Lesson Plan

F.LE.A.2: Construct a Function Rule from Other Views of a Function

FUNCTIONS

F.LE.A.2: Construct a Function Rule from Other Views of a Function

A. Construct and compare linear, quadratic, and exponential models and solve problems.

2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

Overview of Lesson

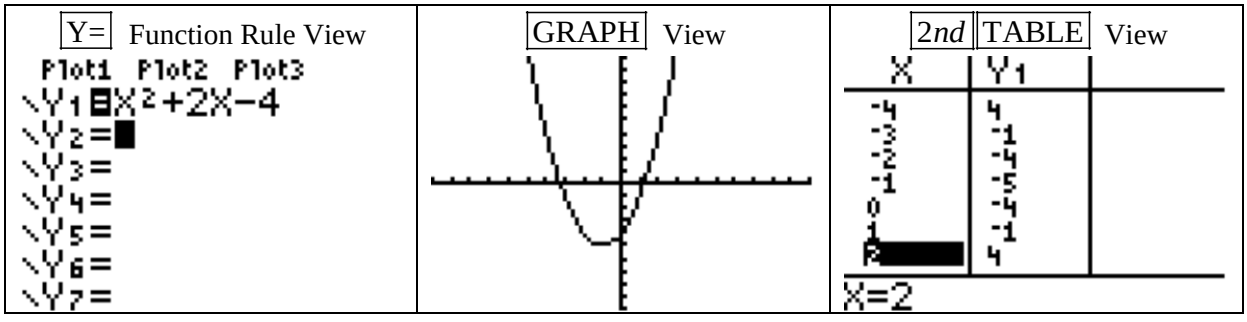
- activate prior knowledge and review learning objectives (see above)
- explain vocabulary and/or big ideas associated with the lesson
- connect assessment practices with curriculum
- model an assessment problem and solution strategy
- facilitate guided discussion of student activity
- facilitate guided practice of student activity
Selected problem set(s)
- facilitate a summary and share out of student work
Homework – Write the Math Assignment

BIG IDEAS:

A function can be represented mathematically through four inter-related views. These are:

1. a function rule (equation)
2. a table of values
3. a graph.
4. words

The TI-83+ graphing calculator allows you to input the function rule and access the graph and table of values, as shown below:

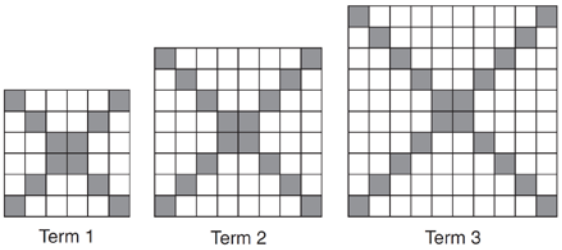


Students must be able to move from one view of a function to another. The problems in this set can generally be better understood by using different views of functions. For example, it is easier for some students to understand the first problem if the problem is modeled using a table of values

Lesson Plan

REGENTS PROBLEMS TYPICAL OF THIS STANDARD

1. The diagrams below represent the first three terms of a sequence.



Assuming the pattern continues, which formula determines a_n, the number of shaded squares in the *n*th term?

a. $a_n = 4n + 12$
c. $a_n = 4n + 4$
b. $a_n = 4n + 8$
d. $a_n = 4n + 2$

2. The third term in an arithmetic sequence is 10 and the fifth term is 26. If the first term is a_1, which is an equation for the *n*th term of this sequence?

a. $a_n = 8n + 10$
c. $a_n = 16n + 10$
b. $a_n = 8n - 14$
d. $a_n = 16n - 38$

3. The table below represents the function *F*.

x	3	4	6	7	8
$F(x)$	9	17	65	129	257

The equation that represents this function is

a. $F(x) = 3^x$
c. $F(x) = 2^x + 1$
b. $F(x) = 3x$
d. $F(x) = 2x + 3$

4. A laboratory technician studied the population growth of a colony of bacteria. He recorded the number of bacteria every other day, as shown in the partial table below.

t (time, in days)	0	2	4
f(t) (bacteria)	25	15,625	9,765,625

Which function would accurately model the technician's data?

a. $f(t) = 25^t$
b. $f(t) = 25^{t+1}$
c. $f(t) = 25t$
d. $f(t) = 25(t + 1)$

5. Which function is shown in the table below?

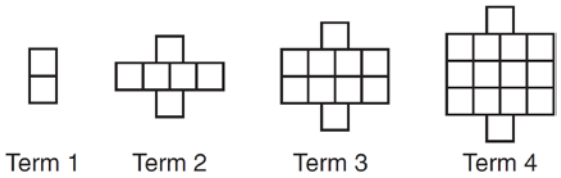
x	f(x)
−2	$\frac{1}{9}$
−1	$\frac{1}{3}$
0	1
1	3
2	9
3	27

a. $f(x) = 3x$
b. $f(x) = x + 3$
c. $f(x) = -x^3$
d. $f(x) = 3^x$

6. Which recursively defined function represents the sequence $3, 7, 15, 31, \ldots$?

a. $f(1) = 3,\ f(n + 1) = 2^{f(n)} + 3$
b. $f(1) = 3,\ f(n + 1) = 2^{f(n)} - 1$
c. $f(1) = 3,\ f(n + 1) = 2f(n) + 1$
d. $f(1) = 3,\ f(n + 1) = 3f(n) - 2$

7. A pattern of blocks is shown below.



If the pattern of blocks continues, which formula(s) could be used to determine the number of blocks in the *n*th term?

I	II	III
$a_n = n + 4$	$a_1 = 2$ $a_n = a_{n-1} + 4$	$a_n = 4n - 2$

a. I and II
b. I and III
c. II and III
d. III, only

8. Which recursively defined function has a first term equal to 10 and a common difference of 4?

a. $f(1) = 10$
$f(x) = f(x - 1) + 4$

b. $f(1) = 4$
$f(x) = f(x - 1) + 10$

c. $f(1) = 10$
$f(x) = 4f(x - 1)$

d. $f(1) = 4$
$f(x) = 10f(x - 1)$

F.LE.A.2: Construct a Function Rule from Other Views of a Function
Answer Section

1. ANS: B
Strategy: Examine the pattern, then test each formula and eliminate wrong choices.
Term 1 has 12 shaded squares.
Term 2 has 16 shaded squares.
Term 3 has 20 shaded squares.

Choice	Equation	Term 1 = 12	Term 2 = 16	Term 3 = 20
a	$a_n = 4n + 12$	= 16 (eliminate)		
b	$a_n = 4n + 8$	= 12 (correct)	= 16 (correct)	= 20 (correct)
c	$a_n = 4n + 4$	= 8 (eliminate)		
d	$a_n = 4n + 2$	= 6 (eliminate)		

PTS: 2 REF: 061424ai NAT: F.LE.A.2 TOP: Sequences

2. ANS: B
Strategy: Build the sequence in a table, then test each equation choice and eliminate wrong answers.

a_1	a_2	a_3	a_4	a_5
		10		26

The a_4 term must be half way between 10 and 26, so it must be 18.
The common difference is 8, so we can fill in the rest of the table as follows:

a_1	a_2	a_3	a_4	a_5
-6	2	10	18	26

The first term in the sequence is -6.

Choice	Equation	Term a_1 = -6	Term a_3 = 10	Term a_5 = 26
a	$a_n = 8n + 10$	= 18 (eliminate)		
b	$a_n = 8n - 14$	= -6 (correct)	= 10 (correct)	= 26 (correct)
c	$a_n = 16n + 10$	= 26 (eliminate)		
d	$a_n = 16n - 38$	= -12 (eliminate)		

PTS: 2 REF: 081416ai NAT: F.LE.A.2 TOP: Sequences

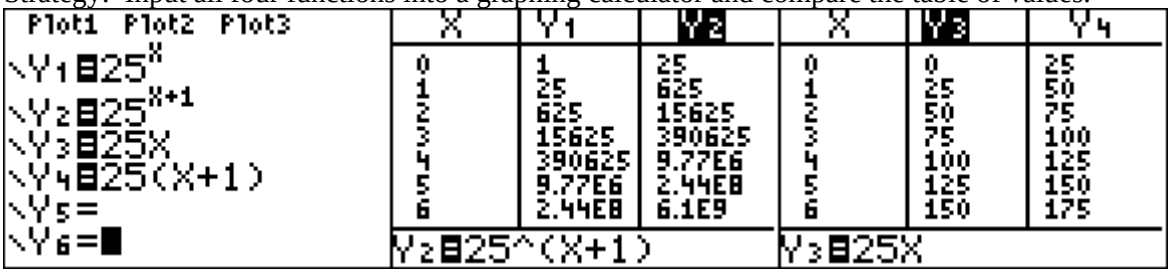
3. ANS: C
Strategy: Test each function to see if it fits the table:

Choice	Equation	(3,9)	(6,65)	(8,257)
a	$F(x) = 3^x$	$F(3) = 3^3 = 27$ (eliminate)		
b	$F(x) = 3x$	$F(3) = 3(3) = 9$ (correct)	$F(6) = 3(6) = 18$ (eliminate)	
c	$F(x) = 2^x + 1$	$F(3) = 2^3 + 1 = 9$ (correct)	$F(6) = 2^6 + 1 = 65$ (correct)	$F(8) = 2^8 + 1 = 257$(correct)
d	$F(x) = 2x + 3$	$F(3) = 2(3) + 3 = 9$ (correct)	$F(6) = 2(6) + 3 = 15$ (eliminate)	

PTS: 2 REF: 061415ai NAT: F.LE.A.2 TOP: Modeling Exponential Equations

4. ANS: B

Strategy: Input all four functions into a graphing calculator and compare the table of values.

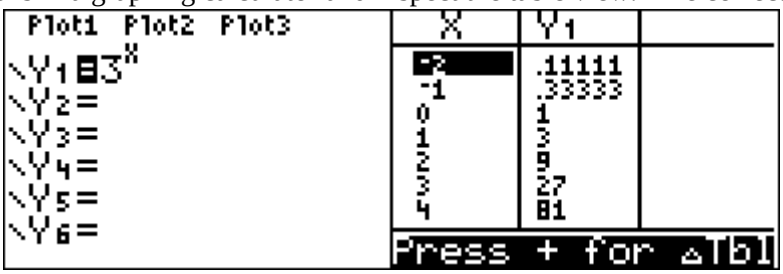


Answer choice *b* produces a table of values that agrees with the table of values in the problem.

PTS: 2 REF: 061513ai NAT: F.LE.A.2
TOP: Modeling Linear and Exponential Equations

5. ANS: D

Strategy: Put the functions in a graphing calculator and inspect the table view. The correct answer is $f(x) = 3^x$.



PTS: 2 REF: 011616ai NAT: F.LE.A.2 TOP: Families of Functions

6. ANS: C

Each choice has a first term equal to 3.
Each additional term is twice its preceding term plus 1.
Strategy: Eliminate wrong answers and check.
All choices have show the the first term equals three: $f(1) = 3$.
Eliminate $f(1) = 3,\ f(n+1) = 2^{f(n)} + 3$ and $f(1) = 3,\ f(n+1) = 2^{f(n)} - 1$ because they are exponential.
Eliminate $f(1) = 3,\ f(n+1) = 3f(n) - 2$ because each term is not three times its preceding term minus two.
Check $f(1) = 3,\ f(n+1) = 2f(n) + 1$ as follows:

$$f(1) = 3,\ f(n+1) = 2f(n) + 1$$

$$f(2) = 2(3) + 1 = 7$$

$$f(3) = 2(7) + 1 = 15$$

$$f(4) = 2(15) + 1 = 31$$

$f(1) = 3,\ f(n+1) = 2f(n) + 1$ produces the sequence 3, 7, 15, 31,.....

PTS: 2 REF: 011618ai NAT: F..IF.A.3 TOP: Sequences

7. ANS: C

Strategy: Examine the pattern, then test each formula and eliminate wrong choices.

Term 1 has 2 squares.
Term 2 has 6 squares.
Term 3 has 10 squares.
Term 4 has 14 squares

n	1	2	3	4
a_n	2	6	10	14

Formula	Equation	Term 1 = 2	Term 2 = 6	Term 3 = 10	Term 4 = 14
I	$a_n = n + 4$	$a_n = n + 4$ $a_1 = 1 + 4$ $a_1 = 5$ This is wrong, so eliminate choices a and b..			
II	$a_1 = 2$ $a_n = a_{n-1} + 4$	$a_1 = 2$ correct	$a_n = a_{n-1} + 4$correct $a_2 = a_1 + 4$ $a_2 = 2 + 4$ $a_2 = 6$	$a_n = a_{n-1} + 4$correct $a_3 = a_2 + 4$ $a_3 = 6 + 4$ $a_3 = 10$	$a_n = a_{n-1} + 4$ $a_4 = a_3 + 4$ $a_4 = 10 + 4$ $a_3 = 14$ correct
III	$a_n = 4n - 2$	$a_n = 4n - 2$ $a_1 = 4(1) - 2$ $a_1 = 4 - 2$ $a_1 = 2$ correct	$a_n = 4n - 2$ $a_1 = 4(1) - 2$ $a_1 = 4 - 2$ $a_1 = 2$ correct	$a_n = 4n - 2$ $a_1 = 4(1) - 2$ $a_1 = 4 - 2$ $a_1 = 2$ correct	$a_n = 4n - 2$ $a_1 = 4(1) - 2$ $a_1 = 4 - 2$ $a_1 = 2$ correct

Choose answer choice *c* because Formulas II and III are both correct.

PTS: 2 REF: 061522ai NAT: F.BF.A.1 TOP: Sequences

8. ANS: A

Strategy: Eliminate wrong answers.

Choices *b* and *d* have first terms equal to 4, but the problem states that the first term is equal to 10. Therefore, eliminate choices *b* and *d*.

A common difference of 4 requires the addition or subtraction of 4 to find the next term in the sequence. Eliminate choice *c* because choice *c multiplies* the preceding term by 4.

Choice *a* is correct because the first term is 10 and 4 is added to each preceding term.

PTS: 2 REF: 081514ai NAT: F.IF.A.3 TOP: Sequences

Lesson Plan

Homework - Write the Math Assignment

START Write your name, date, topic of lesson, and class on your paper.

NAME: Mohammed Chen
DATE: December 18, 2015
LESSON: Missing Number in the Average
CLASS: Z

PART 1a. Copy **the problem** from the lesson and underline/highlight key words.
PART 1b. State your understanding of **what the problem is asking**.
PART 1c. **Answer** the problem.
PART 1d. Explanation of **strategy** with all work shown.

PART 2a. Create **a new problem** that addresses the same math idea.
PART 2b. State your understanding of **what the new problem is asking**.
PART 2c. **Answer** the new problem.
PART 2d. Explanation of **strategy** used in solving the new problem with all work shown.

Clearly label each of the eight parts.

Grading Rubric

Each homework writing assignment is graded using a four point rubric, as follows:

Part 1. The Original Problem	**Up to 2** points will be awarded for: a) correctly restating the original problem; b) explicitly stating what the original problem is asking; c) answering the original problem correctly; and d) explaining the math.
Part 2. My New Problem	**Up to 2** points will be awarded for: a) creating a new problem similar to the original problem; b) explicitly stating what the new problem is asking; c) answering the new problem correctly; and d) explaining the math.

This assignment/activity is designed to incorporate elements of Polya's four step universal algorithm for problem solving with the idea that writing is thinking. Polya's four steps for solving any problem are:

1. Read and understand the problem.
2. Develop a strategy for solving the problem.
3. Execute the strategy.
4. Check the answer for reasonableness.

Lesson Plan

EXEMPLAR OF A WRITING THE MATH ASSIGNMENT

Part 1a. The Problem

TOP Electronics is a small business with five employees. The mean (average) weekly salary for the five employees is $360. If the weekly salaries of four of the employees are $340, $340, $345, and $425, what is the salary of the fifth employee?

Part 1b. What is the problem asking?

Find the salary of the fifth employee.

Part 1c. Answer

The salary of the fifth employee is $350 per week.

Part 1d. Explanation of Strategy

The arithmetic mean or average can be represented algebraically as:

$$\overline{X} = \frac{x_1 + x_2 + \ldots + x_n}{n}$$

I put information from the problem into the formula. The problem says there are 5 employees, so $n = 5$. The problem also gives the mean (average) salary and the salaries of 4 of the employees. These numbers can be substituted into the formula as follows:

$$360 = \frac{340 + 340 + 345 + 425 + x_5}{5}$$

$$1800 = 340 + 340 + 345 + 425 + x_5$$

$$1800 = 1450 + x_5$$

$$1800 - 1450 = x_5$$

$$350 = x_5$$

Check: $360 = \frac{340 + 340 + 345 + 425 + 350}{5} = \frac{1800}{5} = 360$

Part 2a. A New Problem

Joseph took five math exams this grading period and his average score on all of the exams is 88. He remembers that he received test scores of 78, 87, 94, and 96 on four of the examinations, but he has lost one examination and cannot remember what he scored on it. What was Joseph's score on the missing exam?

Part 2b What is the new problem asking?

Find Joseph's score on the missing exam.

Part 2c. Answer to New Problem

Joseph received a score of 85 on the missing examination.

Part 2d. Explanation of Strategy

I substitute information from the problem into the formula for the arithmetic mean, as follows:

$$88 = \frac{78 + 87 + 94 + 96 + x_5}{5}$$

$$440 = 355 + x_5$$

$$85 = x_5$$

$$88 = \frac{78 + 87 + 94 + 96 + 85}{5} = \frac{440}{5} = 88$$

The answer makes sense.