

# 5.1 Representing Patterns

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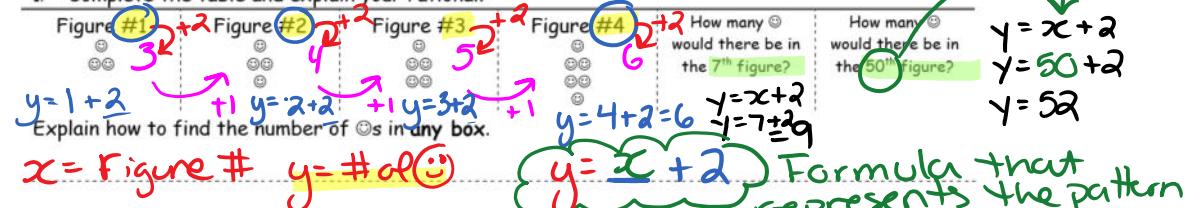
## 5.1 REPRESENTING PATTERNS

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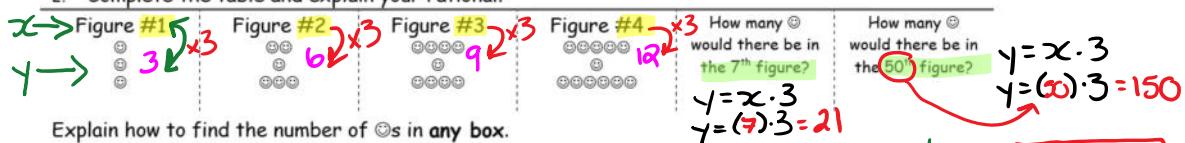
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Recognizing patterns...building equations...

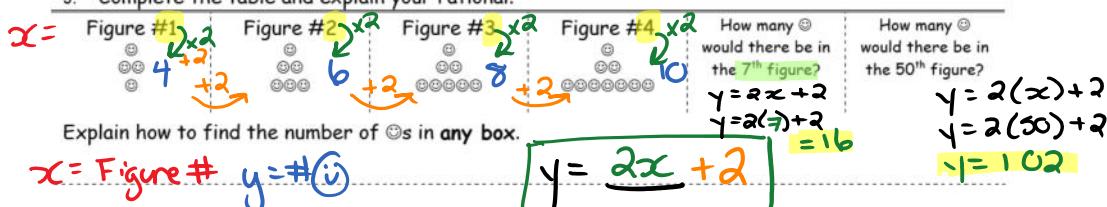
1. Complete the table and explain your rational.



2. Complete the table and explain your rational.



3. Complete the table and explain your rational.



Definition:

Rate of change: The rate of change for a set of numbers is the measure by which each number in the sequence is changing.

- Given 5, 10, 15, 20... The rate of change is addition by 5 each time.
- Given 9, 7, 5, 3... The rate of change is subtraction by 2 each time.

amount

### TABLE OF VALUES

Determine the pattern, complete the table of values and state the rate of change.

34.

x	y
1	11
2	12
3	13
4	14
5	15

is a list of your coordinates

Rate of change:

+1

$$(1, 11), (2, 12), (3, 13), (4, 14), (5, 15)$$

35.

x	y
1	7
2	11
3	15
4	19
5	23

Rate of change:

+4

36.

x	y
1	10
2	8
3	6
4	4
5	2

Rate of change:

-2

### Expression vs. Equation

Expression      \* NO = sign

- use algebra (numbers & variables)
- math phrase to represent a problem

Example:  
#36  $y - 2 ; x + 1$

Equation      \* IS an = sign

- use algebra
- statement of equality with 1 or more variables.

Example:  
 $y = 2x + 2$

### How Can We Represent Patterns?

Example #1: As a fundraiser, the Recycling Club is going to sell t-shirts for \$15 each.

Fill in the table of values for the relationship. How are n and D related?

Number of t-shirts sold ( <u>n</u> )	Total amount raised, in dollars ( <u>D</u> )
0	0
1	15
2	30
3	45
4	60
5	75

Write an **equation** that calculates the total amount raised, D, in dollars, when n t-shirts are sold.

$$D = 15 \cdot n$$

② To find "D" we multiplied "n" tshirts sold by \$15  
 $\Rightarrow n \cdot 15$   
 $\Rightarrow n \times 15 = 15n$

③ Check your equation using substitution:  
 e.g. you wrote  $D = n + 15$  as your equation  
 (WRONG)  $D = (4) + 15 = \$19$  X error  
 (CORRECT)  $D = 15 \cdot n$   $D = 15 \cdot (4) = \$60$  ✓  
 correct.

When two variables are related, it is called a relation.

Relations can be represented in 4 different ways:

- words to describe the pattern
- wrote an equation  
( $D = 15n$ )
- Table of values
- Plot a graph of the relationship  
(Table of values  $\Rightarrow (x, y)$  coordinates)

Describe a written pattern in a table of values, a graph and an equation.

<b>Study the Pattern</b> <b>Words</b> Jason cuts lawns as his summer job. He charges a travelling fee of \$10 plus \$20/hour for his time.	24. Fill out the <u>table of values</u> . Let $x = \text{Hours}$ & $y = \text{Income}$	25. Plot as many points as will fit. <u>Graph</u>	Answer the questions.
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How can you ensure that your equation is correct?  
Substitute values from the table into the equation and make sure they work. For example  $20(6)+10=130$ . Correct.

**Check with substitution**

### Discrete VS. Continuous Relationships

**Discrete**

- distinct quantities counted.
- a definite amount of values between 2 points

ex. # of pages in a book, # of students in a class

**Continuous**

- quantity that can be divided continuously
- all numbers (any numbers) can exist between 2 points.

ex. height, time, age, speed

**Example #2:** Another club member suggests a different price for the t-shirts.  
Here is the table of values.

Number of t-shirts sold ( $n$ )	Total amount raised, in dollars ( $D$ )
0	\$ 0
2	25
4	50
6	75
8	100
10	125

+2  
+2  
+2  
+2  
+2

needs to show both variables  
"n"

How is this table of values different from the first one?

# of T-shirts ( $n$ ) increases by 2 each time

Explain how you can use the **table** to find out **how much each t-shirt is being sold for**.

can divide the total amount raised ( $D$ ) by the ' $n$ ' t-shirts sold ex.  $25 \div 2 = 12.50$  }  $75 \div 6 = 12.50$  } \$12.50

Why did we start our table of values at 0?

To show a clear increase (or decrease) in the pattern.  
⇒ rate of change is obvious

Write a formula.  $D = 12.5n$

$$D = \$12.50 \cdot n$$

3

**PRACTICE**

For the questions below you need to think about how  $n$  and  $D$  are related.

1. Write an equation to go with each table of values.

a)

$n$	$D$
0	0
1	5
2	10
3	15
4	20
5	25

$D = 5n$

b)

$n$	$D$
0	0
2	5
4	10
6	15
8	20
10	25

$D = 2.5n$

c)

$n$	$D$
0	0
5	30
10	60
15	90
20	120
25	150

what is the relation between 5 and 30?  $\times 6$

$D = 6n$

Check each of your equations above using substitution: (try at least 2 values)

a)  $D = 5n$   
 $= 5(2) = 10 \checkmark$   
 $= 5(5) = 25 \checkmark$

b)  $D = 2.5n$   
 $= 2.5(6) = 15 \checkmark$   
 $= 2.5(10) = 25 \checkmark$

c)  $D = 6n$   
 $= 6(5) = 30 \checkmark$   
 $= 6(15) = 90 \checkmark$

2. The distance  $D$  (in km) a car can travel on  $L$  litres of fuel is given by the formula  $D = 8.2L$ . What is the meaning of the number 8.2?

$D = 8.2L$  ← Litres of fuel  
 distance (km) \* 8.2 is the rate of change. Means you can travel 8.2 km/L "per"

$L$	$D$
0	0
1	8.2
2	16.4
3	24.6

\*Build a table of values

3. The temperature of a solution  $T$  (in  $^{\circ}\text{C}$ ) after  $t$  minutes is given by  $T = 2.3t$ . What is the meaning of the number 2.3?

$T = 2.3t$  ← time (min)  
 Temp in  $^{\circ}\text{C}$  \* 2.3 is the rate of change. Means that the Temp. increases  $2.3^{\circ}\text{C}/\text{min}$

$t$	$T$ Temp ( $^{\circ}\text{C}$ )
0	0
1	2.3
2	4.6
3	6.9

**Example #3:** The Recycling Club has found a manufacturer for the t-shirts they want to sell. The manufacturer charges \$50 to make the silkscreen and then \$10 for printing each t-shirt.

Fill in the table of values and write an equation for C.

Number of t-shirts printed (n)	Total cost, in dollars (C)
0	50
1	60
2	70
3	80
4	90
5	100

cost \$50 + (\$10 · n) → \$10 for each tshirt.

$$C = \underline{\underline{50}} + (\underline{\underline{10}} \cdot \underline{\underline{n}})$$

$$C = 50 + 10n$$

Check your equation using substitution:

$$C = 50 + 10n$$

$$= 50 + 10(0) = 50 \checkmark$$

$$= 50 + 10(3) = 80 \checkmark$$

$$= 50 + 10(5) = 100 \checkmark$$

sub-in "n-values"

Why aren't there any negative values in our table of values?

↳ Because we are dealing with items (can't have -tshirts) and cost.

**Example #5:** Here is a partial table of values for another t-shirt manufacturer. Complete the table of values.

- ① Find the pattern
- ② Use pattern to determine initial cost.

Write the equation for this relationship :

$$C = \underline{\underline{45}} + \underline{\underline{15}}n$$

Check your equation using substitution:

Number of t-shirts printed (n)	Total cost, in dollars (C)
0	45
1	60
2	75
3	90
4	105
5	120

set-up fee = \$45  
each t-shirt costs = \$15

$$\begin{aligned} C &= 45 + 15n \\ &= 45 + 15(2) = 75 \checkmark \\ &= 45 + 15(4) = 105 \checkmark \\ &= 45 + 15(5) = 120 \checkmark \end{aligned}$$

### PRACTICE

1. A car rental company charges \$35 per day, plus \$0.10 for each kilometer given.

Fill in the table of values showing the relationship between the total cost for the day ( $C$ ) and the distance driven ( $d$ ), and then write the equation for  $C$ .

$$C = 35 + 0.10d$$

check  $C = 35 + 0.10(100) = 45 \checkmark$   
 $= 35 + 0.10(200) = 55 \checkmark$

Distance driven ( $d$ )	Total cost ( $C$ )
0	35
50	40
100	45
150	50
200	55

$50 \text{ km} \times \$0.10/\text{km}$   
 $50(0.10) = \$5$

initial cost!

2. Here is a partial table of values for a different car rental company.

Find the daily cost and the cost per kilometer, and then write the equation for the total cost.

$$C = 50 + 0.20d$$

$$C = 50 + 0.20(150) = 80 \checkmark$$

$50 + 30$

Distance driven ( $d$ )	Total cost ( $C$ )
0	\$50
50	\$60
100	\$70
150	\$80
200	\$90

daily cost.

each day the distance  $\uparrow 50\text{ km}$  and the cost  $\uparrow$  by \$10  
 $50, \$10 \div 50\text{ km} = \$0.20/\text{km}$

3. For a final car rental company the equation to calculate the total cost is  $C = 0.12d + 35$ .

- a) What is the daily cost? Explain how you know.

\$35 because there is no variable, so it is a flat fee

- b) What is the cost per kilometer? Explain how you know.

\$0.12/km because 0.12 is being multiplied by "d"

4. The temperature  $T$  of a solution after  $t$  minutes is given by  $T = 13 + 0.5t$ .

- a) What is the meaning of the number 13?

13 is the starting temp. of the solution at  $t = 0$

- b) What is the meaning of the number 0.5?

0.5 means the solution is increasing  $0.5^\circ\text{C}$  each min



Required  
1, 2, 3, 4, 5, 7, 8, 9,  
10, 11

Extra Practice  
6, 12, 13, 16

Extension  
14, 15

Assignment #5.1 pg 162 - 165