Math 7 Warm-Up February 5, 2013

Add each of the following linear expressions:

1) \((11x - 8) + (7x - 1)\)
   \[
   \begin{align*}
   &\frac{11x - 8}{7x - 1} \\
   \hline
   &18x - 9
   \end{align*}
   \]

Subtract each of the following linear expressions:

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

3) The perimeter of the garden shown is \(6x + 2\) units. Find the length of the missing side.

   \[
   \begin{align*}
   &1x + 0 \\
   &+ 1x + 0 \\
   &+ 3x + 1 \\
   \hline
   &5x + 1
   \end{align*}
   \]

   \[
   \begin{align*}
   \text{Sum of 3 known sides} \\
   \left(6x + 2\right) - \left(5x + 1\right) \\
   \hline
   \end{align*}
   \]

Homework p. 419 - 420 (1, 2, 3, 4, 6, 7, 9, 15, 16, 17)
What You'll Learn
Scan the lesson. Predict two things you will learn about factoring linear expressions:

- How to find the GCF of monomials.
- How to factor linear expressions into the product of the GCF and the remaining factor.

Real-World Link
Yard Sale: A rectangular yard is being separated into four equal-size sections for different items at a yard sale. The area of the yard is \((8x + 12)\) square meters.

1. How can you find the area of each section of the yard sale?

Divide the yard into 4 equal sections.

2. What is the area of each section? Explain your answer.

\[
\frac{8x + 12}{4} = 2x + 3
\]

\[
\frac{4(2x + 3)}{4} = 8x + 12
\]

3. The algebra tiles represent the area of the entire yard sale. Fill in the length and width. Write an expression that represents the area in terms of the length and width of the model.
Find the GCF of Monomials

A monomial is a number, a variable, or a product of a number and one or more variables.

<table>
<thead>
<tr>
<th>Monomials</th>
<th>Not Monomials</th>
</tr>
</thead>
<tbody>
<tr>
<td>25, x, 40x</td>
<td>x + 4, 40x + 120</td>
</tr>
</tbody>
</table>

To factor a number means to write it as a product of its factors. A monomial can be factored using the same method you would use to factor a number.

The greatest common factor (GCF) of two monomials is the greatest monomial that is a factor of both.

Examples

Find the GCF of each pair of monomials.

1. 4x, 12x

\[
\begin{align*}
4x &= \underline{2 \cdot 2 \cdot x} \\
12x &= \underline{2 \cdot 2 \cdot 3 \cdot x}
\end{align*}
\]

So \(GCF = 2 \cdot 2 \cdot x = 4x\)

2. 18a, 20ab

\[
\begin{align*}
18a &= \underline{2 \cdot 3 \cdot 3 \cdot a} \\
20ab &= \underline{2 \cdot 2 \cdot 5 \cdot a \cdot b}
\end{align*}
\]

So \(GCF = 2 \cdot a = 2a\)

3. 12cd, 36ed

\[
\begin{align*}
12cd &= \underline{2 \cdot 2 \cdot 3 \cdot c \cdot d} \\
36ed &= \underline{2 \cdot 2 \cdot 3 \cdot 3 \cdot e \cdot d}
\end{align*}
\]

So \(GCF = 2 \cdot 2 \cdot 3 = 12\)

Find the GCF of each pair of monomials.

a. 12, 28c

\[
\begin{align*}
12 &= \underline{2 \cdot 2 \cdot 3} \\
28c &= \underline{2 \cdot 2 \cdot 7 \cdot c}
\end{align*}
\]

So \(GCF = 2 \cdot 2 = 4\)

b. 25x, 15xy

\[
\begin{align*}
25x &= 5 \cdot 5 \cdot x \\
15xy &= 3 \cdot 5 \cdot x \cdot y
\end{align*}
\]

So \(GCF = 5x\)

c. 42mn, 14mn

\[
\begin{align*}
42mn &= 2 \cdot 3 \cdot 7 \cdot m \cdot n \\
14mn &= 2 \cdot 7 \cdot m \cdot n
\end{align*}
\]

So \(GCF = 2 \cdot 7 \cdot m \cdot n = 14mn\)
**Factor Linear Expressions**

You can use the Distributive Property and the work backward strategy to express a linear expression as a product of its factors. A linear expression is in **factored form** when it is expressed as the product of its factors.

\[ 8x + 4y = 4(2x + y) \]
\[ = 4(2x + y) \quad \text{Distributive Property} \]

**Examples:**

4. Factor \( 3x + 9 \).

\[
\begin{align*}
\text{GCF} & \quad \text{What is left} \\
3 & \quad 3(x + 3)
\end{align*}
\]

\[ \text{GCF} = 3 \]

**Method 1** Use a model.

\[ 3 \]

\[ \text{Method 2} \quad \text{Use the GCF.} \]

\[ 3x = 3 \cdot x \quad \text{write the prime factorization of 3x and 9} \]
\[ 9 = 3 \cdot 3 \quad \text{Circle the common factors.} \]

5. Factor \( 12x + 7y \).

\[
\begin{align*}
12x & = 2 \cdot 2 \cdot 3 \cdot x \\
7y & = 7 \cdot y
\end{align*}
\]

\[ 2 \]

\[ \text{No common factors} \quad \text{So GCF} = 1 \quad \text{all the have a 1 in common} \]
Factor each expression. If the expression cannot be factored, write "cannot be factored. Use algebra tiles if needed.

d. \(4x - 28\)  
   \(\frac{4x}{\cdot 7}\)  
   \(4 \cdot 7\)  
   \(GCF = 4\)  
   \(4(x - 7)\)

e. \(3x + 33y\)  
   \(\frac{3x}{\cdot 3}\)  
   \(\frac{33y}{\cdot 3}\)  
   \(3(\cdot \cdot \cdot)\)  
   \(3x = 3 \cdot x\)  
   \(33y = 3 \cdot 11 \cdot y\)  
   \(so \ GCF = 3\)  
   \(3(x + 11y)\)

f. \(4x + 35\)  
   \(\frac{4x}{\cdot 35}\)  
   \(\frac{4x}{\cdot 7}\)  
   \(\frac{35}{\cdot 35}\)  
   \(GCF = 1\)  
   \(1(4x + 35)\)  
   or cannot be factored.

Example

6. The drawing of the garden at the right has a total area of \((15x + 18)\) square feet. Find possible dimensions of the garden.

Factor \(15x + 18\).

\[\frac{15x}{\cdot 15}\]  
\[\frac{15x}{\cdot 5}\]  
\[\frac{15}{\cdot 3}\]  
\[\frac{3}{\cdot 3}\]  
\(15x = 5 \cdot 3 \cdot x\)  
\(18 = 2 \cdot 3 \cdot 6\)  
\(so \ GCF = 3\)  
\[3(5x + 6)\]

\[\text{one side} \quad \text{other side}\]
\(so \ 3 \text{ ft by (5x + 6) ft}\)
Guided Practice

Find the GCF of each pair of monomials. (Examples 1–3)

1. 32x, 18  
2. 27s, 54st  
3. 18cd, 30cd

Factor each expression. If the expression cannot be factored, write cannot be factored. Use algebra tiles if needed. (Examples 4 and 5)

4. 36x + 24  
5. 4x + 9  
6. 14x - 16y

7. Mr. Phen's monthly income can be represented by the expression 25x + 120 where x is the number of hours worked. Factor the expression 25x + 120. (Example 6)

8. Building on the Essential Question Explain how the GCF is used to factor an expression. Use the term Distributive Property in your response.

Rate Yourself!
Are you ready to move on?
Shade the section that applies.

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