Directions: Read and review each section. Then complete each practice set as directed. Show all work.

A. Simplifying Polynomial Expressions

I. Combining Like Terms

- You can add or subtract terms that are considered "like", or terms that have the same variable(s) with the same exponent(s).

Ex. 1: \[5x - 7y + 10x + 3y\]
\[5x - 7y + 10x + 3y\]
\[15x - 4y\]

Ex. 2: \[-8h^3 + 10h^3 - 12h^2 - 15h^3\]
\[-8h^3 + 10h^3 - 12h^2 - 15h^3\]
\[-20h^2 - 5h^3\]

II. Applying the Distributive Property

- Every term inside the parentheses is multiplied by the term outside of the parentheses.

Ex. 1: \[3(9x - 4)\]
\[3 \cdot 9x - 3 \cdot 4\]
\[27x - 12\]

Ex. 2: \[4x^2(5x^3 + 6x)\]
\[4x^2 \cdot 5x^3 + 4x^2 \cdot 6x\]
\[20x^5 + 24x^3\]

III. Combining Like Terms AND the Distributive Property (Problems with a Mix!)

- Sometimes problems will require you to distribute AND combine like terms!!

Ex. 1: \[3(4x - 2) + 13x\]
\[3 \cdot 4x - 3 \cdot 2 + 13x\]
\[12x - 6 + 13x\]
\[25x - 6\]

Ex. 2: \[3(12x - 5) - 9(-7 + 10x)\]
\[3 \cdot 12x - 3 \cdot 5 - 9(-7) - 9(10x)\]
\[36x - 15 + 63 - 90x\]
\[-54x + 48\]

Now complete practice set A
B. Solving Equations

I. Solving Two-Step Equations

A couple of hints:
1. To solve an equation, UNDO the order of operations and work in the reverse order.
2. REMEMBER! Addition is "undone" by subtraction, and vice versa. Multiplication is "undone" by division, and vice versa.

Ex. 1: \(4x - 2 = 30\)
\[
\begin{align*}
+2 & \quad +2 \\
4x & \quad = 32 \\
+4 & \quad +4 \\
x & \quad = 8
\end{align*}
\]

Ex. 2: \(87 = -11x + 21\)
\[
\begin{align*}
-21 & \quad -21 \\
66 & \quad = -11x \\
+11 & \quad +11 \\
-6 & \quad = x
\end{align*}
\]

II. Solving Multi-step Equations With Variables on Both Sides of the Equal Sign

When solving equations with variables on both sides of the equal sign, be sure to get all terms with variables on one side and all the terms without variables on the other side.

Ex. 3: \(8x + 4 = 4x + 28\)
\[
\begin{align*}
-4 & \quad -4 \\
8x & \quad = 4x + 24 \\
-4x & \quad -4x \\
4x & \quad = 24 \\
+4 & \quad +4 \\
x & \quad = 6
\end{align*}
\]

III. Solving Equations that need to be simplified first

In some equations, you will need to combine like terms and/or use the distributive property to simplify each side of the equation, and then begin to solve it.

Ex. 4: \(5(4x - 7) = 8x + 45 + 2x\)
\[
\begin{align*}
20x & \quad = 10x + 45 \\
-10x & \quad -10x \\
10x & \quad = 45 \\
+35 & \quad +35 \\
10x & \quad = 80 \\
+10 & \quad +10 \\
x & \quad = 8
\end{align*}
\]

Now complete practice set B
C. Solving Inequalities

I. Follow the rules for solving equations EXCEPT – If you multiply or divide by a negative number you must **flip the inequality sign**.

<table>
<thead>
<tr>
<th>Ex. 1</th>
<th>Flip the sign</th>
<th>Ex. 2</th>
<th>Don’t flip the sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>$-4x + 5 &lt; 13$</td>
<td>$3x + 7 \leq 4$</td>
<td>$-4x &lt; 8$</td>
<td>$3x \leq -3$</td>
</tr>
<tr>
<td>$x &gt; -2$</td>
<td>$x \leq -1$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

II. Graphing on a number line

Always have the variable on the left

- Shading: for $\leq, <$ shade to the left for $\geq, >$ shade to the right
- Markings: for $\leq, \geq$ fill in the circle for $<, >$ open circle

Now complete practice set C
D. Solving Literal Equations

- A literal equation is an equation that contains more than one variable.
- You can solve a literal equation for one of the variables by getting that variable by itself (isolating the specified variable).

Example 1: \(3xy = 18\), Solve for \(x\).
\[
\begin{align*}
\frac{3xy}{3y} &= \frac{18}{3y} \\
x &= \frac{6}{y}
\end{align*}
\]

Example 2: \(5a - 10b = 20\), Solve for \(a\).
\[
\begin{align*}
+10b &= +10b \\
5a &= 20 + 10b \\
\frac{5a}{5} &= \frac{20 + 10b}{5} \\
a &= 4 + 2b
\end{align*}
\]

Now complete practice set D

E. Rules of Exponents

- **Multiplication:** Recall \((x^m)(x^n) = x^{(m+n)}\)
\[
\text{Ex: } (3x^4y^2)(4xy^3) = (3 \cdot 4)(x^4 \cdot x^1)(y^2 \cdot y^3) = 12x^5y^7
\]

- **Division:** Recall \(\frac{x^m}{x^n} = x^{(m-n)}\)
\[
\text{Ex: } \frac{42m^5j^2}{-3m^3j} = \left(\frac{42}{-3}\right)\left(\frac{m^5}{m^3}\right)\left(\frac{j^2}{j^1}\right) = -14m^2j
\]

- **Powers:** Recall \((x^m)^n = x^{(mn)}\)
\[
\text{Ex: } (-2a^2bc^4)^3 = (-2)^3(a^2)^3(b)^3(c^4)^3 = -8a^6b^3c^{12}
\]

- **Power of Zero:** Recall \(x^0 = 1, x \neq 0\)
\[
\text{Ex: } 5x^0y^4 = (5)(1)(y^4) = 5y^4
\]

Now complete practice set E
F. Binomial Multiplication

I. Reviewing the Distributive Property

The distributive property is used when you want to multiply a single term by an expression.

Ex 1: \( 8(5x^2 - 9x) \)
\[ 8 \cdot 5x^2 + 8 \cdot (-9x) \]
\[ 40x^2 - 72x \]

II. Multiplying Binomials – the FOIL method

When multiplying two binomials (an expression with two terms), we use the “FOIL” method. The “FOIL” method uses the distributive property twice!

FOIL is the order in which you will multiply your terms.

First
Outer
Inner
Last

Ex. 1: \((x+6)(x+10)\)

\[
\begin{align*}
\text{FIRST} & \quad \text{OUTER} \\
(x+6)(x+10) & \\
\text{INNER} & \quad \text{LAST}
\end{align*}
\]

\[
\begin{align*}
\text{First} & \quad x \cdot x \quad \rightarrow \quad x^2 \\
\text{Outer} & \quad x \cdot 10 \quad \rightarrow \quad 10x \\
\text{Inner} & \quad 6 \cdot x \quad \rightarrow \quad 6x \\
\text{Last} & \quad 6 \cdot 10 \quad \rightarrow \quad 60
\end{align*}
\]

\[ x^2 + 10x + 6x + 60 \]
\[ x^2 + 16x + 60 \]
(After combining like terms)

Now complete practice set F
G. Factoring

I. Using the Greatest Common Factor (GCF) to Factor.

• Always determine whether there is a greatest common factor (GCF) first.

Ex. 1 \[3x^4 - 33x^3 + 90x^2\]

- In this example the GCF is \(3x^2\).
- So when we factor, we have \(3x^2(x^2 - 11x + 30)\).
- Now we need to look at the polynomial remaining in the parentheses. Can this trinomial be factored into two binomials? In order to determine this make a list of all of the factors of 30.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Since \(-5 + -6 = -11\) and \((-5)(-6) = 30\) we should choose \(-5\) and \(-6\) in order to factor the expression.

- The expression factors into \(3x^2(x - 5)(x - 6)\)

Note: Not all expressions will have a GCF. If a trinomial expression does not have a GCF, proceed by trying to factor the trinomial into two binomials.

II. Applying the difference of squares: \(a^2 - b^2 = (a - b)(a + b)\)

Ex. 2 \[4x^3 - 100x\]

\[4x(x^2 - 25)\]

\[4x(x - 5)(x + 5)\]

Since \(x^2\) and 25 are perfect squares separated by a subtraction sign, you can apply the difference of two squares formula.
III. Factoring by Grouping

**Step 1:** Factor out a GCF if possible.

**Step 2:** Group the first two terms together and the last two terms together.

**Step 3:** Factor out the GCF from each of the two groups.

**Step 4:** The factors inside of the parenthesis should be exactly the same. The matching binomials are your first factor, the coefficients of the parentheses form your second binomial.

**Step 5:** Determine if the remaining factors can be factored any further.

Example 1 – Factor: \( x^2 - 5x^2 + 3x - 15 \)

<table>
<thead>
<tr>
<th>Step 1: Decide if the four terms have anything in common, called the greatest common factor or GCF. If so, factor out the GCF. Do not forget to include the GCF as part of your final answer. In this case, the four terms only have a 1 in common which is of no help.</th>
<th>( x^3 - 5x^2 + 3x - 15 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 2: Create smaller groups within the problem, usually done by grouping the first two terms together and the last two terms together.</td>
<td>( x^3 - 5x^2 + 3x - 15 )</td>
</tr>
<tr>
<td>Step 3: Factor out the GCF from each of the two groups. In this problem, the signs in front of the 5x^2 and the 15 are different, so you need to factor out a positive 3.</td>
<td>( x^2(x - 5) + 3(x - 5) )</td>
</tr>
<tr>
<td>Step 4: Notice that what is inside the parentheses is a perfect match. The one thing that the two groups have in common is ((x - 5)), so you can factor out ((x - 5)) leaving the following:</td>
<td>((x - 5)(x^2 + 3)) or ((x^2 + 3)(x - 5))</td>
</tr>
<tr>
<td>Step 5: Determine if any of the remaining factors can be factored further. In this case they cannot so the final answer is:</td>
<td>((x - 5)(x^2 + 3)) or ((x^2 + 3)(x - 5))</td>
</tr>
</tbody>
</table>

Now complete practice set G
H. Solving Quadratic Equations

Quadratic Equation – An equation where the variable is raised to the 2\textsuperscript{nd} power.

\[ ax^2 + bx + c = 0 \] (standard form)

\( x \) represents an unknown variable, and parameters a, b, and c are the coefficients of the equation.

There are several methods of solving quadratic equations. These include solving by:

I. factoring (if possible – Zero Product Property)

II. square root property (use when there is no middle term)

III. using the quadratic formula (always works)

I. Solving by Factoring (using the zero-product property)

Step 1: Write the equation in standard form.

Step 2: Use factoring strategies to factor the problem.

Step 3: Use the Zero Product Property and set each factor containing a variable equal to zero.

Step 4: Solve each factor that was set equal to zero by getting the x on one side and the answer on the other side.

Example – Solve: 18x\(^2\) – 3x = 6

<table>
<thead>
<tr>
<th>Step 1: Write the equation in the correct form. In this case, we need to set the equation equal to zero with the terms written in descending order.</th>
<th>18x(^2) – 3x – 6 = 0</th>
</tr>
</thead>
</table>
| Step 2: Use a factoring strategies to factor the problem. | 3(6x\(^2\) – x – 2) = 0  
3(3x – 2)(2x + 1) = 0 |
| Step 3: Use the Zero Product Property and set each factor containing a variable equal to zero. | 3x – 2 = 0  or  2x + 1 = 0 |
| Step 4: Solve each factor that was set equal to zero by getting the x on one side and the answer on the other side. | 3x = 2  or  2x = –1  
x = \frac{2}{3}  
x = \frac{1}{2} |
II. Solving by Using the Square Root Property

Step 1: Isolate the perfect square.

Step 2: Take the square root of each side. Don’t forget the ±.

Examples:

\[5x^2 - 45 = 0\]
\[5x^2 = 45\]
\[x^2 = 9\]
\[x = \pm \sqrt{9}\]
\[= \pm 3\]

\[3x^2 - 15 = 0\]
\[3x^2 = 15\]
\[x^2 = 5\]
\[\sqrt{x^2} = \pm \sqrt{5}\]
\[x = \{-\sqrt{5}, \sqrt{5}\}\]

III. Quadratic Formula

Step 1: Make sure the equation is in Standard form.

Step 2: Identify a, b, and c in the equation.

Step 3: Substitute the values of a, b, and c into the quadratic formula. Be careful with parentheses and negative numbers.

Step 4: Simplify this expression to determine the values for x.

\[x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\]

Example

\[3x^2 + 2x - 6 = 0\]
\[a = 3, \ b = 2, \text{ and } c = -6\]
\[x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\]
\[= \frac{-2 \pm \sqrt{4 + 4(3)(6)}}{2(3)}\]
\[= \frac{-2 \pm \sqrt{76}}{6}\]
\[= \frac{-2 \pm 2\sqrt{19}}{6}\]
\[= \frac{-1 \pm \sqrt{19}}{3}\]
\[x_1 = \frac{-1 + \sqrt{19}}{3}\]
\[x_2 = \frac{-1 - \sqrt{19}}{3}\]

\[x^2 - 5x - 3 = 2\]
\[x^2 - 5x - 5 = 0\]
\[x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-5)}}{2(1)}\]
\[= \frac{5 \pm \sqrt{25 + 20}}{2}\]
\[= \frac{5 \pm \sqrt{45}}{2}\]
\[= \frac{5 \pm 3\sqrt{5}}{2}\]

Now complete practice set H
I. Radicals

To simplify a radical, we need to find the greatest perfect square factor of the number under the radical sign (the radicand) and then take the square root of that number.

Ex. 1: \( \sqrt{72} \)
\[
= \sqrt{36 \cdot 2}
= 6\sqrt{2}
\]

Ex. 2: \( 4\sqrt{90} \)
\[
= 4 \cdot \sqrt{9 \cdot 10}
= 4 \cdot 3 \cdot \sqrt{10}
= 12\sqrt{10}
\]

Ex. 3: \( \sqrt{48} \)
\[
= \sqrt{16 \cdot 3}
= 4\sqrt{3}
\]

OR

Ex. 3: \( \sqrt{48} \)
\[
= \sqrt{4 \cdot 12}
= 2\sqrt{12}
= 2\sqrt{4 \cdot 3}
= 2 \cdot 2 \cdot \sqrt{3}
= 4\sqrt{3}
\]

This is not simplified completely because 12 is divisible by 4 (another perfect square).

Now complete practice set I

J. Finding Slope

I. Finding the Slope of the Line that Contains each Pair of Points.

Given two points with coordinates \((x_1, y_1)\) and \((x_2, y_2)\), the formula for the slope, \(m\), of the line containing the points is \( m = \frac{y_2 - y_1}{x_2 - x_1} \).

Ex. (2, 5) and (4, 1)
\[
m = \frac{1 - 5}{4 - 2} = \frac{-4}{2} = -2
\]
The slope is -2.

Ex. (-3, 2) and (2, 3)
\[
m = \frac{3 - 2}{2 - (-3)} = \frac{1}{5}
\]
The slope is \( \frac{1}{5} \).

Now complete practice set J
K. Graphing Lines

II. Using the Slope – Intercept Form of the Equation of a Line.
The slope-intercept form for the equation of a line with slope \( m \) and \( y \)-intercept \( b \) is \( y = mx + b \).

\begin{align*}
\text{Ex. } y &= 3x - 1 \\
\text{Slope: } 3 & \quad \text{\( y \)-intercept: -1}
\end{align*}

\begin{align*}
\text{Ex. } y &= \frac{3}{4}x + 2 \\
\text{Slope: } -\frac{3}{4} & \quad \text{\( y \)-intercept: 2}
\end{align*}

Parallel lines have the same slope.
Perpendicular lines have negative reciprocal slopes: \( m = -\frac{2}{3} \) and \( \frac{3}{2} \).

Ex. 1 \quad m = 3 \text{ through } (-2,4)

\begin{align*}
4 &= 3(-2) + b \\
b &= 10 \\
y &= 3x - 10
\end{align*}

Ex. 2 \quad \text{through (0,4) and (1, -2)}

\begin{align*}
m &= \frac{-2 - 4}{1 - 0} = -6 \\
y &= -6x + 4
\end{align*}

Now complete practice set K

L. Writing equations of lines in slope intercept form

\( y = mx + b \) \( m= \) slope \( b= \) \( y \)-intercept

Parallel lines have the same slope.

Perpendicular lines have negative reciprocal slopes: \( m = -\frac{2}{3} \) and \( \frac{3}{2} \).

Now complete practice set L
M. Using Standard Form to Graph a Line

An equation in standard form can be graphed using several different methods. Two methods are explained below.

a. Re-write the equation in \( y = mx + b \) form, identify the \( y \)-intercept and slope, then graph as in Part II above.

b. Solve for the \( x \)- and \( y \)-intercepts. To find the \( x \)-intercept, let \( y = 0 \) and solve for \( x \). To find the \( y \)-intercept, let \( x = 0 \) and solve for \( y \). Then plot these points on the appropriate axes and connect them with a line.

**Ex.** 2\( x \) – 3\( y \) = 10

a. Solve for \( y \):
\[
-3y = -2x + 10
\]
\[
y = \frac{-2x + 10}{-3}
\]
\[
y = \frac{2}{3}x - \frac{10}{3}
\]

b. Find the intercepts:
\[
\text{let } y = 0: \quad 2x - 3(0) = 10
\]
\[
2x = 10
\]
\[
x = 5
\]

\[
\text{let } x = 0: \quad 2(0) - 3y = 10
\]
\[
-3y = 10
\]
\[
y = \frac{-10}{3}
\]

So \( x \)-intercept is \((5, 0)\) \quad So \( y \)-intercept is \(\left(0, -\frac{10}{3}\right)\)

On the \( x \)-axis place a point at 5.
On the \( y \)-axis place a point at \(-\frac{10}{3} = -3 \frac{1}{3}\)
Connect the points with the line.

Now complete practice set M
N. Solving Systems of Linear Equations

There are 3 methods to solve a system of linear equations:

1. Graphing: Find the point of intersection of the 2 lines

2. Substitution:

   \[ y = 2x + 3 \]
   \[ 2x - 4y = -18 \]
   \[ 2x - 4(2x + 3) = -18 \]
   \[ 2x - 8x - 12 = -18 \]
   \[ -6x = -6 \]
   \[ x = 1 \]
   \[ y = 2(1) + 3 = 5 \]

3. Elimination:

   \[ 3x + 2y = 4 \]
   \[ x - 2y = -8 \]
   \[ 4x = -4 \]

   \[ x = -1 \]

   \[ -1 - 2y = -8 \]

   \[ -2y = 7 \]

   \[ y = -3.5 \]

Now complete practice set N
ACP Algebra II – Summer Packet Practice Sets

Do all work on the packet and circle your answer. It is due the first day of school. You will be assessed on this material.

Practice Set A

Simplify.

1. \(8x - 9y + 16x + 12y\)
2. \(5n - (3 - 4n)\)

3. \(10q(16x + 11)\)
4. \(-2(11b - 3)\)

5. \(3(18z - 4w) + \frac{1}{2}(10z - 6w)\)
6. \(9(6x - 2) - \frac{1}{3}(9x^2 - 3)\)
Practice Set B

Solve each equation. You must show all work.

1. \( \frac{5x}{2} - 2 = 3 \)
2. \( 8(3x - 4) = 196 \)
3. \( 132 = 4\left(\frac{x}{8} - 9\right) \)
4. \( -131 = -5(3x - 8) + 6x \)
5. \( 12x + 8 - 15 = -2(3x - 82) \)
6. \( -(12x - 6) = 12x + 6 \)

Practice Set C

Solve and graph each inequality. You must show all work.

1. \( \frac{1}{3}x + 1 \geq 7 \)
2. \( 3x + 2(x - 5) > 2x \)
Practice Set D

Solve each equation for the specified variable.

1. $9wr = 81, \text{ for } w$
2. $dx + t = 10, \text{ for } x$
3. $P = 180(g - 9), \text{ for } g$

Problem Set E

Simplify each expression.

1. $(p^4q^2)(p^7q^5)$
2. $(-t^7)^3$
3. $\frac{12a^4b^6}{36ab^2c}$
4. $(12x^2y)^0$
5. $(-5a^2b)(2ab^2c)(-3b)$
6. $(3x^4y)(2y^2)^3$
Practice Set F

Multiply. Write your answer in simplest form.

1. \((x - 10)(x - 2)\)  
2. \((x + 10)^2\)

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

Problem Set G

Factor each expression

1. \(3x^2 + 6x\)  
2. \(4a^2b^2 - 16ab^3 + 8ab^2c\)

3. \(6x^3 + 15x^2 + 4x + 10\)  
4. \(d^2 + 3d - 28\)

5. \(g^2 - 9g + 20\)  
6. \(m^2 + 18m + 81\)

7. \(4y^3 - 36y\)  
8. \(5k^2 + 30k - 135\)
Practice Set H

Solve by factoring:

1. \( x^2 - 13x = 30 \)  \quad 2. \( 20x^2 - 130x = -200 \)

Solve Using the Square Root Property

3. \( x^2 = 20 \)  \quad 4. \( 2x^2 - 7 = 155 \)  \quad 5. \( x^2 + 20 = 16 \)

Solving using the Quadratic Formula

6. \( 3x^2 - 4x + 1 \)  \quad 7. \( 2x^2 - 14x - 13 \)  \quad 8. \( 6x^2 = -11x + 35 \)

Problem Set I

Simplify each radical.

1. \( \sqrt{90} \)  \quad 2. \( 3\sqrt{288} \)  \quad 3. \( \sqrt[9]{125} \)  \quad 4. \( \sqrt[9]{125} \)
Practice Set J

Find the slope between the two points.

1. \((-1,4) and (1,-2)\)  
2. \((3,5) and (-3,1)\)  
3. \((1,-3) and (-1,-2)\)

Practice Set K

Graph the equations

1. \(y = 2x + 5\)
   
   **Slope:** __________  
   **\(y\)-intercept:** __________

2. \(y = \frac{-1}{2}x - 3\)
   
   **Slope:** __________  
   **\(y\)-intercept:** __________
Practice Set L

Find the equation of the line in slope-intercept form.

1.

2.

3. \( m = 3 \), through \((2, -3)\)

4. \( m = -\frac{1}{4} \), through \((-1, -1)\)

5. through \((5, 4)\) and \((-1, -3)\)

6. through \((3, 0)\) and \((4, -4)\)

7. Perpendicular to the line \( y = 3x + 2 \) through the point \((2, 3)\)

8. Parallel to the line \( y = -4x - 1 \) and through the origin.
Practice Set M

Graph each equation.

1. \(3x + y = 3\)

2. \(5x + 2y = 10\)

3. \(y = 4\)

4. \(4x - 3y = 9\)
Practice Set N

Solve each system of equations by graphing.

1. \[
\begin{align*}
y &= 2x - 4 \\
y &= -3x + 1
\end{align*}
\]

2. \[
\begin{align*}
y &= 3x - 8 \\
y &= 3x + 2
\end{align*}
\]

Solve each system of equations by elimination.

3. \[
\begin{align*}
x - y &= -9 \\
7x + 2y &= 9
\end{align*}
\]

4. \[
\begin{align*}
4x - 5y &= 17 \\
3x + 4y &= 5
\end{align*}
\]

Solve each system of equations by substitution.

5. \[
\begin{align*}
2x + y &= 11 \\
6x - 2y &= -2
\end{align*}
\]

6. \[
\begin{align*}
-x - y &= -2 \\
4x + 5y &= 16
\end{align*}
\]