

5.1 Representing Patterns

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5.1 REPRESENTING PATTERNS

Name: _____

Block: _____

Recognizing patterns...building equations...

1. Complete the table and explain your rational.

Figure #1	Figure #2	Figure #3	Figure #4	How many ☉ would there be in the 7 th figure?	How many ☉ would there be in the 50 th figure?
☉ ☉	☉☉ ☉☉	☉☉☉ ☉☉☉	☉☉☉☉ ☉☉☉☉		
3	4	5	6		
Explain how to find the number of ☉s in any box.					

$y = 1 + 2$
 $y = 2 + 2$
 $y = 3 + 2$
 $y = 4 + 2 = 6$
 $y = x + 2$
 $y = 7 + 2 = 9$
 $y = 50 + 2 = 52$

$x = \text{Figure \#}$ $y = \# \text{ of } \textcircled{\text{☉}}$

Formula that represents the pattern

2. Complete the table and explain your rational.

Figure #1	Figure #2	Figure #3	Figure #4	How many ☉ would there be in the 7 th figure?	How many ☉ would there be in the 50 th figure?
☉☉☉	☉☉☉☉☉	☉☉☉☉☉☉☉	☉☉☉☉☉☉☉☉☉☉		
3	6	9	12		
Explain how to find the number of ☉s in any box.					

$y = x \cdot 3$
 $y = 7 \cdot 3 = 21$
 $y = 50 \cdot 3 = 150$

$x = \text{Figure \#}$ $y = \# \text{ of } \textcircled{\text{☉}}$ **what is the relationship between x and y ?**

$y = x \cdot 3$

3. Complete the table and explain your rational.

Figure #1	Figure #2	Figure #3	Figure #4	How many ☉ would there be in the 7 th figure?	How many ☉ would there be in the 50 th figure?
☉☉	☉☉☉☉	☉☉☉☉☉☉	☉☉☉☉☉☉☉☉		
4	6	8	10		
Explain how to find the number of ☉s in any box.					

$y = 2x + 2$
 $y = 2(7) + 2 = 16$
 $y = 2(50) + 2 = 102$

$x = \text{Figure \#}$ $y = \# \text{ of } \textcircled{\text{☉}}$

$y = 2x + 2$

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. ← amount

- 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.

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

Rate of change: **+1**

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**

is a list of your coordinates

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

Expression vs. Equation

Expression

* NO = sign

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

Example:

← last page #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 (n)	Total amount raised, in dollars (D)
0	0
1	15
2	30
3	45
4	60
5	75

① Complete table values

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" t-shirts sold by \$15
 $\Rightarrow n \cdot 15 = 15n$

③ Check your equation using **substitution**:

eg. 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.

Study the Pattern
Words
 Jason cuts lawns as his summer job. He charges a travelling fee of \$10 plus \$20/hour for his time.

24. Fill out the table of values.
 Let $x = \text{Hours}$ & $y = \text{Income}$

x	y
1	30
2	50
3	70
4	90
5	110
6	130

25. Plot as many points as will fit. **Graph**

Answer the questions.

26. Rate of change: How is the y changing?
 He earns \$20/h

27. Write an equation to represent this pattern.
 $I = 20h + 10$
 $Y = 20x + 10$

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



Continuous



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

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

- 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

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.

\Rightarrow rate of change is obvious

Write a formula. $D = 12.5n$

$D = \$12.50 \cdot n$

PRACTICE

For the questions below you need to think about how n and D 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

$D = 6n$

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

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) → D
 * 8.2 is the rate of change. Means you can travel 8.2 km/L

$D = 8.2(1) = 8.2$
 $8.2(2)$
 $8.2(3)$

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 $^{\circ}\text{C}$ → T
 * 2.3 is the rate of change. Means that the Temp. increases $2.3^{\circ}\text{C}/\text{min}$

$T = 2.3(1) = 2.3$
 $= 2.3(2) = 4.6$
 $= 2.3(3) = 6.9$

t	$T_{\text{emp}}(^{\circ}\text{C})$
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.

no longer starting at (0,0) →

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

cost set up fee

$$C = \$50 + (\$10 \cdot n)$$

$$C = 50 + 10n$$

\$10 for each t-shirt.

Check your equation using substitution:

$$\begin{aligned}
 C &= 50 + 10n \\
 &= 50 + 10(0) = 50 \checkmark \\
 &= 50 + 10(3) = 80 \checkmark \\
 &= 50 + 10(5) = 100 \checkmark
 \end{aligned}$$

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 ⊖ t-shirts) and cost.

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

- Find the pattern
- use pattern to determine initial cost.

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

5-15
5-15

Write the equation for this relationship:

$$C = 45 + 15n$$

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

Check your equation using substitution:

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

PRACTICE

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

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.

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

$C = 35 + 0.10d$

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

initial fee
 adding \$5
 $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.

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

$C = 50 + 0.20d$

$C = 50 + 0.20(150) = 80$ ✓
 $50 + 30$

daily cost.
 50
 $50 \text{ km} \rightarrow \10
 $100 \text{ km} \rightarrow \20
 $150 \text{ km} \rightarrow \30
 $200 \text{ km} \rightarrow \40
 $250 \text{ km} \rightarrow \50
 $\$10 / 50 \text{ km} = \$0.20/\text{km}$

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.

$\$0.12/\text{km}$ 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°C each min

Required	Extra Practice	Extension
1, 2, 3, 4, 5, 7, 8, 9, 10, 11	6, 12, 13, 16	14, 15

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