Decatur City Schools

Decatur, Alabama

# Mathematics Department

# Summer Course Work

In preparation for

# Geometry

Completion of this summer work

is required on the first class day

of the 2019-2020 school year.

Student Name:_____________________________________

# Decatur City Schools
# Mathematics
# Department

## Summer Workbook
## Geometry
## Topics

1. Fractions

2. Simplifying Expressions & Solving Equations

3. Graphing/Writing Linear Equations

4. Systems of Equations

5. Multiplying Polynomials

6. Factoring

All pages MUST show the work in order for the work to be accepted. If more paper is needed, the work may go on the back of each page or neatly on a separate page.

*Completion of this booklet is required by the first class day of the school year.*

*****If you do not remember something, look it up. Use resources such as Khan Academy, Google, YouTube, etc.**

The following topics will begin your study of Geometry. These topics are considered to be a review of your previous math courses and will not be covered in length during the start of the school year.

**Note: You should expect to purchase a scientific calculator for this course.**

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Mathematics Department
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Dear Parents and Guardians:

Attached are the summer curriculum review materials for *Geometry*. This booklet was prepared by the Decatur City Schools Math Department and contains topics that reflect content learned in prerequisite courses. These materials must be completed and brought to class on the first class day of school.

Your child is required to complete this booklet over the summer. A test based on the material in the packet will be given to your child during the second week of school. It will count as the first test of the year and the grade will be determined as follows:

> Completion of the packet on time will count 20% of the grade
> Performance on the test will count 80% of the grade.

Thank you for your cooperation.

Sincerely,

Decatur City School Mathematics Department

# *Section 1: Fractions*

To multiply fractions:

- Multiply the numerators of the fractions
- Multiply the denominators of the fractions
- Place the product of the numerators over the product of the denominators
- Simplify the fraction

Example: Multiply $\frac{2}{9}$ and $\frac{3}{12}$

- Multiply the numerators (2*3=6)
- Multiply the denominators (9*12=108)
- Place the product of the numerators over the product of the denominators ( $\frac{6}{108}$ )
- Simplify the fraction ( $\frac{6}{108} = \frac{1}{18}$ )

To divide fractions:

- Invert (i.e. turn over) the denominator fraction and multiply the fractions
- Multiply the numerators of the fractions
- Multiply the denominators of the fractions
- Place the product of the numerators over the product of the denominators
- Simplify the fraction

Example: Divide $\frac{2}{9}$ and $\frac{3}{12}$

- Invert the denominator fraction and multiply ( $\frac{2}{9} \div \frac{3}{12} = \frac{2}{9} * \frac{12}{3}$ )
- Multiply the numerators (2*12=24)
- Multiply the denominators (9*3=27)
- Place the product of the numerators over the product of the denominators ( $\frac{24}{27}$ )
- Simplify the fraction ( $\frac{24}{27} = \frac{8}{9}$ )

1) $12 \text{ x } \frac{3}{4} =$

2) $\frac{1}{5} \text{ x } \frac{10}{4} =$

3) $\frac{2}{7} \text{ x } \frac{21}{30} =$

4) $\frac{\frac{20}{3}}{4} =$

5) $\frac{1}{10} \div \frac{3}{5} =$

6) $\frac{2}{5} \div \frac{8}{10} =$

# *Section 2: Simplifying Expressions & Solving Equations*

**Simplifying Expressions**

Expressions are simplified when there is NO equal sign. Often times this involves combining like terms. Like terms are the same if and only if they have the same variable and degree.

**Example 1:**

$3 + 2y^2 – 7 – 5x – 4y^3 + 6x$

| | |
|---|---|
| $–4y^3 + 2y^2 – 5x + 6x + 3 – 7$ | Identify & reorder like terms to be together. |
| $–4y^3 + 2y^2 + 1x – 4$ | Combine like terms. |

**Example 2:**

$6a^2 – 2b + 4ab – 5a$ for $a = –3$ and $b = 4$

| | |
|---|---|
| $6(–3)^2 – 2(4) + 4(–3)(4) – 5(–3)$ | Substitute the values of *a* and *b* in the equation. |
| $6(9) – 8 + (–48) – (–15)$ | Multiply. |
| $54 – 8 – 48 + 15$ | Rewrite to avoid double signs. |
| $13$ | Use order of operations to solve. |

**Solving Equations**

When solving an equation, remember to combine like terms first. Take steps to isolate the variable by following the order of operations backwards and doing inverse operations.

**Example 1:**

$5k + 2(k + 1) = 23$

| | |
|---|---|
| $5k + 2k + 2 = 23$ | Distribute. |
| $7k + 2 = 23$ | Combine like terms. |
| $7k = 21$ | Subtract. |
| $k = 3$ | Divide. |

**Example 2:**

$10 – 4m = –5m + 3(m + 8)$

| | |
|---|---|
| $10 – 4m = –5m + 3m + 24$ | Distribute. |
| $10 – 4m = –2m + 24$ | Combine like terms. |
| $–4m = –2m + 14$ | Subtract. |
| $–2m = 14$ | Add. |
| $m = –7$ | Divide. |

Simplify the following expressions by combining like terms.

7) $3 + 2y^2 - 7 - 5x - 4y^3 + 6x$

8) $4(3x - 2x^3 + 5) - 6x$

9) $x(2x - 3x^4 + 2y - 5xy)$

10) $8a - (7b - 4a) - 3(4a + 2b)$

Evaluate the following expressions by substituting the given values for the variables.

11) $6a^2 - 2b + 4ab - 5a$ ; $a = -3$ and $b = 4$

12) $-k^2 + 4m - 2km - (3k + 2m)$; $k = -2$ and $m = 3$

Solve each equation and check your answer.

13) 3n + 2 = 17

14) 3(n – 4) = 15

15) 6 – (3t + 4) = -17

16) 5k + 2(k + 1) = 23

17) $\frac{5}{7}p - 10 = 30$

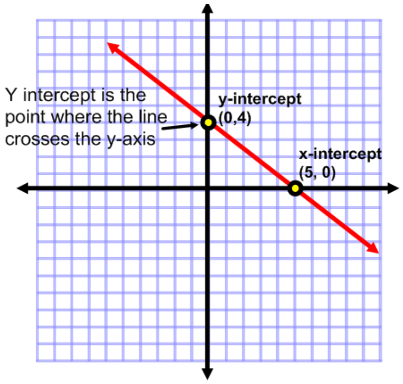
18) $-\frac{1}{2}m - 3 = 1$

# *Section 3: Graphing Linear Equations*

A linear function is a function where the highest power of x is 1. You have seen these functions in many forms. Some of the common forms are y = mx + b (slope-intercept form) and Ax + By = C (standard form). Notice in both forms that the exponent for x is 1.

Every linear function has an x and y intercept.

- x – intercept: Where a function crosses the x – axis. The coordinate is represented by (x, 0).
- y – intercept: Where a function crosses the y – axis. The coordinate is represented by (0, y).

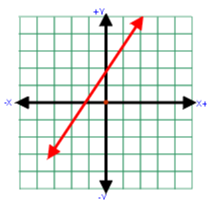



A key concept to consider when thinking of linear functions is slope.

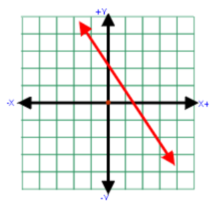
Slope is the "m" in the y = mx + b and is defined to be $-\frac{A}{B}$ for standard form of a line. Here are some definitions of slope:

$$slope = m = \frac{vertical\ change}{horizontal\ change} = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$$

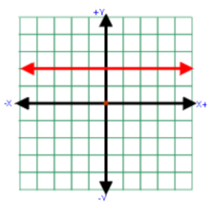
Positive slopes increase from left to right.



Negative slopes decrease from left to right.

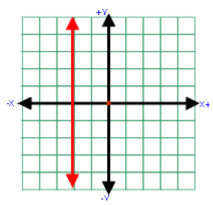


If a line has a slope of <u>zero</u>, it is horizontal and the equation is y = b.



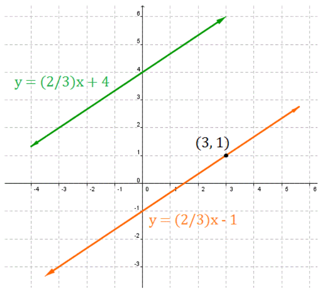
*All points on the line have the same y-coordinate.

If a line has an <u>undefined</u> slope, it is vertical and the equation is x = c.

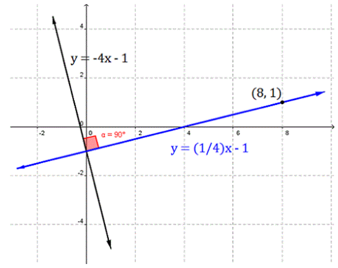


*All points on the line have the same x-coordinate.

Parallel lines have the same slopes.




Perpendicular lines have slopes that are opposite reciprocals.



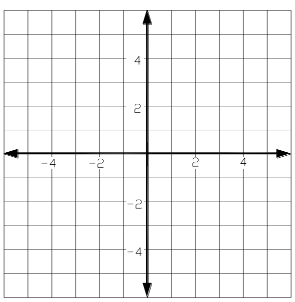

**Formulas for equations of a line:**

**Slope-Intercept: y = mx + b**

**Point-Slope Form: $y - y_1 = m(x - x_1)$**

Graph and label each linear equation. (Note: You may need to put the equation in slope-intercept form.) Are the lines parallel, perpendicular or neither? Explain your answer using the equations.

19) $y = 3x - 2$ $\quad 6x - 2y = -4$



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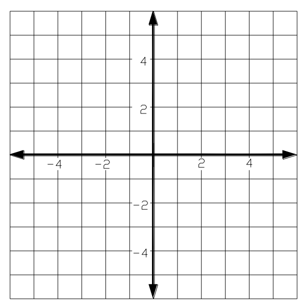
20) $y = \frac{-1}{3}x + 4$ $\quad y = 3x - 1$



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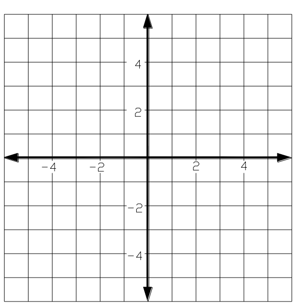
21) $y - 2x = -5$ $\quad y = \frac{1}{2}x$



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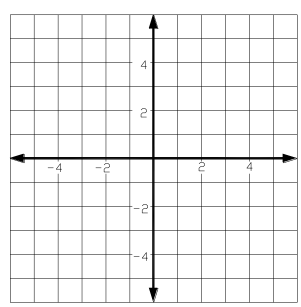
22) $y + 3 = \frac{-3}{4}x$ $\quad y - 2 = \frac{1}{3}x$



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## *Writing Linear Equations*

The Point-Slope Form of the equation of a nonvertical line that passes through the point $(x_1, y_1)$ and has a slope of “m” is $y - y_1 = m(x - x_1)$. You can use the Point-Slope Form to write the equation in Slope-Intercept Form. $y = mx + b$.

- Write the equation of the line that has a slope of -3 and passes through the point (-1,7).

Step 1: Write an equation containing one variable, and solve it.

| | |
|---|---|
| $y - y_1 = m(x - x_1)$ | Start with the Point-Slope Form. |
| $y - (7) = -3(x - (-1)$ | Substitute (7) for $y_1$, (-1)for $x_1$, and (-3) for m. |
| $y - 7 = -3(x + 1)$ | Eliminate double signs by distributing. |
| $y - 7 = -3x - 3$ | Distribute (-3). |
| $y = -3x + 4$ | Add (7) to both sides of the equation. |

Check the answer:

| | |
|---|---|
| $y = -3x + 4$ | Start with one equation. |
| $7 = -3(-1) + 4$ | Substitute “-1” for “x” and 7 for “y”. |
| $7 = 3 + 4$ | Simplify. |
| $7 = 7$ | Simplify. |

- Use the Point-Slope Form to write an equation of a line in Slope-Intercept Form that goes through the given point and has the given slope.

23) (3,-4); m=6

24) (-2,-7); m=-2

25) (1,-8); m=-1

26) (-6,1); m=$\frac{2}{3}$

# Section 4: System of Equations

A system of equations consists of having 2 or more equations. There are three methods to solving a system of equations: graphing, substitution, and elimination. We will only cover the last two in this review. When the lines intersect at exactly one point, the ($x$, $y$) values of that point are the solutions to the system.

## Substitution

**Example 1:**

Solve for the following system of equations.

$4x+3y=4$

$2x-y=7$

| | |
|---|---|
| $2x-y=7$<br>$-y=-2x+7$<br>$y=2x-7$ | Solve for one of the variables in one of the equations. |
| $4x+3y=4$<br>$4x+3(2x-7)=4$<br>$4x+6x-21=4$<br>$10x-21=4$<br>$10x=25$<br>$x=2.5$ | Substitute the expression for $y$ into the other equation and solve for $x$. |
| $y=2x-7$<br>$y=2(2.5)-7$<br>$y=5-7$<br>$y=-2$ | Substitute the value of $x$ into either equation and solve for $y$. |
| $(2.5,-2)$ | Express your answer as a point. |

**Solve the following system of equations using substitution. (Express your answer as a point!)**

**27.** $x+12y=68$
$x=8y-12$

**28.** $3x+2y=6$
$x-2y=10$

# Elimination

**Example 1:**
Solve for the following system of equations.

$$3x + 7y = 15$$
$$5x + 2y = -4$$

| | |
|---|---|
| $5[3x + 7y = 15]$ <br> $-3[5x + 2y = -4]$ | Eliminate either the *x* or *y* variables in both equations. Use the additive inverse property by multiplying the first equation by 5 and the second equation by –3 to eliminate the *x* terms. |
| $15x + 35y = 75$ <br> $-15x - 6y = 12$ | Add the two equations together. |
| $29y = 87$ <br> $y = 3$ | Solve for *y*. |
| $3x + 7(3) = 15$ <br> $3x + 21 = 15$ <br> $3x = -6$ <br> $x = -2$ | Substitute the value of *y* into either equation and solve for *x*. |
| $(-2,3)$ | Express your answer as a point. |

**Solve the following system of equations using elimination. (Express your answer as a point!)**

**29.** $2x + 5y = -4$
$3x - y = 11$

**30.** $10x + 6y = 0$
$-7x + 2y = 31$

# Section 5 - Multiplying Polynomials

## FOIL Method

The FOIL method is a special case of a more general method for multiplying algebraic expressions using the distributive law.

- **F**irst ("first" terms of each binomial are multiplied together)
- **O**uter ("outside" terms are multiplied—that is, the first term of the first binomial and the second term of the second)
- **I**nner ("inside" terms are multiplied—second term of the first binomial and first term of the second)
- **L**ast ("last" terms of each binomial are multiplied)

The general form is:

$$(a+b)(c+d) = \underbrace{ac}_{\text{first}} + \underbrace{ad}_{\text{outside}} + \underbrace{bc}_{\text{inside}} + \underbrace{bd}_{\text{last}}$$

Once you have multiplied by using the FOIL method, you must combine any like terms.

- Use FOIL to multiply $(x + 3)(x + 2)$

"first": $(x)(x) = x^2$
"outer": $(x)(2) = 2x$
"inner": $(3)(x) = 3x$
"last": $(3)(2) = 6$

**So:** $(x + 3)(x + 2) = x^2 + 2x + 3x + 6 = x^2 + 5x + 6$

31) Multiply (x + 5) (x + 7)

32) Multiply (y – 3) (y – 5)

33) Multiply (4x + 2) (4x – 2)

34) Multiply (2a + 3) (3a – 4)

# *Section 6: Factoring*

Factoring is the process of "un-doing" a polynomial. Factors are numbers multiplied together to get a product.

**Example 1:**
$t^2 + 8t + 12$

| | |
|---|---|
| 1•12, 2•6, 3•4 are factors of 12 | Identify the factors of the whole number. |
| 2 and 6 can be added to get 8 | Find the factors of 12 that add to equal 8. |
| $(t + 2)(t + 6)$ | Substitute the numbers into the appropriate factors. |

**Example 2:**
$x^2 – 6x + 8$

| | |
|---|---|
| 1•8, 2•4 are factors of 8 | Identify the factors of the whole number. |
| – 2 and – 4 can be added to get – 6 | Find the factors of 8 that add to equal – 6. |
| $(x - 2)(x - 4)$ | Substitute the numbers into the appropriate factors. |

**Example 3:**
$p^2 – 3p – 40$

| | |
|---|---|
| 1•40, 2•20, 4•10, 5•8 are factors of 40 | Identify the factors of the whole number. |
| 5 and – 8 can be added to get – 3 | Find the factors of – 40 that add to equal – 3. |
| $(p - 8)(p + 5)$ | Substitute the numbers into the appropriate factors. |

**Factor each polynomial.**

**35.** $p^2 + 9p + 20$

**36.** $g^2 – 7g + 10$

**37.** $n^2 + 3n – 18$

**38.** $y^2 – 5y – 6$