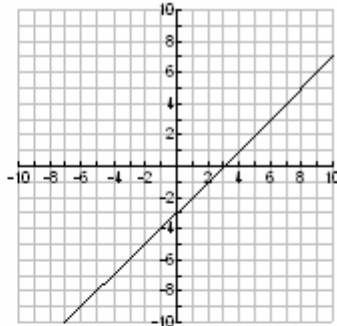
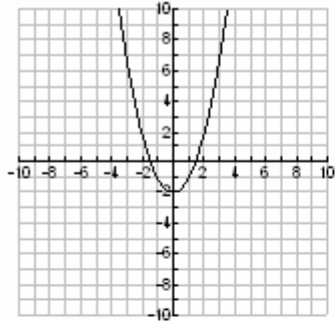
1	2	3	4	n
4	7	10		

1	2	3	4	5	n
0	4	10	18		

-2	-1	0	1	2	3	n
-1	0	1	2	3		

[9] F&R-2 Generalizing relationships (linear, quadratic, absolute value) using a table of ordered pairs, a graph, or an equation (M4.4.4)

1. Look at the graphs below and state if the graph is linear, quadratic, or absolute value.



[9] F&R-3 Describing in words how a change in one variable in a formula affects the remaining variables (e.g., how changing the radius affects the volume of a cylinder) (M4.3.2)

1. The formula for the volume of a right cylinder is

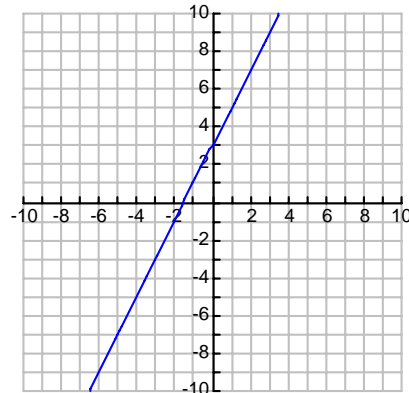
$$V = \pi r^2 h$$

if the r (radius) increases what happens to the V (volume of the cylinder)?

- a. increases
- b. decreases
- c. stays the same

[9] F&R-4 (L) Using a calculator as a tool when describing, extending, representing, or graphing patterns or linear equations (M4.4.2)

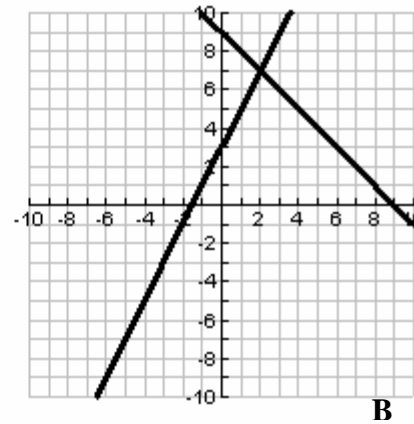
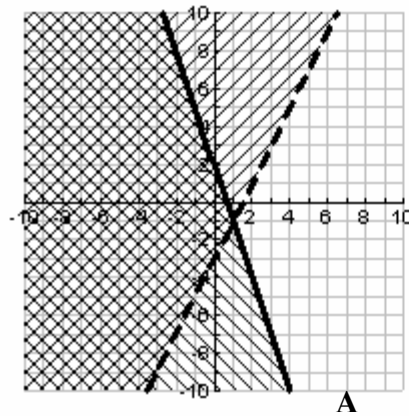
1. Use your graphing calculator to graph the following line to predict what the y value is when x is 124.



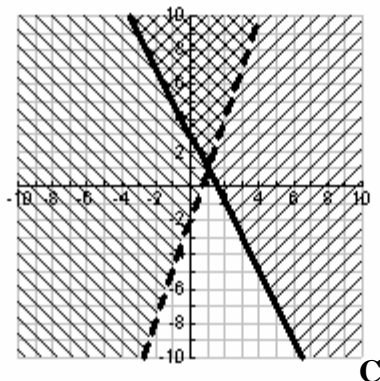
Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[9] F&R-5 Modeling (graphically or algebraically) or solving situations (including real-world applications) using systems of linear equations (M4.4.3)

Match the following systems of equations and inequalities with their correct graphs.



1. _____ $y = 2x + 3$
 $y = -x + 9$
2. _____ $y > 2x - 3$
 $y \leq -3x + 2$
3. _____ $y \geq -2x + 3$
 $y > 3x - 2$



[9] F&R-6 Solving or identifying solutions to multi-step linear equations of the form $ax \pm b = cx \pm d$, where a, b, c and d are rational numbers and $a \neq 0, c \neq 0$ (M4.4.2)

1. Katie and Tom are selling pens. Katie makes a dollar for every two pens she sells and has \$5 dollars that she made yesterday. Tom makes \$2 for every three pens he sells and he owes the teacher \$4 from yesterday. After selling pens all day they have the same amount of money. Using the equation below, how many pens did they sell?

$$\frac{1}{2}x + 5 = \frac{2}{3}x - 4$$

- a. 9
- b. $\frac{45}{2}$
- c. 54
- d. 3

[9] F&R-7 Solving literal equations or formulas for a variable involving one step (e.g. solve for t when $d = rt$) (M4.4.2)

1. Solve for b in the equation $A = bh$.

- a. $b = \frac{h}{A}$
- b. $b = Ah$
- c. $b = \frac{A}{h}$
- d. $b = A - h$

9th Grade Functions and Relationships Answer Key

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences including those represented in real-world situations by:

[9] F&R-1 Describing or extending patterns (families of functions: linear, quadratic, absolute value), up to the n th term, represented in tables, sequences, graphs, or in problem situations (M4.4.1)

1. Complete the tables.

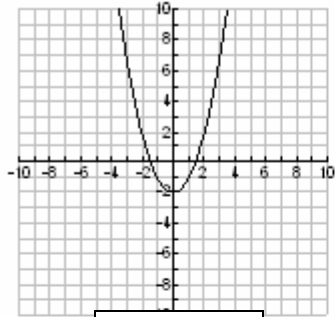
1	2	3	4	n
4	7	10	13	$3n+1$

1	2	3	4	5	n
0	4	10	18	28	$(n-1)(n+2)$

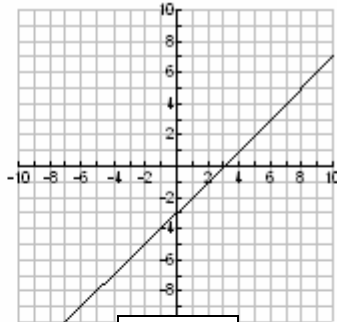
-2	-1	0	1	2	3	n
-1	0	1	2	3	4	$(n+1)$

[9] F&R-2 Generalizing relationships (linear, quadratic, absolute value) using a table of ordered pairs, a graph, or an equation (M4.4.4)

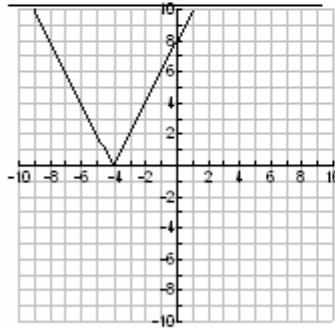
1. Look at the graphs below and state if the graph is linear, quadratic, or absolute value.



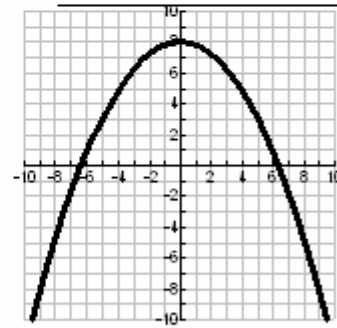
quadratic



linear



absolute value



quadratic

[9] F&R-3 Describing in words how a change in one variable in a formula affects the remaining variables (e.g., how changing the radius affects the volume of a cylinder) (M4.3.2)

1. The formula for the volume of a right cylinder is

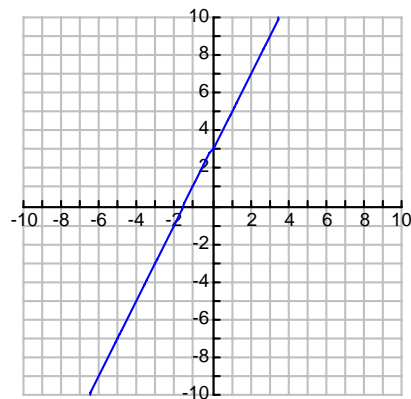
$$V = \pi r^2 h$$

if the r (radius) increases what happens to the V (volume of the cylinder)?

- a. increases *
- b. decreases
- c. stays the same

[9] F&R-4 (L) Using a calculator as a tool when describing, extending, representing, or graphing patterns or linear equations (M4.4.2)

1. Use your graphing calculator to graph the following line to predict what the y value is when x is 124.

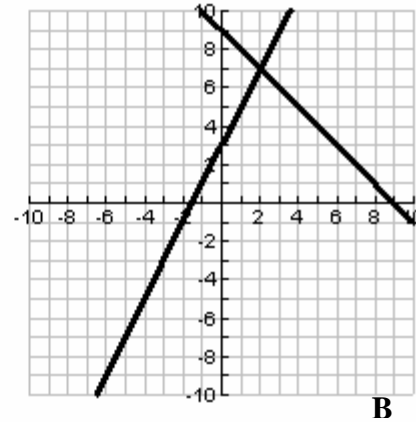
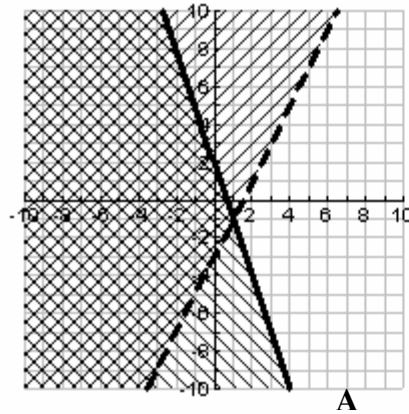


The equation of the line is $y = 2x + 3$. (124, 251) is a point on the line.

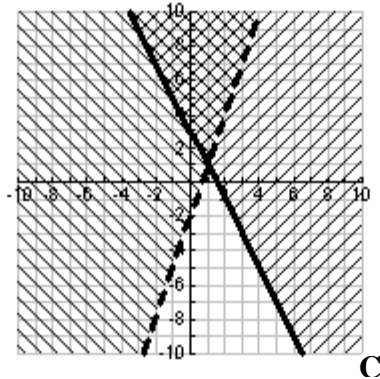
Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[9] F&R-5 Modeling (graphically or algebraically) or solving situations (including real-world applications) using systems of linear equations (M4.4.3)

1. Match the following systems of equations and inequalities with their correct graphs.



1. **B** $y = 2x + 3$
 $y = -x + 9$
2. **A** $y > 2x - 3$
 $y \leq -3x + 2$
3. **C** $y \geq -2x + 3$
 $y > 3x - 2$



[9] F&R-6 Solving or identifying solutions to multi-step linear equations of the form $ax \pm b = cx \pm d$, where a, b, c and d are rational numbers and $a \neq 0, c \neq 0$ (M4.4.2)

1. Katie and Tom are selling pens. Katie makes a dollar for every two pens she sells and has \$5 dollars that she made yesterday. Tom makes \$2 for every three pens he sells and he owes the teacher \$4 from yesterday. After selling pens all day they have the same amount of money. Using the equation below, how many pens did they sell?

$$\frac{1}{2}x + 5 = \frac{2}{3}x - 4$$

- a. 9
- b. $\frac{45}{2}$
- c. **54***
- d. 3

[9] F&R-7 Solving literal equations or formulas for a variable involving one step (e.g. solve for t when $d = rt$) (M4.4.2)

1. Solve for b in the equation $A = bh$.

- a. $b = \frac{h}{A}$
- b. $b = Ah$
- c. **$b = \frac{A}{h}$ ***
- d. $b = A - h$

10th Grade Functions and Relationships

Describing Patterns and Functions: The student demonstrates conceptual understanding of functions, patterns, or sequences including those represented in real-world situations by:

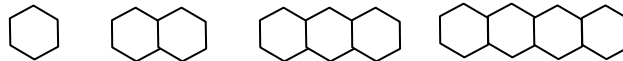
[10] F&R-1 Describing or extending patterns (families of functions: linear, quadratic, absolute value), up to the n th term, represented in tables, sequences, graphs, or in problem situations (M4.4.1)

- Which is the next term in the pattern: 5.5, 9, 12.5, 16, ... ?
 - 17.5
 - 19.5
 - 28.5
 - None of the above

- Complete the table.

1	2	3	4	5		10	n
-4	-3	0	5	12	32		

- Dan is using hexagonal tiles as a border around his kitchen floor. The table below shows the relationship between the number of tiles and the perimeter of the figure.



Tiles	1	2	3	4	5
Perimeter	6	10	14	18	22

Write a sentence that gives the perimeter if there are n tiles.

[10] F&R-2 Generalizing equations and inequalities (linear, quadratic, absolute value) using a table of ordered pairs or a graph (M4.4.4)

1. Torvald uses an equation to produce the following table of ordered pairs:

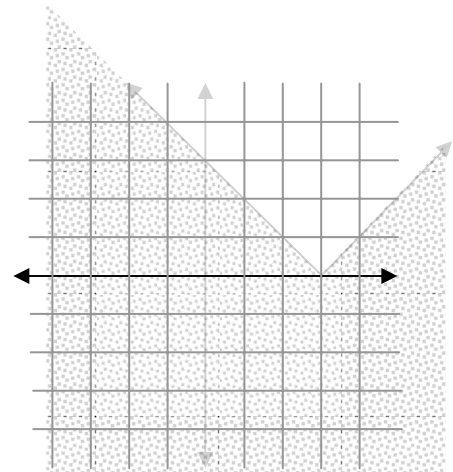
x	y
-2	-7
0	-3
2	1
4	5

Which equation describes this list?

- a. $y = -3x$
- b. $y = x + 4$
- c. $y = 2x - 3$
- d. $y = 2x^2$

2. Which equation gives the graph at the right?

- a. $y \leq |x - 3|$
- b. $y > |x + 3|$
- c. $y < |x - 3|$
- d. $y \geq |x - 3|$



[10] F&R-3 Describing in words how a change in one variable or constant in an equation affects the outcome of the equation (M4.3.2)

1. The equation $A = \frac{1}{2}h(b_1 + b_2)$ is used to find the area of a trapezoid. If all the other dimensions are held constant and b_2 decreases, the area of the trapezoid _____.
- a. increases
 - b. decreases
 - c. remains the same

2. Charmain tests two spring scales and finds that as more mass is added to the scales they stretch longer. But the scales are not the same; Scale A stretches according to the equation $l = 2.5m$, while Scale B follows the equation $l = 6m$. (l is the length of the spring, m is the mass of the object hung on the spring.)

When a mass of 3 kilograms is hung from the two scales, which one stretches farther?

- a. Scale A
- b. Scale B

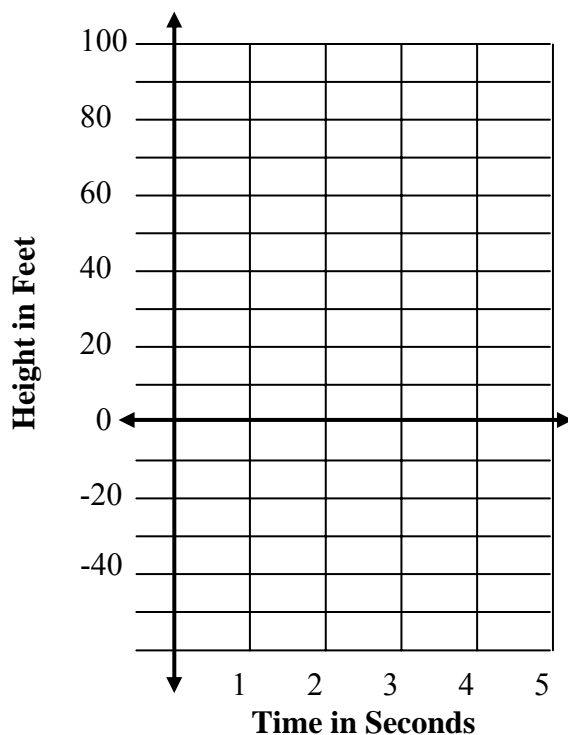
[10] F&R-4 (L) Using a calculator as a tool when describing, extending, representing, or graphing patterns, linear or quadratic equations (M4.4.2)

1. The height of a ball thrown into the air follows the curve described by the equation:

$$h = -16t^2 + 65t + 20.$$

Use a calculator to complete the table. Graph the coordinates on the graph at the below.

Time (t)	0	1	2	3		5
Height (h)	20	69			24	



Modeling and Solving Equations and Inequalities: The student demonstrates algebraic thinking by:

[10] F&R-5 Modeling (graphically or algebraically) or solving situations using systems of linear equations or inequalities (including real-world applications) (M4.4.3)

1. Dylan gets his pictures developed at Photo-Phast. Photo-Phast uses the equation $C = \$0.15 \cdot p$ to calculate the cost, C , of p photographs. Anne gets her pictures developed at Quick-Pix. Quick-Pix uses the equation $C = \$0.10 \cdot p + \1.20 to calculate their charges. Dylan and Anne paid the amount of money for their pictures. How many pictures did they get developed?
 - a. 5 photos
 - b. 24 photos
 - c. 36 photos
 - d. 120 photos

[10] F&R-6 Selecting and using the quadratic formula to solve problems (M4.4.2)

1. Use the quadratic formula to find x : $0 = -(\frac{1}{2})x^2 + 3x + 8$
 - a. $x = 22$ or 28
 - b. $x = 0$ or -8
 - c. $x = -2$ or 8
 - d. No Solution

[10] F&R-7 Solving or identifying solutions to literal equations or formulas for a variable involving multi-steps (e.g., solve for h when $A = \frac{1}{2}h(b_1 + b_2)$) (M4.4.2)

1. Given the equation $A = 3Pr - 8$, solve for r .
 - a. $r = 3PA - 8$
 - b. $r = \frac{1}{3}A - 8(P)$
 - c. $r = 3A - P + 8$
 - d. $r = (A + 8)/3P$

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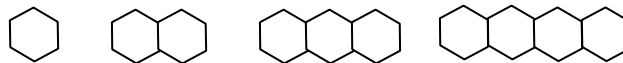
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- Complete the table.

1	2	3	4	5	7	10	n
-4	-3	0	5	12	32	77	$n^2 - 2n - 3$

- Dan is using hexagonal tiles as a border around his kitchen floor. The table below shows the relationship between the number of tiles and the perimeter of the figure.



Tiles	1	2	3	4	5
Perimeter	6	10	14	18	22

Write a sentence that gives the perimeter if there are n tiles.

Sample response: If n is the number of tiles, then $4n + 2$ is the perimeter of the figure.

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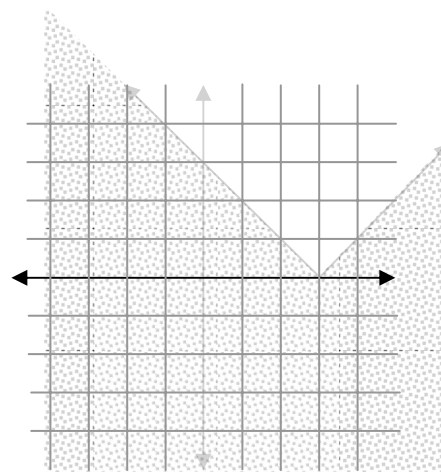
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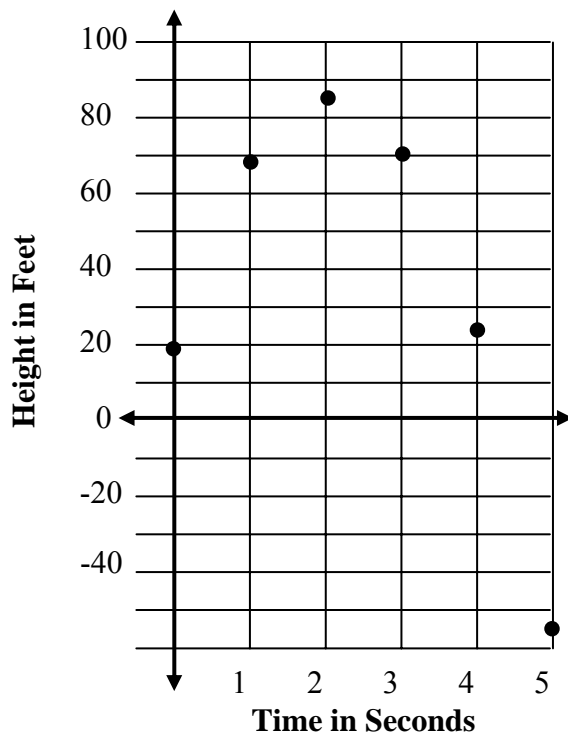
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