Algebra Cheat Sheets

Algebra Cheat Sheets provide you with a tool for teaching your students note-taking, problem-solving, and organizational skills in the context of algebra lessons. These sheets teach the concepts as they are presented in the Algebra Class Software.

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</tr>
</tbody>
</table>
**Adding Integers**

**• Adding means combining**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. If the signs are the same, then add and use the same sign.</td>
<td>$8 + 4 = 12$</td>
</tr>
<tr>
<td></td>
<td>$-8 + -4 = -12$</td>
</tr>
<tr>
<td>2. If the signs are different, then subtract and use the sign of the larger number.</td>
<td>$-8 + 4 = -4$</td>
</tr>
<tr>
<td></td>
<td>$8 + -4 = 4$</td>
</tr>
</tbody>
</table>

Adding Integers – Examples
**Subtracting Integers**

Subtracting is the opposite of adding.
Change the sign of the second term and add.

<table>
<thead>
<tr>
<th>Expression</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>$8 - (+4)$</td>
<td>$8 - 4 = 4$</td>
</tr>
<tr>
<td>$-8 - (+4)$</td>
<td>$-8 - 4 = -12$</td>
</tr>
<tr>
<td>$8 - (-4)$</td>
<td>$8 + 4 = 12$</td>
</tr>
<tr>
<td>$-8 - (-4)$</td>
<td>$-8 + 4 = -4$</td>
</tr>
</tbody>
</table>

Subtracting Integers – Examples
### Algebra Cheat Sheet 3

#### Multiplying Integers

Multiply integers as you would whole numbers, then apply the sign rules to the answer.

1. If the signs are the same, the product is positive.
   - \((8) (4) = 32\)
   - \((-8) (-4) = 32\)

2. If the signs are different, the product is negative.
   - \((-8) (4) = -32\)
   - \((8) (-4) = -32\)

---

**Multiplying Integers – Examples**
Divide integers as you would whole numbers, then apply the sign rules to the answer.

1. If the signs are the same, the quotient is positive.
   - $32 \div 8 = 4$
   - $-32 \div -8 = 4$

2. If the signs are different, the quotient is negative.
   - $32 \div -8 = -4$
   - $-32 \div 8 = -4$

Dividing Integers – Examples
The absolute value of a number is the distance a number is from ‘0’ on the number line.

The absolute values of ‘7’ and ‘-7’ are 7 since both numbers have a distance of 7 units from ‘0.’
To combine terms, the variables must be identical.

1. Put the terms in alphabetical order.
2. Combine each set of like terms.
3. Put the answers together.

Combining Like Terms – Examples

\[3a + 4b + 2c + 5a - 6c - 2b\]

1. Put the terms in alphabetical order:
\[3a + 5a + 4b - 2b + 2c - 6c\]

2. Combine each set of like terms:
   - \[3a + 5a = 8a\]
   - \[4b - 2b = 2b\]
   - \[2c - 6c = -4c\]

3. Put the answer together:
\[8a + 2b - 4c\]
To combine terms, the variables must be identical.

1. Put the terms in alphabetical order.
2. Combine each set of like terms.
3. Put the answers together.

Combining Like Terms – Examples
### Algebra Cheat Sheet 7

#### Distributive Property I

Multiply each term inside the parenthesis by the term on the outside of the parenthesis.

<table>
<thead>
<tr>
<th>Expression</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>( c(a + b) )</td>
<td>( ca + cb )</td>
</tr>
<tr>
<td>( c(a - b) )</td>
<td>( ca - cb )</td>
</tr>
</tbody>
</table>

### Distributive Property – Examples

\[
3b (a + 4) = \\
3b (a) + 3b (4) = \\
3ab + 12b
\]
## Algebra Cheat Sheet 7

### Distributive Property I

Multiply each term inside the parenthesis by the term on the outside of the parenthesis.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>(c(a + b) = ca + cb)</td>
<td>(c(a - b) = ca - cb)</td>
</tr>
</tbody>
</table>

Distributive Property – Examples
1. Set the problem up vertically.
2. Combine the terms.

Adding Expressions – Examples

Write the problem vertically:

\[
\begin{align*}
8c + 2d - 4g \\
-7c + 4d - 8g
\end{align*}
\]

1. Combine the c’s: \[8c - 7c = c\]
2. Combine the d’s: \[2d + 4d = 6d\]
3. Combine the g’s: \[-4g - 8g = -12g\]
4. The answer is: \[c + 6d - 12g\]
1. Set the problem up vertically.
2. Combine the terms.

Adding Expressions – Examples
Algebra Cheat Sheet 9

Subtracting Expressions

3. Set the problem up vertically.
4. Change the signs of each term on the bottom line.
5. Combine the terms.

Subtracting Expressions – Examples

<table>
<thead>
<tr>
<th>Change the bottom signs:</th>
<th>Combine the terms:</th>
</tr>
</thead>
<tbody>
<tr>
<td>8c + 2d - 4g</td>
<td>8c + 2d - 4g</td>
</tr>
<tr>
<td>- 7c - 4d + 8g</td>
<td>-7c + 4d - 8g</td>
</tr>
</tbody>
</table>

1. Combine the c’s: 8c - 7c = c
2. Combine the d’s: 2d + 4d = 6d
3. Combine the g’s: -4g - 8g = -12g
4. The answer is: c + 6d - 12g
## Algebra Cheat Sheet 9

### Subtracting Expressions

1. Set the problem up vertically.
2. Change the signs of each term on the bottom line.
3. Combine the terms.

### Subtracting Expressions – Examples
Look for ‘clue’ words:

1. For the clue words, ‘*the product of*’ place the constant before the variable. Do not use a sign.

2. The clue words ‘*more than*’ and ‘*less than*’ indicate inverted order.

3. If there are no clue words, write the expression in the order that the words appear.

### Writing Expressions – Examples

<table>
<thead>
<tr>
<th>Example</th>
<th>Expression</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The product of 4 and ( x )</td>
<td>4x</td>
</tr>
<tr>
<td>The product of ( y ) and 5</td>
<td>5y</td>
</tr>
<tr>
<td>2. ( x ) more than three thirteen less than ( y )</td>
<td>3 + x</td>
</tr>
<tr>
<td></td>
<td>y – 13</td>
</tr>
<tr>
<td>3. the sum of ten and ( x ) the difference between ( y ) and 4</td>
<td>10 + x</td>
</tr>
<tr>
<td></td>
<td>y – 4</td>
</tr>
</tbody>
</table>
Look for ‘clue’ words:

1. For the clue words, ‘the product of’ place the constant before the variable. Do not use a sign.
2. The clue words ‘more than’ and ‘less than’ indicate inverted order.
3. If there are no clue words, write the expression in the order that the words appear.

Writing Expressions – Examples
Algebra Cheat
Sheet 11

Evaluating Expressions

Step 1. Replace the variable with parentheses.
Step 2. Place the value of the variable inside the parentheses.
Step 3. Calculate the answer.

Evaluating Expressions – Examples

Evaluate $10x + 7$, when $x = 5$.

Step 1. $10 \ (\quad) + 7$

Step 2. $10 \ (5) + 7$

Step 3. $50 + 7 = 57$
### Evaluating Expressions

**Step 1.** Replace the variable with parentheses.

**Step 2.** Place the value of the variable inside the parentheses.

**Step 3.** Calculate the answer.

### Evaluating Expressions – Examples
Algebra Cheat Sheet 12

Solving Equations

Step 1. Get all the variables on the left and all the numbers on the right of the equal sign by adding opposites.

Step 2. Divide by the coefficient of the variable to determine its value.

Solving Equations – Examples

2d + 3 = -7

1. \( -3 = -3 \)
   \[
   \frac{-3}{2} = \frac{-3}{2}
   \]
   \[
   2d = -10
   \]

2. \( d = -5 \)
Solving Equations

**Step 1.** Get all the variables on the left and all the numbers on the right of the equal sign by adding opposites.

**Step 2.** Divide by the coefficient of the variable to determine its value.
Step 3. Get all the variables on the left and all the numbers on the right of the sign by adding opposites.

Step 4. Divide by the positive value of the variable’s coefficient.

Step 5. If the variable is negative, divide by –1 and reverse the sign.

Solving Inequalities – Examples

\[-2d + 3 < -7\]

1. \[-3 = -3\]
   \[-2d < -10\]

2. \[-d < -5\]

3. \[d > 5\]
**Algebra Cheat Sheet 13**

**Solving Inequalities**

**Step 1.** Get all the variables on the left and all the numbers on the right of the sign by adding opposites.

**Step 2.** Divide by the positive value of the variable’s coefficient.

**Step 3.** If the variable is negative, divide by –1 and reverse the sign.

**Solving Inequalities – Examples**
Look for ‘clue’ words:

1. For the clue words, ‘the product of’ place the constant before the variable. Do not use a sign.
2. The clue words ‘more than’ and ‘less than’ indicate inverted order.
3. If there are no clue words, write the equation in the order that the words appear.
4. The equal sign is used in place of the word ‘is.’

Writing Equations – Examples

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The product of 4 and ( x ) is 12.</td>
<td>( 4x = 12 )</td>
</tr>
<tr>
<td></td>
<td>The product of ( y ) and 5 is 10.</td>
</tr>
<tr>
<td>2. ( x ) more than three is 12.</td>
<td>( 3 + x = 12 )</td>
</tr>
<tr>
<td></td>
<td>Thirteen less than ( y ) is (-3).</td>
</tr>
<tr>
<td>3. The sum of ten and ( x ) is 12.</td>
<td>( 10 + x = 12 )</td>
</tr>
<tr>
<td></td>
<td>The difference between ( y ) and 4 is (-2).</td>
</tr>
</tbody>
</table>
Look for ‘clue’ words:

1. For the clue words, ‘the product of’ place the constant before the variable. Do not use a sign.
2. The clue words ‘more than’ and ‘less than’ indicate inverted order.
3. If there are no clue words, write the equation in the order that the words appear.
4. The equal sign is used in place of the word ‘is.’

Writing Equations – Examples
Look for ‘clue’ words:
1. For the clue words, *the product of* place the constant before the variable. Do not use a sign.
2. The clue words *more than* and *less than* indicate inverted order.
3. If there are no clue words, write the equation in the order that the words appear.
4. The < is used in place of *is less than.*
5. The > is used in place of *is greater than.*

<table>
<thead>
<tr>
<th>Writing Inequalities – Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> The product of 4 and ( x ) is greater than 12.</td>
</tr>
<tr>
<td><strong>2.</strong> ( x ) more than three is less than 12.</td>
</tr>
<tr>
<td><strong>3.</strong> The difference between ( y ) and 4 is greater than –2.</td>
</tr>
</tbody>
</table>
Look for ‘clue’ words:

1. For the clue words, ‘the product of’ place the constant before the variable. Do not use a sign.
2. The clue words ‘more than’ and ‘less than’ indicate inverted order.
3. If there are no clue words, write the equation in the order that the words appear.
4. The < is used in place of ‘is less than.’
5. The > is used in place of ‘is greater than.’
**Step 1.** Get the desired variable on the left and all the others on the right of the equal sign by adding opposites.

**Step 2.** Divide both sides by the positive value of any other variable on the left.

Solving Literal Equations – Example

Solve for \( l \) (length) \( A = lw \)

1. \( lw = A \)

Divide by \( w \)

2. \( l = \frac{A}{w} \)
**Algebra Cheat Sheet 16**

**Solving Literal Equations**

**Step 1.** Get the desired variable on the left and all the others on the right of the equal sign by adding opposites.

**Step 2.** Divide both sides by the positive value of any other variable on the left.

---

Solving Literal Equations – Example
**Locating Points:**

**Step 1.** Find the location on the x-axis. It is –3.

**Step 2.** Find the location on the y-axis. It is 4.

**Step 3.** Write the location in this form (x, y). The point is (–3, 4).

**Plotting points:**

Plot the point (5, –3) on the coordinate plane.

**Step 1.** Begin at point (0, 0). Move 5 to the right (on the x-axis) since 5 is positive.

**Step 2.** Move 3 down since –3 is negative.

**Step 3.** Plot the point.

**Notes – Points on the Coordinate Plane**

♦ Use graph paper.

♦ Begin by marking the x-axis and y-axis as shown in the diagram above.
The y-intercept is the constant in the equation. It is the value of y when x = 0.

A line with a positive slope goes up and to the right.

A line with a negative slope goes down and to the right.

To graph the equation: \( y = 5x - 3 \)

**Step 1.** The y-intercept is –3. Plot the point (0, –3).

**Step 2.** The slope is 5. Move 1 to the right and 5 up from the first point. Plot the second point at (1, 2).

**Step 3.** Draw the line connecting the two points.
♦ The y-intercept is the constant in the equation. It is the value of y when \( x = 0 \).

♦ A line with a positive slope goes up and to the right.

♦ A line with a negative slope goes down and to the right.

To graph the equation: \( y = 5x - 3 \)

**Step 1.** The y-intercept is \(-3\). Plot the point \((0, -3)\).

**Step 2.** The slope is 5. Move 1 to the right and 5 up from the first point. Plot the second point at \((1, 2)\).

**Step 3.** Draw the line connecting the two points.

**Graphing - Using the Slope and y-intercept**
**Step 1.** Substitute ‘0’ for x, and calculate the value of y. Enter both on the first line of the function table.

**Step 2.** Substitute ‘1’ for x, then calculate the value of y. Enter both numbers on the second line of the function table.

**Step 3.** Plot the two points, and draw a line between them.

---

**Graphing - Using Function Tables**

\[ y = 5x - 3 \]

**Step 1.** Substitute ‘0’ for x; 
\[ y = -3 \]. Enter x and y on the first line.

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-3</td>
</tr>
</tbody>
</table>

**Step 2.** Substitute ‘1’ for x; 
\[ y = 2 \]. Enter these numbers on the second.

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

**Step 3.** Plot the two points, 
(0, -3) and (1, 2) then draw a line between them.
**Step 1.** Substitute ‘0’ for x, and calculate the value of y. Enter both on the first line of the function table.

**Step 2.** Substitute ‘1’ for x, then calculate the value of y. Enter both numbers on the second line of the function table.

**Step 3.** Plot the two points, and draw a line between them.

---

**Graphing - Using Function Tables**
Find the Slope of a Line from Two Points

**Step 1.** Make a function table, entering the x and y values of the two points.

**Step 2.** Subtract: \( y_1 - y_2 = \text{Rise} \)

**Step 3.** Subtract: \( x_1 - x_2 = \text{Run} \)

**Step 4.** Slope = \( \frac{\text{Rise}}{\text{Run}} = \frac{y_1 - y_2}{x_1 - x_2} \)

---

**Slope of a Line from Two Points**

Find the slope of the line which includes points \((-2, -2)\) and \((1, 6)\).

**Step 1.** Enter the x and y values for the two points.

\[
\begin{array}{|c|c|}
\hline
\text{x} & \text{y} \\
\hline
-2 & -2 \\
1 & 6 \\
-2 & -8 \\
\hline
\end{array}
\]

**Step 2.** The rise is \((-2) - (5)\) or \(-7\).

**Step 3.** The run is \((-2) - (1)\) or \(-1\)

**Step 4.** The slope is \(4\).

\[
\frac{\text{Rise}}{\text{Run}} = \frac{-8}{-2}
\]
### Find the Slope of a Line from Two Points

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1.</td>
<td>Make a function table, entering the x and y values of the two points.</td>
</tr>
<tr>
<td>Step 2.</td>
<td>Subtract: $y_1 - y_2 = \text{Rise}$</td>
</tr>
<tr>
<td>Step 3.</td>
<td>Subtract: $x_1 - x_2 = \text{Run}$</td>
</tr>
<tr>
<td>Step 4.</td>
<td>Slope = $\frac{\text{Rise}}{\text{Run}} = \frac{y_1 - y_2}{x_1 - x_2}$</td>
</tr>
</tbody>
</table>

**Slope of a Line from Two Points**
To find the equation of a line shown on a graph.

**Step 1.** Determine the y-intercept. Find the point where x = 0. Substitute this value in the equation in place of ‘b.’

**Step 2.** Find the value of y when x = 1.

**Step 3.** Subtract the value found in Step 1 from the value found in Step 2. This is the slope. Substitute this value in the equation in place of ‘m.’

**Equation of a Line – Example**

**Step 1.** The y-intercept is 6. \( y = mx + 6 \).

**Step 2.** When x = 1, y = 2.

**Step 3.** The slope (m) is 2 – 6 or –4.

The equation of the line is: \( y = -4x + y \)
To find the equation of a line shown on a graph.

**Step 1.** Determine the y-intercept. Find the point where \( x = 0 \). Substitute this value in the equation in place of ‘b.’

**Step 2.** Find the value of \( y \) when \( x = 1 \).

**Step 3.** Subtract the value found in Step 1 from the value found in Step 2. This is the slope. Substitute this value in the equation in place of ‘\( m \).’

---

**Equation of a Line – Example**
Step 1. Plot the y-intercept.

Step 2. Use the slope as the rise, and 1 as the run. Count the rise and run to find another point.

Step 3. Determine what kind of a line will connect the points. (Use a dotted line for < or >; use a solid line for ≤ or ≥.)

Step 4. Shade above the line for greater than (>), and below the line for less than (<).

**Example – Graphing Inequalities**

\[ y \leq x + 2 \]

Step 1. Substitute ‘0’ for x; \( y = 2 \). Enter x and \( y \) on the first line.

Step 2. Substitute ‘1’ for x; \( y = 3 \). Enter these numbers on the second.

Step 3. Plot the two points, (0, 2) and (1, 3) then draw a solid line between them.

Step 4. Shade below the line because the sign is \( \leq \).
<table>
<thead>
<tr>
<th>Algebra Cheat Sheet 22</th>
<th>Graphing Inequalities</th>
</tr>
</thead>
</table>

**Step 1.** Plot the y-intercept.

**Step 2.** Use the slope as the rise, and 1 as the run. Count the rise and run to find another point.

**Step 3.** Determine what kind of a line will connect the points. (Use a dotted line for < or >; use a solid line for ≤ or ≥.)

**Step 4.** Shade above the line for greater than (>), and below the line for less than (<).

**Example – Graphing Inequalities**
### Forms of Linear Equations

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Slope–intercept form</strong></td>
<td>y = mx + b</td>
</tr>
<tr>
<td><strong>Standard form</strong></td>
<td>Ax + by = C</td>
</tr>
</tbody>
</table>

#### Forms of Linear Equations – Examples

Change the slope-intercept equation to standard form.

\[
y = \frac{2}{3} x - 3 \quad \text{slope-intercept form}
\]

\[
5y = 2x - 15 \quad \text{Multiply each side by 5.}
\]

\[
-2x + 5y = -15 \quad \text{Subtract 2x from each side.}
\]

Change the standard form equation to slope-intercept form.

\[
3x + 2y = 6 \quad \text{Standard form equation}
\]

\[
2y = -3x + 6 \quad \text{Subtract 3x from each side.}
\]

\[
y = \frac{-3}{2}x + 3 \quad \text{Slope-intercept form}
\]
**Algebra Cheat Sheet 23**

**Forms of Linear Equations**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope–intercept form</td>
<td>( y = mx + b )</td>
</tr>
<tr>
<td>Standard form</td>
<td>( Ax + by = C )</td>
</tr>
</tbody>
</table>

Forms of Linear Equations – Examples
**Solving Equations II**

**Step 1.** Get all the variables on the left and all the numbers on the right of the equal sign by adding opposites.

**Step 2.** Combine like terms.

**Step 3.** Divide by the coefficient of the variable to determine its value.

---

**Solving Equations II – Example**

\[ 4x + 4 = 2x - 6 \]

1. \[ 4x - 2x = -6 - 4 \]
2. \[ 2x = -10 \]
3. \[ x = -5 \]
Step 1. Get all the variables on the left and all the numbers on the right of the equal sign by adding opposites.

Step 2. Combine like terms

Step 3. Divide by the coefficient of the variable to determine its value.

Solving Equations II – Examples
To multiply monomials, add the exponents of the same variables.

Example – Multiplying Monomials

\[(a^3 b^5 c^8) (a^2 b^7 c^1)\]

<table>
<thead>
<tr>
<th>Step 1. Multiply the a’s</th>
<th>((a^3)(a^2) = a^5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2. Multiply the b’s</td>
<td>((b^5)(b^7) = b^{12})</td>
</tr>
<tr>
<td>Step 3. Multiply the c’s</td>
<td>((c^8)(c^1) = c^9)</td>
</tr>
</tbody>
</table>

Step 4. Put them together:

\[(a^3 b^5 c^8) (a^2 b^7 c^1) = a^5 b^{12} c^9\]
To multiply monomials, add the exponents of the same variables.

Examples – Multiplying Monomials
To divide monomials, subtract the exponents of the same variables.

### Example – Dividing Monomials

\[
\frac{(a^4 b^7 c^8)}{(a^3 b^2 c^6)}
\]

<table>
<thead>
<tr>
<th>Step 1. Divide the a’s</th>
<th>( \frac{a^4}{a^3} = a^{4-3} = a )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2. Divide the b’s</td>
<td>( \frac{b^7}{b^2} = b^{7-2} = b^5 )</td>
</tr>
<tr>
<td>Step 3. Divide the c’s</td>
<td>( \frac{c^8}{c^6} = c^{8-6} = c^2 )</td>
</tr>
</tbody>
</table>

Step 4. Put them together:

\[
\frac{(a^4 b^7 c^8)}{(a^3 b^2 c^6)} = a b^5 c^2
\]
To divide monomials, subtract the exponents of the same variables.

**Examples – Dividing Monomials**
# Raising Monomials to a Power

To raise monomials to a power, multiply the exponent of each variable by the power.

## Example – Raising Monomials to a Power

\[(a \ b^4 \ c^2)^2\]

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Square the a’s</td>
<td>((a)(a) = a^2)</td>
</tr>
<tr>
<td>2.</td>
<td>Square the b’s</td>
<td>((b^4)(b^4) = b^8)</td>
</tr>
<tr>
<td>3.</td>
<td>Square the c’s</td>
<td>((c^2)(c^2) = c^4)</td>
</tr>
<tr>
<td>4.</td>
<td>Put them together:</td>
<td>((a^2 \ b^8 \ c^4))</td>
</tr>
</tbody>
</table>
To raise monomials to a power, multiply the exponent of each variable by the power.

<table>
<thead>
<tr>
<th>Algebra Cheat Sheet 27</th>
<th>Raising Monomials to a Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>♦ To raise monomials to a power, multiply the exponent of each variable by the power.</td>
<td></td>
</tr>
</tbody>
</table>

Examples – Raising Monomials to a Power
To multiply, divide or raise monomials to negative powers, use the rules for integers.

**Example – Raising Monomials to a Power**

\[
\left( m^{5} n^{6} p^{3} \right) \left( m^{-2} n^{-1} p^{3} \right)
\]

<table>
<thead>
<tr>
<th>Step 1. Multiply the m’s</th>
<th>( (m^5) (m^{-2}) = m^3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2. Multiply the n’s</td>
<td>( (n^6) (n^{-1}) = n^5 )</td>
</tr>
<tr>
<td>Step 3. Multiply the p’s</td>
<td>( (p^3) (p^3) = p^6 )</td>
</tr>
<tr>
<td><strong>Step 4. Put them together:</strong></td>
<td>( (m^5 n^6 p^3) (m^{-2} n^{-1} p^3) = m^3 n^5 p^6 )</td>
</tr>
</tbody>
</table>
To multiply, divide or raise monomials to negative powers, use the rules for integers.

Examples – Raising Monomials to a Power
To divide by a monomial, separate the given expression into the sum of two fractions and divide.

Dividing by a Monomial – Example

\[
\frac{12x^2 - 8x}{4x} = \frac{12x^2}{4x} + \frac{-8x}{4x} = 3x - 2
\]
To divide by a monomial, separate the given expression into the sum of two fractions and divide.

Dividing by a Monomial – Example
The greatest common factor (GCF) is the greatest number that is a factor of two or more given numbers.

In algebra, the GCF consists of the GCF of the coefficients multiplied by the GCF of the variables.

Greatest Common Factor – Example

\(- 6x^2y + 3xy^2\)

- The GCF of the coefficients, \(-6\) and \(3\), is \(3\).
- The GCF of the variables, \(x^2y\) and \(xy^2\) is \(xy\).
- The product is \(3xy\); this is the GCF.
The greatest common factor (GCF) is the greatest number that is a factor of two or more given numbers.

In algebra, the GCF consists of the GCF of the coefficients multiplied by the GCF of the variables.

Greatest Common Factor – Examples
Combining Like Terms II

**Step 1.** Arrange the terms in descending order of exponents.

**Step 2.** Combine the terms with like exponents and variables.

**Example – Combining Like Terms II**

\[-3y^8 + 6y^9 - 4y^9 + 8y + 7y^8 - 2y\]

**Step 1.** \[6y^9 - 4y^9 - 3y^8 + 7y^8 + 8y - 2y\]

**Step 2.** \[2y^9 + 4y^8 + 6y\]
Step 1. Arrange the terms in descending order of exponents.

Step 2. Combine the terms with like exponents and variables.

Examples – Combining Like Terms II
### Adding Polynomials

**Step 1.** Set up the problem vertically in descending order of exponents.

**Step 2.** Add the like terms.

---

**Example – Adding Polynomials**

\[-3y^8 + 6y^9 - 4y^9 + 8y + 7y^8 - 2y\]

**Step 1.** \[6y^9 - 4y^9 - 3y^8 + 7y^8 + 8y - 2y\]

**Step 2.** \[2y^9 + 4y^8 + 6y\]
Step 1. Set up the problem vertically in descending order of exponents.

Step 2. Add the like terms.

Examples – Adding Polynomials
Step 1. Set up the problem vertically in descending order of exponents.

Step 2. Change the signs of all the bottom terms. (the ones to be subtracted)

Step 3. Combine the like terms.

A short way of saying this is:

Change the bottom signs and add.

Example – Subtracting Polynomials

\((-20x^2 + 30x^3 + 3 + 10x) - (30x^2 + 10x^3 + 2 - 20x)\)

<table>
<thead>
<tr>
<th>Step 1.</th>
<th>(30x^3 - 20x^2 + 10x + 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- ((10x^3 + 30x^2 - 20x + 2))</td>
</tr>
<tr>
<td>Step 2.</td>
<td>(30x^3 - 20x^2 + 10x + 3)</td>
</tr>
<tr>
<td></td>
<td>- (10x^3 - 30x^2 + 20x - 2)</td>
</tr>
<tr>
<td>Step 3.</td>
<td>(20x^3 - 50x^2 + 30x + 1)</td>
</tr>
</tbody>
</table>
Step 1. Set up the problem vertically in descending order of exponents.

Step 2. Change the signs of all the bottom terms. (the ones to be subtracted)

Step 3. Combine the like terms.

A short way of saying this is:

Change the bottom signs and add.

Examples – Subtracting Polynomials
Missing Factor problems can be set up as multiplication problems with one factor blank, or as a division problem. In either case, the answer is always the same.

**Missing Factors – Example**

**Here are the two ways a problem can be written:**

\[
\begin{align*}
(3x - 2) (\ ?) &= -3x^2 + 2x \\
a &= (3x - 2) \\
b &= (\ ?) \\
c &= -3x^2 + 2x
\end{align*}
\]

\[
\frac{c}{a} = b = \frac{-3x^2 + 2x}{(3x - 2)} = ?
\]

The missing factor is \(x\).
If \((a)(b) = c\) then \(\frac{c}{a} = b\) and \(\frac{c}{b} = a\).

Missing Factor problems can be set up as multiplication problems with one factor blank, or as a division problem. In either case, the answer is always the same.

**Missing Factors – Examples**
The degree of a polynomial is highest degree (exponent) of any of its terms after it has been simplified.

Example – Degree of a Polynomial

$40x^3 + 10x^2 + 5x + 4$

- 3 is the largest exponent
- this is a third degree polynomial
**Degree of a Polynomial**

- The degree of a polynomial is highest degree (exponent) of any of its terms after it has been simplified.

### Examples – Degree of a Polynomial
To multiply a polynomial by \(-1\), change the sign of each term of the polynomial.

\[-1 (3a + 4b - 2c) = -3a - 4b + 2c\]
### Multiply a Polynomial by a Variable

**Step 1.** Multiply each term of the polynomial by the variable.

**Step 2.** Combine the results.

#### Example – Multiply Polynomials by Monomials

\[ x(2x^2 + 3x - 4) \]

<table>
<thead>
<tr>
<th>Step 1.</th>
<th>( x(2x^2) = 2x^3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( x(3x) = 3x^2 )</td>
</tr>
<tr>
<td></td>
<td>( x (- 4) = - 4x )</td>
</tr>
</tbody>
</table>

| Step 2. | \( 2x^3 + 3x^2 - 4x \) |

Therefore: \[ x(2x^2 + 3x - 4) = 2x^3 + 3x^2 - 4x \]
Algebra Cheat Sheet 37

Multiply a Polynomial by a Variable

Step 1. Multiply each term of the polynomial by the variable.

Step 2. Combine the results.

Examples – Multiply Polynomials by Monomials
Multiplying a Polynomial by an Integer

Step 1. Multiply each term of the polynomial by the integer.

Step 2. Combine the results.

Example – Multiply a Polynomial by an Integer

\(-2 \ (2x^2 + 3x - 4)\)

Step 1.

\(-2 \ (2x^2) = 4x^2\)

\(-2 \ (3x) = -6x\)

\(-2 \ (-4) = 8\)

Step 2.

\(4x^2 - 6x + 8\)

Therefore: \(-2 \ (2x^2 + 3x - 4) = 4x^2 - 6x + 8\)
Step 1. Multiply each term of the polynomial by the integer.
Step 2. Combine the results.

Examples – Multiply a Polynomial by an Integer
### Multiply a Polynomial by a Monomial

**Step 1.** Multiply each term of the polynomial by the monomial.

**Step 2.** Combine the results.

Example—Multiply Polynomials by Monomials

\[-2x \cdot (2x^2 + 3x - 4)\]

<table>
<thead>
<tr>
<th>Step 1.</th>
<th>[-2x \cdot (2x^2) = -4x^3]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[-2x \cdot (3x) = -6x^2]</td>
</tr>
<tr>
<td></td>
<td>[-2x \cdot (-4) = 8x]</td>
</tr>
</tbody>
</table>

| Step 2. | \[-4x^3 - 6x^2 + 8x\] |

Therefore: \[-2x(2x^2 + 3x - 4) = -4x^3 - 6x^2 + 8x\]
**Algebra Cheat Sheet 39**

**Multiply a Polynomial by a Monomial**

**Step 1.** Multiply each term of the polynomial by the monomial.

**Step 2.** Combine the results.

Examples – Multiply Polynomials by Monomials
The product of 2 binomials has 4 terms. To find these 4 terms, multiply each term in the 1st binomial with each term in the 2nd binomial. This process is called the FOIL method.

The formula is:  \((a + b) (c + d) = ac + ad + bc + bd\)

- \(F = (ac)\) is the product of the **FIRST** terms
- \(O = (ad)\) is the product of the **OUTSIDE** terms
- \(I = (bc)\) is the product of the **INSIDE** terms
- \(L = (bd)\) is the product of the **LAST** terms

**Example – Multiplying Two Binomials**

\((m + 3) (m + 4)\)

<table>
<thead>
<tr>
<th>Step 1. Multiply first terms:</th>
<th>((m) (m) = m^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2. Multiply outside terms:</td>
<td>((m) (4) = 4m)</td>
</tr>
<tr>
<td>Step 3. Multiply inside terms:</td>
<td>((3) (m) = 3m)</td>
</tr>
<tr>
<td>Step 4. Multiply last terms</td>
<td>((4) (3) = 12)</td>
</tr>
<tr>
<td>Step 5. Combine like terms:</td>
<td>(m^2 + 4m + 3m + 12)</td>
</tr>
<tr>
<td></td>
<td>(m^2 + 7m + 12)</td>
</tr>
</tbody>
</table>
Multiplying Two Binomials

♦ The product of 2 binomials has 4 terms. To find these 4 terms, multiply each term in the 1st binomial with each term in the 2nd binomial. This process is called the FOIL method.

♦ The formula is: \((a + b)(c + d) = ac + ad + bc + bd\)

\[\begin{align*}
F &= (ac) \text{ is the product of the } \textit{FIRST} \text{ terms} \\
O &= (ad) \text{ is the product of the } \textit{OUTSIDE} \text{ terms} \\
I &= (bc) \text{ is the product of the } \textit{INSIDE} \text{ terms} \\
L &= (bd) \text{ is the product of the } \textit{LAST} \text{ terms}
\end{align*}\]

Examples – Multiplying Two Binomials