SECTION 1.3 VARIABLES AND EXPRESSIONS

Name: Key **Date:** _____ **Period:** _____

Vocabulary

DEFINITION	EXAMPLE
Algebraic Expression an expression that includes 1 or more variables, and may also include symbols indicating an operation or a relationship	J = S + 5, J, S k = 3 − z, m

EXAMPLE 1

Use the variable J to represent John's age in years. You don't know J, John's age, but you do know that John is 5 years older than Sue. Use the variable S to represent Sue's age and write an equation that expresses the relationship between J and S.

$J = S + 5$

EXPLORATION 1

We look at a family of 4 people and their ages. Today, Adam's age is 4 more than his sister Bonnie's age. Their mother Carmen is twice as old as Bonnie and their father Daniel's age is one year more than twice Adam's age. Let the variable A represent Adam's age right now.

A = Adam's age, B = Bonnie's age, C = Carmen's age, D = Daniel's age

1. Write an expression that represents Bonnie's age in terms of Adam's age.

   Since $A = B + 4$, Bonnie's age is 4 less than Adams, so $B = A - 4$

2. Using what we learned about Bonnie's age, write Carmen's age in terms of Adam's age.

   $C = 2B$ so $C = 2(A - 4)$ or $C = 2A - 8$

3. Write Daniel's age in terms of Adam's age.

   $D = 2A + 1$

4. Let the variable B represent Bonnie's age at this time. Write an expression that represents Adam, Carmen and Daniel's ages in terms of B. Explain in words and in symbols how you arrived at your expressions.

   $A = B + 4$ since Adam is 4 years older than his sister

   $C = 2B$ since Carman is twice as old as Bonnie

   $D = 2A + 1 = 2(B + 4) + 1 = 2B + 8 + 1 = 2B + 9$

   since Daniel is 1 year more than twice Adam's age (or 9 years older than Carmen.)

EXAMPLE 2

Mary rides her bike everyday at an average rate of 12 miles per hour. Use the variable t to represent the length of time for Mary's bike ride, measured in hours.

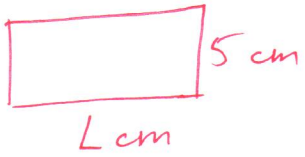
Find the distance that Mary travels if the she rides for

1. 2 hours, $\frac{12 \text{ miles}}{\text{hour}} \cdot 2 \text{ hours} = 24 \text{ miles}$
2. 5 hours, $\frac{12 \text{ miles}}{\text{hour}} \cdot 5 \text{ hours} = 60 \text{ miles}$
3. t hours.

$\frac{12 \text{ miles}}{\text{hour}} \cdot t \text{ hours} = 12t \text{ miles}$

EXAMPLE 3

Sketch a rectangle that has length L cm and width 5 cm. Express the area and perimeter of the rectangle.



Area $= lw = L \cdot 5 = 5L \text{ cm}^2$

Perimeter $= 2(L+5)$ (formulas may vary slightly)

$= 2L + 10 \text{ cm}$

PROBLEM 1

Sketch a rectangle whose length is twice its width. Let L represent the length and W the width. Write an algebraic expression for:

1. the area in terms of W.
2. the area in terms of L.
3. the perimeter in terms of W.

$L = 2W$

so

$\frac{1}{2}L = W$

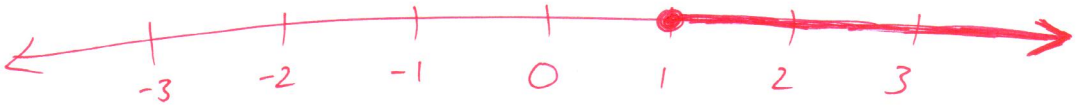
1. $A = (2W)(W) = 2W^2 \text{ units}^2$
2. $A = (L)(\frac{1}{2}L) = \frac{1}{2}L^2 \text{ units}^2$
3. $P = 2(2W + W) = 2(3W) = 6W \text{ units}$

Variables can also describe elements in a set. For example, we can use the variable x to define a set of numbers as well as to represent them on the number line.

EXAMPLE 4

Write the set of all numbers greater than or equal to 1 in set notation. Indicate this set on the number line.

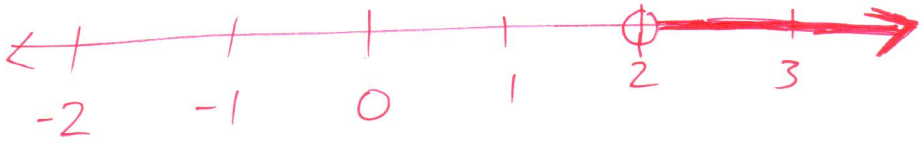
$\{x \mid x \geq 1\}$ is set notation



EXAMPLE 5

Write the set of all numbers greater than 2 in set notation. Indicate this set on the number line.

set notation: $\{x \mid x > 2\}$



PROBLEM 3

1. Express the statement that x is greater than or equal to 2 and smaller than 7 in the language of algebra.

$7 > x \geq 2$ or $2 \leq x < 7$

2. Write the set of numbers greater than or equal to 2 and smaller than 7 at the same time using set notation.

$\{x \mid 2 \leq x < 7\}$

3. Indicate on the number line below where the set of numbers greater than or equal to 2 and smaller than 7 at the same time is.

4. Find 5 numbers x that satisfy this condition. Answers will vary.

2.5, 3, 4, 4.7, $\frac{7}{3}$, $\frac{14}{3}$, etc.

SUMMARY (What I learned today)