Integrated Algebra A

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Unit #1

Algebraic Expressions

Topics covered
1. Translating Expressions and Equations
2. Like Terms
3. Distributive Rule

Name ________________________________
A letter that stands for a number "unknown".

Variable

XYZ or C (lowercase letter)

A group of numbers, variables, and/or operations.

No equal sign

Expression

X-5 or XYZ or 3Y

Evaluate, simplify

Solve

A variable that contains <, >, ≤, ≥, and have more than 1 answer.

Inequality

n < 8

3x - 2 ≥ -9

Expression with an equal sign

Equation

3y - 6 = 21 or 9 + 8 = 9
expression

- No equal sign
- Simplify an expression
- Evaluate

equation

- Have variables, numbers, and operations
- Solve for n
- Has an equal sign

- Different
- Same
- Different
Translating Words in Algebraic Expressions

Vocabulary words

Addition: \[ + \]
- plus
- *more than*
- (Sum)
- added to
- gain
- increased by
- greater than

Subtraction: \[ - \]
- take away (difference)
- minus
- deduct
- decreased by
- *less than*
- Subtract from
- less than

Multiplication: \[ \times \]
- times
- (product)
- multiply by
- of
- twice \((2x)\)
- double \((2x)\)
- tripie \((3x)\)

Division: \[ \div \]
- quotient
- divide by
- \(*\)divide into
- one third \(\frac{1}{3}\)
- one half \(\frac{1}{2}\)

*Exceptions to the rule: Switch the order of numbers

Strategy

1. Highlight the operation key words (any word in the boxes above.)
2. Circle the words that mean numbers or variables.

Guided Practice

1: \( a \text{ number} \text{ plus } four \) \[ k + 4 \]
2: \( \text{The quotient of a } a \text{ number and four} \) \[ \frac{d}{4} \]

Independent Practice

3: \( a \text{ number} \text{ decreased by seven} \) \[ n - 7 \]
4: \( \text{The product of two } \text{ and a number} \) \[ 2x \]
NOTE: Phrases and Commas: Commas are sometimes used to specify parentheses. The parentheses goes around the two numbers before or after the comma.

Guided Practice “the product of \((x, y)\) decreased by \(2\)” which is written

\[
(x, y) - 2
\]

vs.

“the product of \(x, y\) decreased by \(2\)” which is written as:

\[
\times(y - 2)
\]

Independent practice

5. The sum of a number and \(10\), divided by \(4\)

\[
\frac{(n + 10)}{4}
\]

6. The difference of \(7\) and a number, multiplied by \(3\)

\[
(7 - n) \times 3
\]

Guided Practice

Use mathematical symbols to translate the following verbal phrases into algebraic language:

1) The sum of a number and \(3\)

\[
x + 3
\]

2) Two less than a number

\[
n - 2
\]

3) The product of \(5\) and a number, decreased by \(r\)

\[
5x - r
\]

4) The sum of \(t\) and \(u\), divided by \(6\)

\[
\frac{(t + u)}{6}
\]

5) Twice, the sum of \(x\) and \(y\)

\[
2(x + y)
\]

Independent practice

Using the letter \(n\) to represent “a number”, write each verbal phrase as an algebraic expression:

1) A number increased by \(12\)

\[
\text{\underline{\text{\textcolor{red}{n}}}} + 12
\]

* 2) 7 less than a number

\[
\text{\underline{\text{\textcolor{red}{n}}}} - 7
\]
3) 4 added to (twice a number)  
\[ 4 + 2x \]

5) A number increased by 6.  
\[ n + 6 \]

7) 5 times a number, decreased by 7.  
\[ (5x) - 7 \]

9) the sum of a number and 5, decreased by 7.  
\[ (n + 5) - 7 \]

4) Four times a number  
\[ 4n \]

6) A number divided by 2.  
\[ n/2 \]

8) 9 less than twice a number.  
\[ 2x - 9 \]

Translating Words into Algebraic Equations

**Expressions** cannot be solved because they do not have an equal sign. **Equations** on the other hand have an equal sign! So far, we have learned how to translate words into algebraic expressions and today we are going to take that one step further!

**Words that indicate when to put an" = " sign:**
- is
- equals
- the result is
- exceeds by

**SPECIAL CASE:**
"EXCEEDS": represents both an equal sign, which will be followed by the addition operation.

**Strategy**
1. Highlight the operation key words (any word in the boxes above.)
2. Circle the words that mean numbers or variables.
3. Box out the word that means an equal sign.
Guided practice
Translate the following sentences into equations.

1. Four times a number is 20.
   \[ 4 \times x = 20 \]
   *Can you figure out what “the number” is? \( \text{\textbf{5}} \)

2. A number decreased by 6 equals 8.
   \[ n - 6 = 8 \]
   *Can you figure out what “the number” is? \( \text{\textbf{14}} \)

3. A number divided by 2 is 4.
   \[ \frac{n}{2} = 4 \]
   *Can you figure out what “the number” is? \( \text{\textbf{8}} \)

4. Five times a number, decreased by 7, equals 13.
   \[ 5x - 7 = 13 \]

Independent practice: Use the highlight, circle, box strategy!

5. When a number is subtracted from 8, the result is 10.
   \[ 8 - n = 10 \]

6. 9 less than twice a number is 10.
   \[ 2x - 9 = 10 \]

7. The sum of 50 and a number is equal to 6 times that number.
   \[ 50 + x = 6x \]

8. Four times a number increased by 5 equals the number by 10.
   \[ 4x + 5 = n + 10 \]

MULTIPLE CHOICE PROBLEMS FOR TRANSLATIONS

1. If Peter can pick 5 quarts of peppers every 2 hours, how many hours would it take him to pick \( q \) quarts?

   1. \( 10q \)
   2. \( \frac{q}{10} \)
   3. \( \frac{2q}{5} \)
   4. \( \frac{2q}{10} \)
2. John's father weighs 20 pounds more than twice what John weighs. If John's weight is represented by \( y \), then his father's weight may be represented by:

\[
\begin{align*}
1. & \quad 2y \\
2. & \quad 2y - 20 \\
3. & \quad 2y + 20 \\
4. & \quad \frac{1}{2} y + 20
\end{align*}
\]

3. Which expression represents less than the product of 7 and \( x^2 \)?

\[
\begin{align*}
1. & \quad 7(x - 5) \\
2. & \quad 7x - 5 \\
3. & \quad 7 + x - 5 \\
4. & \quad 5 - 7x
\end{align*}
\]

4. Which is the correct verbal expression for the mathematical expression \( 3n + 2 \)?

\[
\begin{align*}
1. & \quad \text{Two more than three times a number.} \\
2. & \quad \text{Two less than three times a number.} \\
3. & \quad \text{Two more than a number, times three.} \\
4. & \quad \text{Three times two plus some number.}
\end{align*}
\]

5. How would say the mathematical expression \( n^2 - 6 \) in words?

\[
\begin{align*}
1. & \quad \text{Six more than a number squared.} \\
2. & \quad \text{A number squared less than six.} \\
3. & \quad \text{Six less than a number squared.} \\
4. & \quad \text{The sum of a number squared and six.}
\end{align*}
\]

6. Which verbal expression corresponds to the mathematical expression \( (2x - 1)^2 \)?

\[
\begin{align*}
1. & \quad \text{Two times a number, squared, minus one.} \\
2. & \quad \text{Two times a number minus one, squared.} \\
3. & \quad \text{Two times a number minus one squared.} \\
4. & \quad \text{Two more than a number minus one, squared.}
\end{align*}
\]
Variables and Like Terms

<table>
<thead>
<tr>
<th>Like terms</th>
<th>Unlike terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3x$ and $7x$</td>
<td>$4x$ and $7y$</td>
</tr>
<tr>
<td>$8x$ and $-3x$</td>
<td>$3x^2y$</td>
</tr>
<tr>
<td>$4xy^2$ and $xy^2$</td>
<td>$-5$</td>
</tr>
</tbody>
</table>

What are like terms?
Monomials that have exactly the same variables.

Combining Like Terms (Adding & Subtracting)

**Procedure**
1. Circle or box out like terms.
2. Add or subtract the coefficients
3. Keep the term (variable(s))

**BE CAREFUL!**
The sign or operations goes with the number before it.

2$\cdot$3 means $-3$
-2$\cdot$3 means $+3$

**Guided Practice:** Simplify each term! (remember you can't solve because there is no equal sign).

**Example A**
Simplify

\[
\begin{align*}
5x + 3x &= 8x \\
8x &= 8x
\end{align*}
\]

**Example B**
Simplify

\[
\begin{align*}
5x - 3x &= 2x \\
2x &= 2x
\end{align*}
\]

**Example C**
Simplify

\[
\begin{align*}
(1xy + 3n) - (n + 4xy) - 5 &= 5x + 2n - 5 \\
1 + 4 &= 5 \\
3 - 1 &= 2n \\
5xy + 2n - 5 &= 5xy + 2n - 5
\end{align*}
\]

**Example D**
Simplify

\[
\begin{align*}
5m^2 - (1m^2 + 6m - 3m^2 - 6m) &= 1m^2 + 0 \\
5 - 1 - 3 &= 1 \\
6 - 6 &= 0 \\
\end{align*}
\]
Practice

1. $\frac{5x + 7x}{12x}$
2. $\frac{-3x^2 + 10x^2}{7x^2}$
3. $\frac{13c - 12c}{c - 1c}$

4. $19y + 1y$
5. $3yz - 5yz$
6. $-e + 8e$

7. $4a + 9 + a$
8. $7s + 5x - 8s$
9. $4.7x - 5.9x$

10. $5x - 6y - 8y + 7x$
11. $23x + 8 + 6x + 3y$
12. $4a^2 - 3 - 2a^2$

13. $10b^2 - 9b - 4b^2 + 6b$
14. $5y^2 + y - 7y^2 - y$
15. $3x - 5 + 2x$
16. $2y + 3 - y + 7$

Independent practice

15. $5x - 5$
16. $y + 10$
Multiplying, Dividing, and Distributive rule

**You do Not like terms to multiply or divide.**

Multiplying terms:

**Procedure**
- **Multiply** the coefficient in front of the variable.
- **Keep** the variable(s).

Example & Practice:

1) \(5 \cdot 3x = 15x\)
   
2) \(4y(2x) = 8xy\)
   
3) \(-7 \cdot 4x^2 = -28x^2\)

4) \(\frac{6m \cdot -4n}{-24mn} = \frac{-24}{-24}\)
   
5) \(-10(-5d) = 50d\)
   
6) \(2(12p^3) = 24p^3\)

Distributive Property

**Rainbow**

Example 1: \(7(t - 8) = 7t - 56\)

Example 2: \(-2(x + 1) = -2x - 2\)

Example 3: \(2(2x - 3) = 4x - 6\)

Example 4: \(-1(5 + w) = -5 + w\)
Independent Practice
Simplify each expression using the distributive rule.
5) \(4(y + 9)\)
   \[4y + 36\]
6) \(-6(2x + 8)\)
   \[-12x - 48\]
7) \(3(r + 2)\)
   \[3r + 6\]
8) \(-2(d + 6)\)
   \[-2d - 12\]
9) \(-3(4 - 2)\)
   \[-3 \cdot 2\]
10) \(-j(x - 4)\)
    \[-x + 4\]

Dividing terms
Procedure

- Divide the coefficient in front of the variable.
- Cross out any like terms that are on the top and bottom.
- Keep the remaining variable

Guided Example: Simplify each expression
11) \(\frac{30x}{6} = 5x\)
12) \(\frac{-18k}{2k} = -9\)
13) \(\frac{24}{12y} = \frac{2}{y}\)
14) \(\frac{7y}{0} = \text{Undefined}\)

Practice: Simplify each expression.
15) \(\frac{-27m}{3} = -9m\)
16) \(\frac{144y}{y} = 144\)
17) \(\frac{-100}{-4d} = \frac{25}{d}\)
18) \(\frac{89y}{0} = \text{Undefined}\)
19) \(\frac{42c}{-1} = -42c\)