IMPORTANT INSTRUCTIONS FOR STUDENTS!!!
We understand that students come to Algebra II with different strengths and needs. For this reason, students have options for completing the packet and getting assistance!

- Students should try to answer all the questions if possible; you **must** show all work.
- Students **must** answer a minimum of 51 out of 60 questions to receive full credit.
- So, if you really can’t answer certain questions, students may write the word “pass” on up to 5 questions without penalty. (The purpose of this option is to allow students to show what they know on certain concepts while informing the teacher of concepts that may need to be reviewed with students after school starts).
- Khan Academy video tutorials may be very helpful to you. HISD has aligned Khan Academy with Algebra I, are available by clicking this link:  
- There will be a **quiz** over this material.
- Finally, honor and integrity is at the heart of a Westside Wolf! Smart wolves never cheat. You are only hurting yourself by attempting to copy someone else’s work. This packet is to help you be ready for Algebra II, and help your teachers know what you can do.
- Students who enrolled at Westside High School on or after August 22nd, must submit their summer packet **within two weeks of their enrollment date at Westside**.

**Now! Get Ready, Get Set, and Do Your Best!**
### Algebra 2 Prep Summer Packet

#### Solving Equations

<table>
<thead>
<tr>
<th>Property of Equality</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition Property of Equality</td>
<td>For any numbers $a$, $b$, and $c$, if $a = b$, then $a + c = b + c$.</td>
</tr>
<tr>
<td>Subtraction Property of Equality</td>
<td>For any numbers $a$, $b$, and $c$, if $a = b$, then $a - c = b - c$.</td>
</tr>
<tr>
<td>Multiplication Property of Equality</td>
<td>For any numbers $a$, $b$, and $c$, if $a = b$, then $ac = bc$.</td>
</tr>
<tr>
<td>Division Property of Equality</td>
<td>For any numbers $a$, $b$, and $c$, with $c \neq 0$, if $a = b$, then $\frac{a}{c} = \frac{b}{c}$.</td>
</tr>
</tbody>
</table>

### Example 1
Solve: $3 \frac{1}{2} p = 1 \frac{1}{2}$

Original equation:

$$\frac{7}{2} p = \frac{3}{2}$$

Rewrite each mixed number as an improper fraction:

$$\frac{2 \left( \frac{7}{2} p \right)}{\frac{7}{2}} = \left( \frac{3}{2} \right) \frac{2}{7}$$

Multiply each side by the reciprocal of $\frac{7}{2}$.

$$p = \frac{3}{7}$$

Simplify

Check: $3 \frac{1}{2} \left( \frac{3}{7} \right) = 1 \frac{1}{2}$

### Example 2
Solve: $-5n = 60$

Original equation:

$$-5n = 60$$

Divide both sides by -5 or multiply both sides by $-\frac{1}{5}$

$$n = -12$$

Simplify

Check: $-5 (-12) = 60$

Substitute solution for variable

Left Hand Side $= $ Right Hand Side

LHS $= $ RHS $\text{ correct}$

### Solving Equations with the Variable on Each Side
To solve an equation with the same variable on each side, first use the Addition or the Subtraction Property of Equality to write an equivalent equation that has the variable on just one side of the equation. Then use the Multiplication or Division Property of Equality to solve the equation.

### Example 1
**Solve:** \( 5y - 8 = 3y + 12 \)

\[
\begin{align*}
5y - 8 - 3y &= 3y + 12 - 3y \\
2y - 8 &= 12 \\
2y &= 20 \\
y &= 10
\end{align*}
\]

**Check:**
\[
\begin{align*}
5(10) - 8 &= 3(10) + 12 \\
42 &= 42
\end{align*}
\]

LHS = RHS correct

### Example 2
**Solve:** \(-11 - 3y = 8y + 1\)

\[
\begin{align*}
-11 - 3y + 3y &= 8y + 1 + 3y \\
-11 &= 11y + 1 \\
-11 - 1 &= 11y + 1 - 1 \\
-12 &= 11y \\
- \frac{12}{11} &= y \\
-1 &= \frac{1}{11} \\
\text{Check:} & -11 - 3y = 8y + 1 \\
-11 - 3 \left( - \frac{12}{11} \right) &= 8 \left( - \frac{12}{11} \right) + 1 \\
-11 + \frac{36}{11} &= - \frac{96}{11} + 1 \\
- \frac{121}{11} + \frac{36}{11} &= - \frac{96}{11} + \frac{11}{11} \\
- \frac{85}{11} &= - \frac{85}{11} \\
\text{LHS} &= \text{RHS} \text{ correct}
\end{align*}
\]

### Example 3
**Solve:** \(8 (2a - 1) = -10 (a - 5)\)

\[
\begin{align*}
8a - 4 &= -10a + 50 \\
8a - 4 + 10a &= -10a + 50 + 10a \\
18a &= 54 \\
\frac{18a}{18} &= \frac{54}{18} \\
a &= 3
\end{align*}
\]

**Check:**
\[
\begin{align*}
4 (2a - 1) &= -10 (a - 5) \\
4 (2(3) - 1) &= -10 (3 - 5) \\
4 (6 - 1) &= -10 (-2) \\
4 (5) &= 20 \\
20 &= 20
\end{align*}
\]

LHS = RHS correct

### Exercises: Solve each equation. Then check your solution.

1. \(20 = y - 8\)
2. \(w - \frac{1}{2} = \frac{5}{8}\)
3. \(-17 = b + 4\)
4. \(h = -2\)
5. \(\frac{1}{8} m = 6\)
6. \(1p = \frac{3}{5}\)
7. \(3h = -42\)
8. \(-\frac{1}{2} m = 16\)
9. \(-3t = 51\)
10. \(6 - b = 5b + 30\)
11. \(5y - 2y = 3y + 2\)
12. \(5x + 2 = 2x - 10\)
Describe Number Patterns

Write Equations: Sometimes a pattern can lead to a general rule that can be written as an equation.

Example: Suppose you purchased a number of packages of blank CDs. If each package contains 3 CDs, you could make a chart to show the relationship between the number of packages of compact disks and the number of disks purchased. Use $x$ for the number of packages and $y$ for the number of compact disks.

Make a table of ordered pairs for several points of the graph.

<table>
<thead>
<tr>
<th>Number of packages</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of CDs</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>12</td>
<td>15</td>
</tr>
</tbody>
</table>

The difference in the $x$ values is 1, and the difference in the $y$ values is 3. This pattern shows that $y$ is always three times $x$. This suggests the relation $y = 3x$. Since the relation is also a function, we can write the equation in functional notation as $f(x) = 3x$.

Exercises:

19. Write an equation for the function in functional notation. Then complete the table.

<table>
<thead>
<tr>
<th>$x$</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>10</td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

20. Write an equation for the function in functional notation. Then complete the table.

<table>
<thead>
<tr>
<th>$x$</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$</td>
<td>10</td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>
21. Write an equation in functional notation.

22. Write an equation in functional notation.

**Equations of Linear Function**

<table>
<thead>
<tr>
<th>Standard Form</th>
<th>$Ax + By = C$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope-Intercept Form</td>
<td>$y = mx + b$, where $m$ is the given slope and $b$ is the $y$-intercept</td>
</tr>
<tr>
<td>Point-Slope Form</td>
<td>$y - y_1 = m(x - x_1)$, where $m$ is the given slope and $(x_1, y_1)$ is the given point</td>
</tr>
</tbody>
</table>

**Example 1:** Write an equation of a line in standard form whose slope is $-4$ and whose $y$-intercept is $3$.

$y = mx + b$
$y = -4x + 3$
$+4x + 4x$
$4x + y = 3$

**Example 2:** Graph $3x - 4y = 8$

$3x - 4y = 8$ Original equation
$-4y = -3x + 8$ Subtract $3x$ from each side
$\frac{-4y}{-4} = \frac{-3x + 8}{-4}$ Divide each side by $-4$
$y = \frac{3}{4}x - 2$ Simplify

The $y$-intercept of $y = 3/4x - 2$ is $-2$ and the slope is $\frac{3}{4}$. So graph the point $(0, -2)$. From this point, move up 3 units and right 4 units. Draw a line passing through both points.
Exercises:
Write an equation of the line in Standard Form with the given information.
23. Slope: 8, y-intercept -3
24. Slope: -2, point (5, 3)
25. Slope: -1, y-intercept -7

Write an equation of the line in Standard Form in each graph.
26. 27. 28.

Graph each equation.
29. $2x - y = -1$
30. $3x + y = 2$
31. $x + y = -1$

Graphing Systems of Equations
Solve by Graphing One method of solving a system of equations is to graph the equations on the same coordinate plane.
Example: Graph each system of equations. Then determine whether the system has no solution, one solution, or infinitely many solutions. If the system has one solution, name it.

a. $x + y = 2$
   $x - y = 4$
   The graphs intersect. Therefore, there is one solution. The point (3, -1) seems to lie on both lines. Check this estimate by replacing x with 3 and y with -1 in each equation.
   $x + y = 2$
   $3 + (-1) = 2 \checkmark$
   $x - y = 4$
   $3 - (-1) = 3 + 1 or 4 \checkmark$
   The solution is (3, -1).

b. $y = 2x + 1$
   $2y = 4x + 2$
   The graphs coincide. Therefore there are infinitely many solutions.
Exercises:
Graph each system of equations. Then determine whether the system has no solution, one solution, or infinitely many solutions. If the system has one solution, name it.

32. \( y = -2 \)
\( 3x - y = -1 \)

33. \( x = 2 \)
\( 2x + y = 1 \)

34. \( y = \frac{1}{2}x \)
\( x + y = 3 \)

35. \( 2x + y = 6 \)
\( 2x - y = -2 \)

36. \( 3x + 2y = 6 \)
\( 3x + 2y = -4 \)

37. \( 2y = -4x + 4 \)
\( y = -2x + 2 \)

Solving Systems of Equations by Substitution

Example 1: use substitution to solve they system of equations.

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

Substitute 2x for y in the second equation.

\( 4x - y = -4 \) second equation
\( 4x - 2x = -4 \) combine like terms
\( 2x = -4 \) Divide each side by 2
\( x = -2 \) and simplify.

Use \( y = 2x \) to find the value of y.

\( y = 2x \) First equation
\( y = 2(-2) \) \( x = -2 \)
\( y = -4 \) simplify

The solution is \((-2, -4)\).

Example 2: Solve for one variable, then substitute.

\( x + 3y = 7 \)
\( 2x - 4y = -6 \)

Solve the first equation for \( x \) since the coefficient of \( x \) is 1.

\( x + 3y = 7 \) First equation
\( x + 3y - 3y = 7 - 3y \) Subtract 3y from each side
\( x = 7 - 3y \) Simplify

Find the value of y by substituting \( 7 - 3y \) for \( x \) in the second equation.
\[
\begin{align*}
2x - 4y &= -6 & \text{Second equation} & \text{Simplify.} \\
2(7 - 3y) - 4y &= -6 & x &= 7 - 3y \\
14 - 6y - 4y &= -6 & \text{Distributive Property} & \text{Use } y = 2 \text{ to find the value of } x. \\
14 - 10y &= -6 & \text{Combine like terms.} & x &= 7 - 3(2) \\
14 - 10y - 14 &= -6 - 14 & \text{Subtract } 14 \text{ from each side.} & x &= 1 \\
-10y &= -20 & \text{Simplify.} & \text{The solution is } (1, 2). \\
y &= 2 & \text{Divide each side by } -10 \text{ and simplify.} \\
\end{align*}
\]

**Exercises:** Use substitution to solve each system of equations. If the system does not have exactly one solution, state whether it has no solution or infinitely many solutions.

38. \[
y = 4x \\
3x - y = 1
\]
39. \[
x = 2y \\
y = x - 2
\]
40. \[
x = 2y - 3 \\
x = 2y + 4
\]

---

**Elimination Using Addition and Subtraction**

**Elimination Using Addition:** In systems of equations in which the coefficients of the \(x\) or \(y\) terms are additive inverses, solve the system by adding the equations. Because one of the variables is eliminated, this method is called elimination.

**Example 1:** Use addition to solve the system of equations

\[
x - 3y = 7 \\
3x + 3y = 9
\]

Write the equations in column form and add to eliminate \(y\).

\[
\begin{array}{c}
x - 3y = 7 \\
3x + 3y = 9
\end{array}
\]

\[
\begin{array}{c}
4x = 16 \\
4x = 16 \\
x = 4
\end{array}
\]

Substitute 4 for \(x\) in either equation and solve for \(y\).

\[
\begin{array}{c}
4x - 3y = 7 \\
4 - 3y - 4 = 7 - 4
\end{array}
\]

\[
\begin{array}{c}
-3y = 3 \\
-3y - 3 = 3 \\
y = -1
\end{array}
\]

The solution is \((4, -1)\).

**Example 2:** The sum of two numbers is 70 and their difference is 24. Find the numbers.

Let \(x\) represent one number and \(y\) represent the other number.

\[
\begin{array}{c}
x + y = 70 \\
2x - y = 24
\end{array}
\]

\[
\begin{array}{c}
2x = 94 \\
2x - 2 = 94 \\
x = 47
\end{array}
\]

Substitute 47 for \(x\) in either equation.

\[
\begin{array}{c}
47 + y = 70 \\
47 + y - 47 = 70 - 47 \\
y = 23
\end{array}
\]

The numbers are 47 and 23.
Exercises: Use elimination to solve each system of equations.

41. \( x + y = -4 \)  
   \( x - y = 2 \)

42. \( 2m - 3n = 14 \)  
   \( m + 3n = -11 \)

43. \( 3a - b = -9 \)  
   \(-3a - 2b = 0\)

Multiplying a Polynomial by a Monomial

Product of Monomial and Polynomial: The Distributive Property can be used to multiply a polynomial by a monomial. You can multiply horizontally or vertically. Sometimes multiplying results in like terms. The products can be simplified by combining like terms.

Example 1: Find \(-3x^2 (4x^2 + 6x - 8)\).

\[-3x^2 (4x^2 + 6x - 8) = -3x^2 (4x^2) + (-3x^2)(6x) + (-3x^2)(8) = -12x^4 - 18x^3 + 24x^2\]

Example 2: Simplify \(-2(4x^2 + 5x) - x (x^2 + 6x)\).

\[-2(4x^2 + 5x) - x (x^2 + 6x) = -2(4x^2) + (-2)(5x) + (-x)(x^2) + (-x)(6x) = -8x^2 + (-10x) + (-x^3) + (-6x^2) = (-x^3) + (-14x^2 - 10x)\]

Exercises: Find each product.

44. \( x(5x + x^2) \)

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

46. \(-2xy(2y + 4x^2)\)

47. \(-2g (g^2 - 2g + 2) \)

48. \(3x (x^4 + x^3 + x^2) \)

49. \(-4x (2x^3 - 2x + 3) \)
Factoring Using the Greatest Common Factor

Example 1: Use GCF to factor $12mn + 80m^2$
Find the GCF of $12mn$ and $80m^2$
$12mn = 2 \cdot 2 \cdot 3 \cdot m \cdot n$
$80m^2 = 2 \cdot 2 \cdot 2 \cdot 5 \cdot m \cdot m$
GCF $= 2 \cdot 2 \cdot m$ or $4m$
Write each term as the product of the GCF and its remaining factors.
$12mn + 80m^2 = 4m(3n) + 4m(20m)$
$= 4m(3n + 20m)$

Example 2: Factor $6ax + 3ay + 2bx + by$
by grouping.
$= (6ax + 3ay) + (2bx + by)$
$= 3a(2x + y) + b(2x + y)$
$= (3a + b)(2x + y)$

Check using the FOIL method.
$(3a + b)(2x + y)$
$= 3a(2x) + (3a)(y) + (b)(2x) + (b)(y)$
$= 6ax + 3ay + 2bx + by$

Exercises: Factor each polynomial.
50. $24x + 48y$
51. $30m^2 + m^2n - 6n$
52. $q^4 - 18q^3 + 22q$
53. $9x^2 - 3x$
54. $4m + 6n - 8mn$
55. $45s^3 - 15s^2$

Multiplying Polynomials

Multiply Binomials: To multiply two binomials, you can apply the Distributive Property twice. You can use FOIL (First, Outer, Inner and Last) method.

Example 1: Find $(x + 3)(x - 4)$
$(x + 3)(x - 4)$
$= x(x - 4) + 3(x - 4)$
$= x^2 - 4x + 3x - 12$
$= x^2 - x - 12$

Example 2: Find $(x - 2)(x + 5)$ using FOIL method.
$(x - 2)(x + 5)$
First Outer Inner Last
$= (x)(x) + (x)(5) +(-2)(x) +(-2)(5)$
$= x^2 + 5x - 2x - 10$
$= x^2 + 3x - 10$

Exercises: Find each product.
56. $(x + 2)(x + 3)$
57. $(x - 4)(x + 1)$
58. $(x - 6)(x - 2)$
59. $(3n - 4)(3n - 4)$
60. $(8m - 2)(8m + 2)$