EXPLORING FUNCTIONS 2

SECTION 2.1 FUNCTIONS

Name: Key Date: ______ Period: ______

Vocabulary

DEFINITION	EXAMPLE
Function and Function Notation relationship between variables A rule that assigns to each element of a given set of inputs one & only one output value	$d(t) = 50t$ d of t equals 50t
Independent Variable input variable	t
Dependent Variable output variable	d
Domain set of all inputs for a function (c = number of cats, independent var.)	if $P(c) = 3c$, whole numbers
Range set of all outputs for a function (P = pounds of cat food, dependent var.)	if $P(c) = 3c$, non-negative integer multiples of 3

EXPLORATION 1

1. For each of the following examples, decide which variable is the dependent variable. Explain your choice.
   a. If you buy $4 raffle tickets, the number of tickets T purchased and the total cost of the tickets C.

   T is independent, you can think of cost of tickets being based on number of tickets purchased.
   C is dependent

   b. If your car gets 35 miles per gallon, the number gallons G used and the number of miles M driven.

   M is independent, G is dependent, because the number of miles driven does not depend on the number of gallons purchased (since you do not drive just because you have fuel)

2. Brainstorm and discuss settings other relationships between two quantities could be labeled with variables. Which would be the dependent variable?

   Answers will vary
   t = time, = episodes of TV watched in a TV marathon
   t, the time the marathon lasts, is the independent variable

EXAMPLE 1

Mary drives a car for t hours at a constant rate of 50 miles per hour. She drives d miles during this time. The time t and the distance d are related. Find an expression for d in terms of t.

d depends on t

t	d
1	50
2	100
3	150
...	...
t	$t \cdot 50$

$d(t) = 50t$

PROBLEM 1

What is the value of $d(8)$ and what does it represent in words?

what is the distance traveled in 8 hours? (8 is the time)

We know $d(t) = 50t$. So $d(8) = 50(8)$

$d(8) = 400$. Mary drives 400 miles in 8 hours.

EXPLORATION 2

For each of the following situations, think about what the inputs and outputs represent. For each case, do negative inputs make sense? Do the inputs have to be whole numbers? How about the outputs? Describe all the possible inputs and outputs.

1. Mary rides in a car for t at a constant rate of 50 miles per hour. The distance traveled is $d(t) = 50t$.

   input: $t \geq 0$ output: $d(t) \geq 0$

   can be negatives? no must be whole numbers? no, not inputs, not outputs

2. Raffle tickets cost \$4 per ticket. The total cost for T tickets is $C(T) = 4T$.

   T is the input: whole numbers C(T) is the output: non-negative integer multiples of 4

   can be neg? X can be neg? X

   must be whole? ✓ must be whole? ✓

3. The car get 35 miles per gallon. The number of miles you can drive using G gallons is $M(G) = 35G$.

   G is the input: $G \geq 0$ M(G) is the output: $M(G) \geq 0$

   can be neg? X can be neg? X

   must be whole? X must be whole? X

EXAMPLE 2

For each of the functions determine the its domain:

1. $P(x) = 4x$, the perimeter of a square whose sides have length x.

   sides are a positive length: $x > 0$

2. $f(x) = 4x$. x can be any number, so the domain is all numbers

3. $h(x) = \frac{1}{x}$.

   $\frac{1}{0}$ cannot be done, so x can be any number except 0.

EXAMPLE 3

Suppose that tickets to the movies sell for \$3 each. How much does it cost to purchase 1 ticket? 2 tickets? 5 tickets? x tickets?

What is the input or independent variable?

number of tickets bought, call it x

What is the output or dependent variable?

cost of tickets (total), call it C

Write the relationship between the independent and dependent variables in words and then as a equation using functional notation.

total cost of movie tickets is 3 times number of tickets

$C(x) = 3x$

Make a table for these inputs.

Number of Ticket	Cost
1	$C(1) = 3(1) = 3$
2	$C(2) = 3(2) = 6$
3	$C(3) = 3(3) = 9$
4	$C(4) = 3(4) = 12$
5	$C(5) = 3(5) = 15$
x	$C(x) = 3(x) = 3x$

EXPLORATION 3

Discovering the rule for a function is an important step in understanding any particular function. Consider the function with inputs and outputs as described below. Do you see a pattern? Complete the last two lines. Write down the formula of the function.

Input $= x$	Output $= f(x)$
1	11
2	12
3	13
4	14
5	15
x	$x + 10$

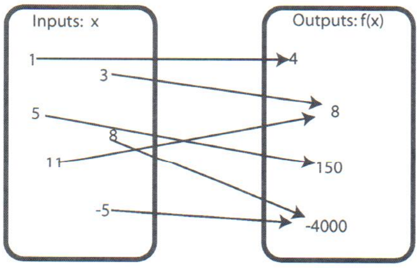
each output is 10 more than the input

$f(x) = x + 10$

EXPLORATION 4

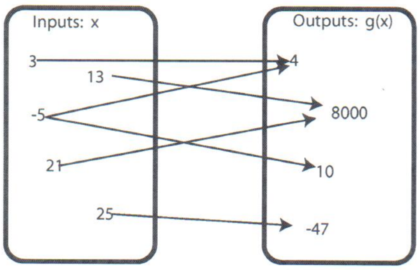
1. For each of the diagrams below, the arrows represent a rule for assigning output values to the given inputs x. For each case, determine if the rule describes a function.

A.



yes, each input has only one output

B.



no, -5 has 2 outputs

Answers will vary

2. Make up your own rule that is a function. $f(x) = 2x - 1$
3. Make up your own rule that is not a function. input is any number, function is $f(x) = -x$ or x

EXAMPLE 4

Isabel is uses the function $C(x) = 8x$ to describe the cost (in dollars) of buying x tickets to a 3D movie. Describe in words what this function represents.

The cost of buying x tickets is 8 times x.

So each ticket costs $8.

In the next exploration, you get to make up your own story to match a formula!

EXPLORATION 5

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

Answers will vary

1. Imagine you are a teacher and you want to make word problem so that your students will come up with the formula for $f(x)$. Make up a story that matches the formula. Describe in words what $f(x)$ represents. What does the 3 represent in your story? What about the 2?

   Janet eats 2 candies. After that, she eats candies in groups of 3. Write a formula for how many candies Janet has eaten, in terms of how many groups of 3 she has eaten.

2. Add to your story. Now you want the students to solve the equation $17 = 3x + 2$.

   Janet has eaten 17 candies. How many groups of 3 candies has she eaten?

3. Share your story with your neighbors. How are their stories similar? How are they different?

   Answers will vary.

Ordered Pairs

EXAMPLE 5

Suppose that the rule for a function f is given by the equation $f(x) = 5x$. Find $f(2)$, $f(3)$, $f(5)$, $f(10)$, $f(t)$, and $f(3t)$.

Solution

Input $= x$	Output $= f(x)$	Ordered Pair
2	$5(2) = 10$	$(2, 10)$
3	$5(3) = 15$	$(3, 15)$
5	$5(5) = 25$	$(5, 25)$
10	$5(10) = 50$	$(10, 50)$
t	$5(t) = 5t$	$(t, 5t)$
$3t$	$5(3t) = 15t$	$(3t, 15t)$

SUMMARY (What I learned today)