Name Period

Geometry Honors Summer Assignment 2023-2024

Geometry Honors is a rigorous course which emphasizes topics inherent to Euclidean and solid geometry. Knowledge of geometry will be developed with an emphasis on its logical structure using critical thinking skills and problem solving strategies. Inductive and deductive methods of reasoning will be applied to formal proofs and constructions. Concept applications require a strong foundation in algebra.

Required materials:

1. **TI-84 or TI-30 (calculator with trigonometry functions)**
2. **Pencils (for all exams)**
3. **Colored pens/pencils for homework corrections**
4. **3-ring notebook for notes and homework**

Prerequisite Knowledge

A. Rounding
B. Simplify Radical Expressions
C. Solving Linear Equations in One Variable
D. Solving a System of Linear Equations in Two Variables
E. Finding Slope using the Slope Formula
F. Writing Equations of Lines in Slope-Intercept and Point-Slope Form
G. Multiply Binomials
H. Special Products of Binomials
I. Factor Trinomials
J. Using the Zero Product Property and Factoring to Solve Given Equations
K. Solving Quadratic Equations by Taking Square Roots

This assignment is due the 1st week of school. You MUST show work. You may show work on the packet and attach extra pages if needed. Please make sure all work is clearly labeled by topic and problem number.

For extra practice, use the DeltaMath assignment "Geometry Honors Summer Packet Supplemental Review".

- This is optional and should be used for extra practice on any topics you may need.
- You may use the videos provided with each topic for more clarification.
- Information for accessing DeltaMath can be found on Google Classroom. If you don't have the Google Classroom code, please email your Geometry Honors teacher.

Suggested Resources for Additional Help:

PurpleMath https://www.purplemath.com/modules/index.htm
Khan Academy https://www.khanacademy.org/math/algebra

A. Rounding

To round a number: **Step 1:** Find the place to which you are rounding. **Step 2:** Look at the digit immediately to the right of that place. **Step 3:** If this digit is greater than or equal to 5, round the digit in the rounding place up 1. If the digit is less than 5, the digit in the rounding place is unchanged. **Step 4:** If you are rounding to a decimal place or to the nearest whole number, drop the digits to the right of the rounding place. If you are rounding to tens, hundreds, or any larger place value, fill in zeros as needed.

Example: Round 14.638 to the nearest tenth.

Step 1: The digit to be rounded is 6.
Step 2: 3 is to the right of 6.
Step 3: $3 < 5$, so 6 is unchanged.
Step 4: Drop the digits 3 and 8.
Answer: 14.6

Practice on Your Own
Round each number to the indicated place value.

1. 146.3892; hundredth ____________

2. 235.7; whole number ____________

3. 47; tens ____________

4. 15.275; tenth ____________

5. 0.0048; thousandth ____________

6. 3.99; tenth ____________

Make sure that you know the difference between an exact and approximate answer.

Exact	Approximate
$\frac{1}{3}$	0.3
$\sqrt{2}$	1.41
$\frac{17}{9}$	1.88889
2π	6.28

*** If you round an answer, then it is approximate. In geometry, you will provide exact answers unless rounding rules are given. All answers in this packet should be exact.**

B. Simplify Radical Expressions

Definition: A radical expression is in *simplest form* when all of the following conditions are met.

1. The number, or expression, under the radical sign contains no perfect square factors (other than 1).
2. The expression under the radical sign does not contain a fraction.
3. If the expression is a fraction, the denominator does not contain a radical expression.

How to Simplify Radical Expressions		
Look for perfect square factors and simplify these first. If the radical expression is preceded by a negative sign, then the answer is negative.	If the expression is a product, simplify then multiply, or multiply then simplify, whichever is most convenient.	If the expression is (or contains) a fraction, simplify then divide, or divide then simplify, whichever is most convenient.
Example 1: Simplify $\sqrt{81}$. Since 81 is a perfect square factor, simplify the expression to 9. $\sqrt{81} = \sqrt{9 \cdot 9} = 9$ $-\sqrt{81} = -\sqrt{9 \cdot 9} = -9$	Example 2: Simplify $\sqrt{25}\sqrt{16}$. Since both numbers are perfect squares, simplify then multiply: $\sqrt{5 \cdot 5}\sqrt{4 \cdot 4} =$ $5 \cdot 4 = 20$	Example 3: Simplify $-\sqrt{\frac{4}{49}}$. $-\sqrt{\frac{4}{49}} = -\frac{\sqrt{2 \cdot 2}}{\sqrt{7 \cdot 7}} = -\frac{2}{7}$

Practice on Your Own
Simplify each expression.

1. $\sqrt{25}$ ____________

2. $\sqrt{9}\sqrt{36}$ ____________

3. $\sqrt{\frac{81}{121}}$ ____________

4. $-\sqrt{81}$ ____________

5. $\sqrt{100}\sqrt{4}$ ____________

6. $\sqrt{2(32)}$ ____________

7. $\sqrt{169}$ ____________

8. $-\sqrt{\frac{1}{625}}$ ____________

9. $\sqrt{20}$ ____________

10. $\sqrt{72}$ ____________

11. $\sqrt{117}$ ____________

12. $\sqrt{50}$ ____________

C. Solving Linear Equations in One Variable

To solve a one-step equation, do the inverse of whatever operation is being done to the variable. Remember, because it is an equation, what is done to one side of the equation must also be done to the other side.

Solve an addition equation using subtraction.	Solve a subtraction equation using addition.
$x + 5 = 15$ $\underline{\ \ -5 \ \ -5}$ $x \ \ \ = 10$	$x - 8 = -3$ $\underline{\ \ +8 \ \ +8}$ $x \ \ = \ \ 5$
Solve a multiplication equation using division.	**Solve a division equation using multiplication.**
$7x = 42$ $\frac{7x}{7} = \frac{42}{7}$ $x = 6$	$\frac{x}{12} = -3$ $12 \cdot \frac{x}{12} = -3 \cdot 12$ $x = -36$

To solve an equation, you need to isolate the variable on one side of the equals sign. Follow the order of operations in reverse to solve a multi-step equation. That is, add and subtract before you multiply or divide. Sometimes, you need to use the Distributive Property before you use inverse operations.

The Distributive Property of Multiplication	
Multiplying a sum by a number: $a(b + c) = ab + ac$	Multiplying a difference by a number: $a(b - c) = ab - ac$
Example 1: Simplify $7(2x + 3)$. $7\,(2x + 3) = 7(2x) + 7(3) = 14x + 21$	Example 2: Simplify $15(3 - 4m)$. $15\,(3 - 4m) = 15(3) - 15(4m) = 45 - 60m$
Note: Remember, if a variable does not have a coefficient, assume the coefficient is 1. Example 3: Simplify $11(5 + y)$. $11\,(5 + 1y) = 11(5) + 11(1y) = 55 + 11y$	

To solve multi-step equations with fractions, first clear the fractions.
Step 1: Clear fractions: multiply every term by the least common denominator (LCD)
Step 2: Use the distributive property, if necessary.
Step 3: Use inverse operations to undo any addition or subtraction, then multiply or divide.

$$\frac{1}{3}x + \frac{2}{5} = -x + 1 \quad \text{Write the given equation}$$

$$15\left(\frac{1}{3}x + \frac{2}{5}\right) = 15(-x + 1) \quad \text{Multiply all terms by 15 (LCD)}$$

$$5x + 6 = -15x + 15 \quad \text{Use the distributive property}$$

$$20x + 6 = 15 \quad \text{Add 15x to both sides}$$

$$20x = 9 \quad \text{Subtract 6 from both sides}$$

$$x = \frac{9}{20} \quad \text{Divide both sides by 20}$$

C. Solving Linear Equations in One Variable

Ex. 1: Solve an equation with a variable on one side

Solve $9x - 6 = 21$.

$9x - 6 = 21$ Write the given equation

$9x = 27$ Add 6 to both sides

$x = 3$ Divide both sides by 3

Ex. 2: Solve an equation with a variable on both sides

Solve $7x - 12 = 3x + 8$.

$7x - 12 = 3x + 8.$ Write the given equation

$4x - 12 = 8$ Subtract $3x$ from both sides

$4x = 20$ Add 12 to both sides

$x = 5$ Divide both sides by 4

Ex. 3: Solve an equation using the distributive property

Solve $2(x - 4) = -4(x + 3)$

$2(x - 4) = -4(x + 3)$ Write the given equation

$2x - 8 = -4x - 12$ Use the distributive property

$6x - 8 = -12$ Add $4x$ to both sides

$6x = -4$ Add 8 to both sides

$x = -\frac{4}{6}$ Divide both sides by 6

$x = -\frac{2}{3}$ Simplify

Ex. 4: Solve an equation with fractions

Solve $\frac{2}{3}(4x - 11) = 9$

$\frac{2}{3}(4x - 11) = 9$ Write the given equation

$2(4x - 11) = 27$ Multiply both sides by 3

$8x - 22 = 27$ Use the distributive property

$8x = 49$ Add 22 to both sides

$x = \frac{49}{8}$ Divide both sides by 8

C. Solving Linear Equations in One Variable

Practice on your own.
Solve for the variable.

1. $3y + 5 = 9y - 13$

2. $4 + 11m = 7m - 1$

3. $9x + 15 = 7 + x$

4. $2y + 6 + 4y - 3 = 5y + 12$

5. $x = 2(90 - x) - 3$

6. $180 - x = 3(90 - x) + 4$

7. $\frac{2}{3}x + 15 = 17$

8. $\frac{9}{4}x + \frac{1}{5} = \frac{11}{5}$

9. $3y - 11 = \frac{1}{2}(2y - 2)$

10. $5x - 1 = \frac{1}{2}(8x + 12)$

11. $x = \frac{1}{2}(180 - x) + 12$

12. $\frac{x-2}{3} = 5$

D. Solving a System of Linear Equations in Two Variables

Solving by Substitution

Step 1: Solve for a variable in one of the equations
Step 2: Substitute into the other equation
Step 3: Solve for the other variable.
Step 4: Plug that value back into one of the original equations and solve
Step 5: Check your solution.

Solve

① $2x - 3y = -2$
② $4x + y = 24$

$y = 24 - 4x$	Solve equation ② for y.
$2x - 3(24 - 4x) = -2$	Substitute into equation ①
$2x - 72 + 12x = -2$	Solve for the other variable, x.
$14x - 72 = -2$	
$14x = 70$	
$x = 5$	
$2(5) - 3y = -2$	Plug x back into equation ① and solve for y
$10 - 3y = -2$	
$-3y = -12$	
$y = 4$	
$4(5) + 4 = 24$	Check solution using equation ②
$24 = 24$ ✓	

Practice on Your Own

Solve for the variables.

1. $-3x + y = 7$
   $-x + 2y = 9$

2. $-5x + 4y = 6$
   $x + 5y = -7$

D. Solving a System of Linear Equations in Two Variables

Solving by Elimination

Step 1: Write the system so that like terms are under one another
Step 2: Eliminate one of the variables: look for a pair of opposites (ex. -4x and 4x are opposites). If there are no opposites, multiply one or both equations to create a pair of opposites.
Step 3: Add the equations together – the opposite pair should eliminate.
Step 4: Solve for the remaining variable.
Step 5: Plug that value back into one of the original equations and solve
Step 6: Check your solution.

Solve

① $2x - 3y = -2$
② $4x + y = 24$

$2x - 3y = -2$ $4x + y = 24$	Write the system so that like terms are under one another
$2x - 3y = -2$ $12x + 3y = 72$	Since the y variables already have opposite signs, multiple equation ② by 3
$14x = 70$	Add the equations together.
$x = 5$	Solve for the remaining variable, x.
$2(5) - 3y = -2$ $10 - 3y = -2$ $-3y = -12$ $y = 4$	Plug x back into equation ① and solve for y
$4(5) + 4 = 24$ $24 = 24$ ✓	Check solution using equation ②

Practice on Your Own

Solve for the variables.

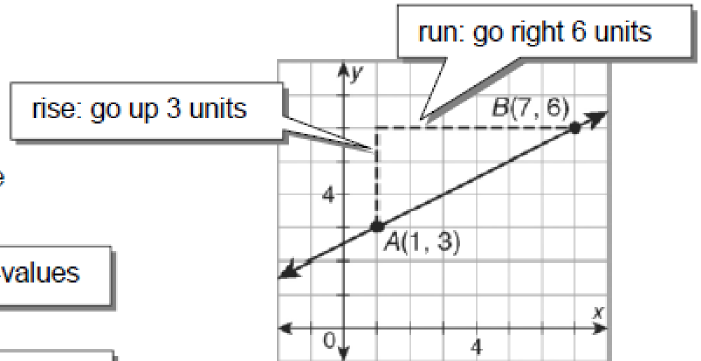
3. $2x + y = 4$
   $4x + 3y = 2$

4. $-7x - 5y = -6$
   $x - 4y = -18$

E. Finding Slope

The **slope** of a line describes how steep the line is. You can find the slope by writing the ratio of the **rise** to the **run.**

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{3}{6} = \frac{1}{2}$$



You can use a formula to calculate the slope m of the line through points (x_1, y_1) and (x_2, y_2).

$$m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$$

Change in y-values

Change in x-values

To find the slope of $\overline{AB}$ using the formula, substitute (1, 3) for (x_1, y_1) and (7, 6) for (x_2, y_2).

$m = \frac{y_2 - y_1}{x_2 - x_1}$	Slope formula
$= \frac{6 - 3}{7 - 1}$	Substitution
$= \frac{3}{6}$	Simplify.
$= \frac{1}{2}$	Simplify.

Practice on Your Own

Find the slope of the line that passes through the given points.

1. A(-2, 2) B(-8, -2)

2. E(-5, -8) F(4, 13)

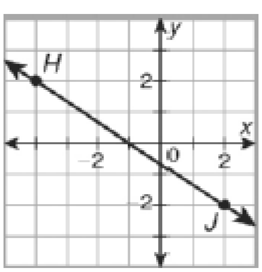
3. C(2, 5) D(6, 5)

4. G(3, 1) H(6, -3)

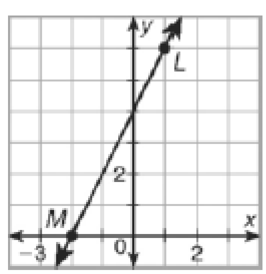
5. J(-10, 4) K(-14, 7)

6. L(-20, 15) M(0, 19)

7.



8.



F. Writing Equations of Lines

Slope-Intercept Form

Write the equation of the line through (0, 1) and (2, 7) in slope-intercept form.

Step 1: Find the slope.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \quad \text{Formula for slope}$$

$$= \frac{7-1}{2-0} = \frac{6}{2} = 3$$

Step 2: Find the y-intercept.

$y = mx + b$ Slope-intercept form

$1 = 3(0) + b$ Substitute 3 for m, 0 for x, and 1 for y.

$1 = b$ Simplify.

Step 3: Write the equation.

$y = mx + b$ Slope-intercept form

$y = 3x + 1$ Substitute 3 for m and 1 for b.

Practice on Your Own

Write the equation of the line through the given points in slope-intercept form. Box in your answer.

1. A(2, 0) B(0, 3)

2. C(-5, -1) D(-4, 4)

3. E(-1, 5) F(-4, 5)

4. G(0, 1) H(-2, -3)

5. J(5, 5) K (4, 0)

6. L(-5, 4) M(0, 2)

F. Writing Equations of Lines

Point-Slope Form

Given a point = (x_1, y_1) and a slope = m

Substitute into point-slope form

$$y - y_1 = m(x - x_1)$$

Ex. 1: Write the equation in point-slope form given the point (-6, 4) and slope $\frac{1}{3}$.

$$y - 4 = \frac{1}{3}(x + 6)$$

Ex. 2: Write the equation in point-slope form given points (-1, -3) and (4, 5)

$$m = \frac{5 - (-3)}{4 - (-1)} = \frac{8}{5}$$

$$y - 5 = \frac{8}{5}(x - 4) \quad or \quad y + 3 = \frac{8}{5}(x + 1)$$

Practice on Your Own

Use the given information to write the equation of the line in point-slope form. Box in your answer.

7. P(2, 5) slope 6

8. P(-5, -1) slope -8

9. P(-3, 4) slope $-\frac{2}{7}$

10. G(-3, 1) H(-2, -3)

11. J(-5, 5) K (-4, 5)

12. L(-5, 4) M(0, 2)

G. Multiply Binomials

Definition: A binomial is the sum or difference of two monomials.

To multiply a binomial by another binomial, use the Distributive Property twice.

Example: Multiply $(x + 6)(3x - 5)$.	
$= x(3x - 5) + 6(3x - 5)$	First use of the Distributive Property.
$= x(3x) - x(5) + 6(3x) + 6(-5)$	Second use of the Distributive Property.
$= 3x^2 - 5x + 18x - 30$	Multiply using properties of exponents.
$= 3x^2 + 13x - 30$	Combine like terms ($-5x + 18x = 13x$).

Practice on Your Own

Find each product.

1. $(n + 6)(n + 3)$ ________________

2. $(c + 12)(c - 5)$ ________________

3. $(10q + 3)(q + 4)$ ________________

4. $(k + 7)(3k - 1)$ ________________

5. $(u - 1)(u + 1)$ ________________

6. $(r + 6)(r + 6)$ ________________

7. $(5a - 4)(5a + 4)$ ________________

8. $(3g + 1)(8g + 12)$ ________________

9. $(5z + 8)(4z - 2)$ ________________

10. $(4p - 9)(2p - 1)$ ________________

H. Special Products of Binomials

Reminder: An expression squared means that expression multiplied by itself.
For example, $(7x)^2 = (7x)(7x) = 49x^2$.

Formulas for Finding Special Products of Binomials		
Square of a Sum	**Square of a Difference**	**Difference of Two Squares**
$(a + b)^2 = a^2 + 2ab + b^2$	$(a - b)^2 = a^2 - 2ab + b^2$	$(a + b)(a - b) = a^2 - b^2$
Example 1: $(4x + 3)^2$ $a = 4x$; $b = 3$; $ab = (4x)(3)$ $a^2 = (4x)^2 = 16x^2$ $ab = 12x$ so $2ab = 24x$ $b^2 = 3^2 = 9$ $(4x + 3)^2 = 16x^2 + 24x + 9$	**Example 2:** $(5x - 2)^2$ $a = 5x$; $b = 2$; $ab = (5x)(2)$ $a^2 = (5x)^2 = 25x^2$ $ab = 10x$ so $2ab = 20x$ $b^2 = 2^2 = 4$ $(5x - 2)^2 = 25x^2 - 20x + 4$	**Example 3:** $(3x + 8)(3x - 8)$ $a = 3x$ and $b = 8$ $a^2 = (3x)^2 = 9x^2$ $b^2 = 8^2 = 64$ $(3x + 8)(3x - 8) = 9x^2 - 64$

Practice on Your Own

Multiply.

1. $(7x + 1)^2$ ____________

2. $(w + 6)(w - 6)$ ____________

3. $(3p - 5)^2$ ____________

4. $(m + 9)^2$ ____________

5. $(5y + 1)(5y - 1)$ ____________

6. $(d - 2)^2$ ____________

7. $(4b - 7)(4b + 7)$ ____________

8. $(10 - 3h)(10 + 3h)$ ____________

9. $(-a + 8)(-a - 8)$ ____________

10. $(-2z + 1)(-2z - 1)$ ____________

I. Factor Trinomials

Definition: A trinomial is a polynomial that has three terms. For example, $x^2 + 5x + 4$ is a trinomial. The factored form of $x^2 + 5x + 4$ is $(x + 4)(x + 1)$.

To factor a trinomial:
Step 1: Set up a product of two ( ) where each will hold two terms. It will look like (   )(   ).
Step 2: Find the factors that go in the first positions of each set of ( ).
Step 3: Decide on the signs that will go in each set of ( ).
Step 4: Find that factors that go in the last positions of each set of ( ).

Example: Factor: $x^2 + 4x - 12$.		
Step 1:	$(\quad)(\quad)$	
Step 2:	$(x \quad)(x \quad)$	The only possible factors of x^2 are x and x.
Step 3:	$(x + \quad)(x - \quad)$	The last term is negative, use opposite signs.
Step 4:	$(x + 6)(x - 2)$	The factors of -12 are $\pm 1 \cdot \pm 12$ or $\pm 3 \cdot \pm 4$ or $\pm 6 \cdot \pm 2$ and the only pair of these that can have a sum of 4 (the coefficient of the middle term) is 6 and -2.

Practice on Your Own
Factor each polynomial completely.

1. $x^2 + 5x + 4$
2. $x^2 + 3x - 10$
3. $x^2 - 18x + 45$
4. $x^2 - x - 20$
5. $x^2 - 10x + 16$
6. $x^2 + 2x - 24$

Factoring Trinomials when the leading coefficient is NOT equal to 1…

(factor out the greatest common factor (GCF) before your start)

…and PRIME:
Step 1: Set up a product of two ( ) where each will hold two terms.
Step 2: Find the factors that go in the first positions of each set of ( ).
Step 3: Find the factors that go in the last positions of each set of ( ) by guess and check.

Example: Factor: $3x^2 – 4x – 7$
Step 1 and 2: $(3x \quad)(x \quad)$
Step 3: $(3x – 7)(x + 1)$ Since $3x(1) + (-7)(x) = -4x$, this is the answer.

Practice on Your Own

Factor each polynomial completely.

7. $3p^2 - 2p - 5$
8. $2n^2 + 3n - 9$
9. $5x^2 + 19x + 12$

I. Factor Trinomials

Factoring Trinomials when the leading coefficient is NOT equal to 1…

(factor out the greatest common factor (GCF) before your start)

…and NOT prime:

Step 1: Find two integers whose product is equal to the product of the first and last terms *(ac),* and whose sum equals the coefficient of the middle term *(b).*

Step 2: Rewrite the middle term using the two integers.

Step 3: Use the grouping method and express your answer as a product of two binomials.

Example: Factor: $8x^2 - 14x - 15$
Step 1: ac = -120, b = -14; the two integers are -20 and +6
Step 2: $8x^2 - 20x + 6x - 15$
Step 3: $4x(2x - 5) + 3(2x - 5) = (2x - 5)(4x + 3)$

Practice on Your Own

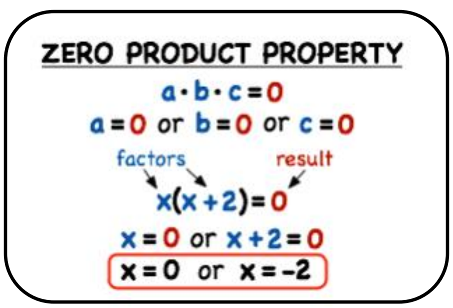
Factor each polynomial completely.

10. $4n^2 - 15n - 25$

11. $6y^2 + 5y - 6$

12. $6x^2 + 7x - 49$

Using the zero product property and factoring to solve given equations



13. $(x - 4)(x + 5)(x - 6) = 0$

14. $x(2x - 1)(3x + 4) = 0$

15. $x^2 + 6x + 5 = 0$

16. $x^2 - x = 12$

17. $2x^2 = 9x + 5$

Use factoring to find the zeros of each function.

18. $y = x^2 + 12x + 35$

19. $y = 6x^2 - 10x - 4$

20. $y = x^2 - 18x + 81$

J. Solving Quadratic Equations by taking Square Roots

One method of solving quadratic equations is to find the square root of both sides of the equation. This method only works when the equation is limited to an x^2 term and a constant.

To solve a quadratic equation by the square root method, follow these steps:
Step 1: Simplify the expression by combining like terms and then isolate the x^2 term.
Step 2: Divide both sides of the equation by the coefficient of x^2.
Step 3: Find the square root of both sides of the equation. Remember, you will get a positive and a negative value as your answers.

Example: Solve $5x^2 = 3x^2 + 32$. — Step 1: Subtract $3x^2$ from both sides.
$2x^2 = 32$ — Step 2: Divide both sides by 2.
$x^2 = 16$ — Step 3: Find the square root of both sides.
$x = 4$ or -4

Solve each equation by taking square roots. Answers should be in simplest radical form.

1. $2k^2 - 1 = 99$
2. $25x^2 + 7 = 88$
3. $8v^2 + 8 = -32$
4. $6x^2 + 6 = 222$
5. $8k^2 - 7 = 281$
6. $25p^2 - 10 = -9$
7. $3(r-2)^2 + 8 = 83$
8. $6(v+3)^2 - 1 = 5$