

## Topic 1C: Lessons 9 - 13

A graphic artist kept track of the amount of paper he used to print pictures. Each row of this table show the number of pictures he printed and the number of sheets of paper used. Complete the table.

input Pictures	output Paper
6	→ 1
30	→ 5
12	→ 2
36	→ 6
24	<del>4</del>
x	x ÷ 6

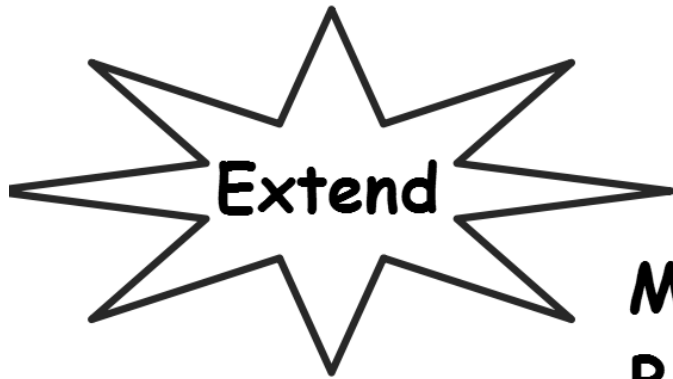
Describe this pattern as an algebraic expression where  $x$  represents the value of the input column.

If the input was 96, what would the output be?  
What about 120?

Pictures	Paper
6	1
30	5
12	2
36	
24	
$x$	

With your table partner to find more input/output values. Use the following inputs: 60, 138, 174.

Pictures	Paper
6	1
30	5
12	2
36	
24	
x	



Make a table with 4 rows.  
Begin with these three rows:

$$\text{input} = 6 \quad \text{output} = 14$$

$$\text{input} = 10 \quad \text{output} = 22$$

$$\text{input} = 3 \quad \text{output} = 8$$

Write an algebraic expression  
for the pattern in this table of  
the input is  $x$ .

# 1-9: Using Expressions to Describe Patterns



# Using Expressions to Describe Patterns

How can you write expressions to describe patterns?

Delvin saves a part of everything he earns. The table at the right shows Delvin's savings pattern.

The INPUT column shows the money he has earned. The OUTPUT column shows the money he has saved.

Write an expression to describe the pattern.

$x$

INPUT	OUTPUT
\$84	\$42
\$66	\$33
\$50	\$25
\$22	■
\$30	■

An input/output table is a table of related values. Identify the pattern.

What is the relationship between the values?

$$\frac{1}{2}(84) = 42 \rightarrow 42 \text{ is half of } 84.$$

$$\frac{1}{2}(66) = 33 \rightarrow 33 \text{ is half of } 66.$$

$$\frac{1}{2}(50) = 25 \rightarrow 25 \text{ is half of } 50.$$

The pattern is:  $\frac{1}{2}(\text{INPUT}) = \text{OUTPUT}$

Let  $x = \text{INPUT}$ .

So, the pattern is  $\frac{1}{2}x$ .

Use the pattern to find the missing values.

$$\frac{1}{2}(22) = 11$$

$$\frac{1}{2}(30) = 15$$

INPUT	OUTPUT
\$84	\$42
\$66	\$33
\$50	\$25
\$22	\$11
\$30	\$15

## Do you know HOW?

Use the input/output table for **1** and **2**.

<i>INPUT</i>	0	1	2	3	4
<i>OUTPUT</i>	3	4	5	6	7


$$\begin{array}{c|c|c} 8 & 20 & x \\ \hline 11 & 23 & x+3 \end{array}$$

1. If the input number is 8, what is the output number?
2. Write an algebraic expression that describes the output pattern.

$$x+3$$



## Do you UNDERSTAND?


- Suppose that Delvin earned \$36 mowing lawns. What input and output entries would you add to his table?
-  **Reasonableness** Is it reasonable for an output to be greater than the input in the table above? Explain.
- What algebraic expression using division also describes the output pattern for the table above?

<i>INPUT</i>	<i>OUTPUT</i>
\$84	\$42
\$66	\$33
\$50	\$25
\$22	\$11
\$30	\$15

Use this table for **8** and **9**.

**8.** Copy and complete the table.

**9.** Write an algebraic expression that describes the relationship between the input and output values.



$x \div 3$

<i>Total Students</i>	12	18	24	27	36	39
<i>Number of Study Groups</i>	□	6	8	□	12	□



Animated Glossary  
[pearsonrealize.com](http://pearsonrealize.com)

## Quick Check

Use the input/output table below for 1 through 3.

<b>Input</b>	18	21	28	34	40
<b>Output</b>	9	12	19	25	31

1. What algebraic expression describes the output pattern if the input is the variable  $x$ ?

- A  $x \div 2$
- B  $2x$
- C  $x - 9$
- D  $x + 9$

3. If the output is 57, what is the input?

- A 114
- B 75
- C 66
- D 48

2. If the input is 62, what is the output?

- A 31
- B 53
- C 71
- D 124

The input/output table shows how much Jake pays for toys. Use the input/output table for 1-4.

1. If Jake buys 12 toys, what is the cost?
2. If Jake pays \$45, how many toys did he buy?
3. Write an expression to describe the output pattern if the input is the variable  $t$ .
4. What inputs and outputs should be added to the table for 20 toys?

$x$   
toys      cost

INPUT	OUTPUT
6 $\times 3 \rightarrow$	18
7 $\times 3 \rightarrow$	21
8 $\times 3 \rightarrow$	24
9 $\times 3 \rightarrow$	27
12	36
15	45

5. **Writing to Explain** Jessie says that the expression  $2x$  describes the input/output table. Explain why Jessie's expression is correct or incorrect.

<b>INPUT</b>	2	3	4	5
<b>OUTPUT</b>	4	5	6	7

$$x + 2$$

# Using Expressions to Describe Patterns

Use this table for 1–4.

<b>Total Cups in Boxes</b>	18	36	54	66	72	84
<b>Total Number of Boxes</b>	3	6	9	□	□	□

1. How many boxes are needed for 66, 72, and 84 cups? \_\_\_\_\_
2. How many cups will be in 20 boxes? \_\_\_\_\_
3. Write an algebraic expression that explains the relationship between the input (total cups in boxes) and output values (total number of boxes) if the variable  $c$  is the input. \_\_\_\_\_
4. **Writing to Explain** Jason thinks he needs 25 boxes to pack 144 cups. Is Jason correct? Explain.



Determine the number that correctly fills in the blank in the function machine.

1)

Input	Output
84	104
	76
97	117
7	27
22	42

2)

Input	Output
81	71
70	60
40	
73	63
95	85

3)

Input	Output
8	32
10	
9	36
7	28
6	24

4)

Input	Output
6	3
	2
8	4
20	10
16	8

5)

Input	Output
78	93
	18
72	87
7	22
71	86

6)

Input	Output
44	
74	64
94	84
90	80
95	85

7)

<b>In</b>	5	6	4	2	3
<b>Out</b>	40	48		16	24

8)

<b>In</b>	90	20	60		100
<b>Out</b>	9	2	6	7	10

9)

<b>In</b>	61	42	40	56	97
<b>Out</b>	77	58		72	113

10)

<b>In</b>	21	75	105	15	52
<b>Out</b>	15	69		9	46

11)

<b>In</b>	5	4	3		10
<b>Out</b>	35	28	21	49	70

12)

<b>In</b>	42	30	18	36	
<b>Out</b>	7	5	3	6	9



en**Vi**sion**MA**TH™  
Scott Foresman • Addison Wesley  
*digital*



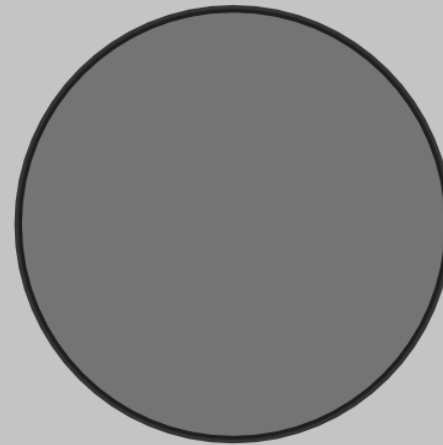
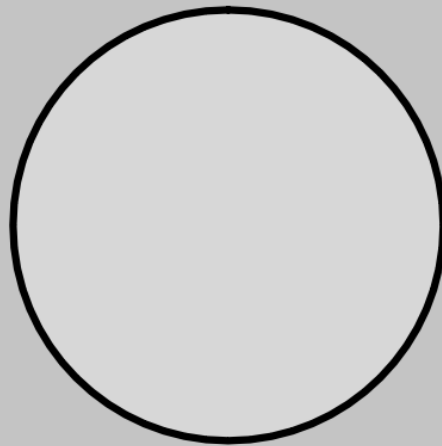
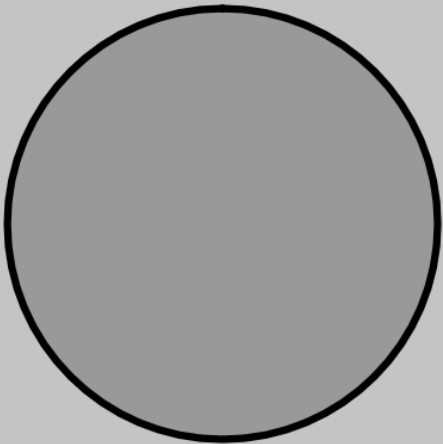
## Vocabulary

$$3n + 4 + 2n - 6$$

- 1. term: parts of an expression** separated by + and -  
**3n, 4, 2n, -6**
- 2. like terms: same parts** — same variable or no variable  
**3n and 2n; 4 and -6**
- 3. coefficient: the number being multiplied by the variable**  
**3 and 2**
- 4. constant: a number by itself**  
**4 and 6**

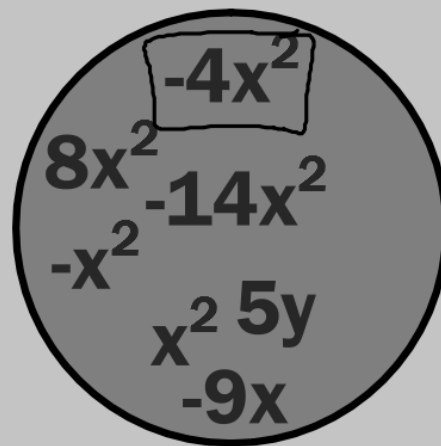
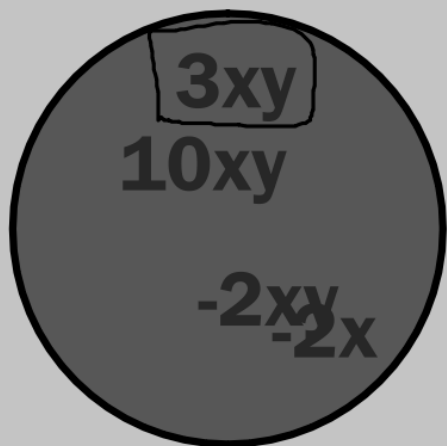
# Combining Like Terms

$7$        $67$        $3x$        $9$   
 $3y$        $2x$        $-2y$        $5x$   
 $-7xy$        $5y$        $-9x$        $y$   
 $x$        $16y$

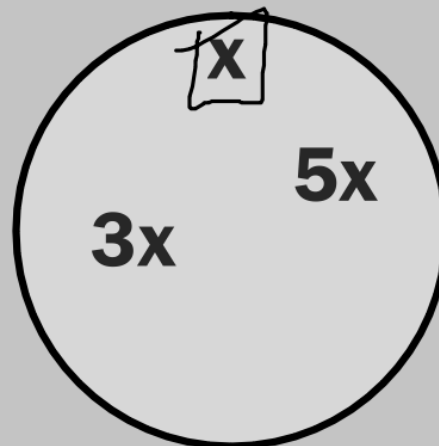
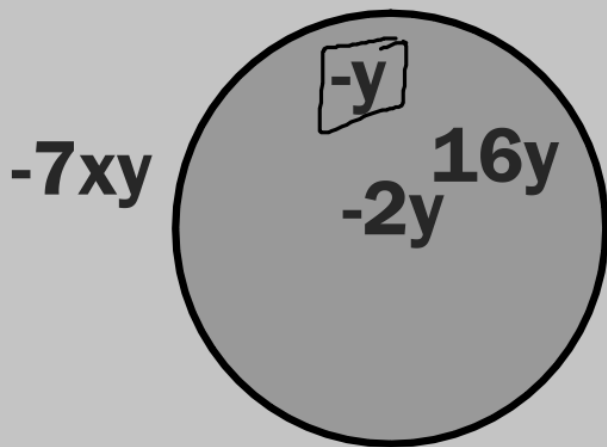


$14$

# Combining Like Terms



$y$

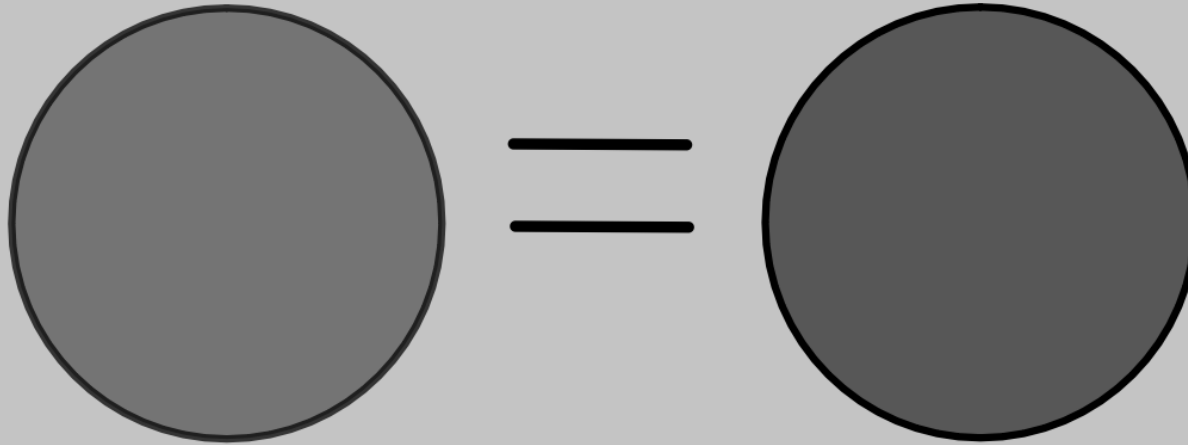


$xy$

**Combine these like terms:**

$$\begin{array}{l} 3xy \quad 10xy \\ -2xy \quad xy \\ -7xy \end{array} = \bigcirc$$

**Combine these like terms:**



**5x   3x   x   -2x   -9x**

**Combine these like terms:**

$$\begin{array}{c} -y \\ -2y \quad y \quad 5y \\ 16y \end{array} = \bigcirc$$

## Do you know HOW?

In **1** through **4**, simplify each expression.

**1.**  $x + x = \blacksquare x$

**2.**  $4y - y = \blacksquare y$

**3.**  $2x + 2x + 2x = \blacksquare x$

**4.**  $y + 5y + 1 = \blacksquare y + 1$

## Do you UNDERSTAND?

5. Explain why the expression  $2y - y$  can be simplified to  $y$ .
6. Sara simplifies the expression  $6x + 5 - 4x$  and gets the expression  $7x$ . Is she correct? If not, explain why.



# Simplifying Algebraic Expressions

## Sec. 1-5

- \* term  $\rightarrow$  a number, a variable, or the product of numbers and variables.
- \* Coefficient  $\rightarrow$  a number that is multiplied by a variable.

**TERMS:**  $(6)$   $(x)$   $(3x)$   $(5x^2)$       **Note:**  $x$  is the same as  $1x$ .

↙      ↙

**Coefficients**

- \* like terms  $\rightarrow$  terms with the same variable raised to the same power.
  - $\rightarrow$  coefficients do not have to be the same.
  - $\rightarrow$  constants (numbers) are also like terms.

<b>LIKE TERMS</b>	$3x$ and $2x$	$w$ and $\frac{w}{7}$	$5$ and $1.4$
<b>UNLIKE TERMS</b>	$5x^2$ and $2x$	$6a$ and $6b$	$3.2$ and $x$

exponents are different.      variables are different.      one is a constant and one is a variable.

**Example:** Highlight or draw shapes around the like terms:

$\frac{t}{2}$   $(5a^3y^2)$   $(7t)$   $x^2$   $4z$   $k$   $(4.5y^2)$   $(2t)$   $(\frac{2}{3}a)$

- \* To combine like terms, add or subtract the coefficients.

$$\begin{array}{r}
 (4x) + (5x) = 9x \\
 \begin{array}{c}
 \text{xx} \\
 \text{xx}
 \end{array} + \begin{array}{c}
 \text{xxx} \\
 \text{xx}
 \end{array} = \begin{array}{c}
 \text{xxxxx} \\
 \text{xxxx}
 \end{array}
 \end{array}$$

$$\begin{array}{r}
 (6a) - (1a) = 5a \\
 \begin{array}{c}
 \text{aaa} \\
 \text{aa}
 \end{array} - \begin{array}{c}
 \text{a} \\
 \text{aa}
 \end{array} = \begin{array}{c}
 \text{aaa} \\
 \text{aa}
 \end{array}
 \end{array}$$