Dear Parents and Students,

As educators, we realize that students experience a learning loss in mathematics if not academically engaged. Consequently, at the beginning of each school year we are forced to spend an inordinate amount of time reviewing concepts from the previous math course. Our solution for this problem is to expedite the review process in the form of a summer math packet.

The purpose of these packets is to have students review concepts taught during the school year so that there is no retention loss in key concept areas and to better prepare the students for the upcoming year in mathematics.

We ask that over the course of the summer, you download and print the summer math packet that corresponds to your child(ren). If your child is entering the 9th grade then you will download the "Incoming Geometry Students" packet. All work is to be turned in the first full day of school.

As teachers, we will still be reviewing, but not reteaching.

Should you have any questions regarding the math packet please feel free to contact:

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Thank you for your understanding and cooperation. Enjoy the summer! We look forward to working with you and your child during the upcoming 2016-2017 academic term.

7th graders	"Incoming Pre-Algebra Students"
8th graders	"Incoming Algebra 1 Students"
9th graders	"Incoming Geometry Students"
10th graders	"Incoming Algebra 2 with Trig Students"
11th graders	"Incoming Pre-Calculus Students"
12th graders	"Incoming Calculus Students"

Algebra 2 with Trig
Summer Review Packet

About Algebra 2 with Trig:

Algebra 2 with Trig is an extension of the concepts learned in Algebra 1 with the addition of more complex mathematical concepts like logarithms, exponential functions, matrices. It teaches students to think, reason, and communicate critically and mathematically. This packet is designed to help you review those concepts necessary for your success in Algebra 2 with Trig. **Show all work for your problems**.

Table of Contents

Fractions

To simplify a fraction, divide numerator and denominator by a common factor.

Ex.- $\frac{18 \div 6}{12 \div 6} = \frac{3}{2}$

To add or subtract fractions, rewrite the fractions using a common denominator, then add or subtract the numerators.

Ex.- $\frac{1}{4} + \frac{2}{3} = \frac{3}{12} + \frac{8}{12} = \frac{11}{12}$

To multiply fractions, multiply numerator times numerator and denominator times denominator. To divide fractions, multiply by the reciprocal. Simplify answers as needed.

Ex.- $\frac{1}{4} \bullet \frac{2}{5} = \frac{2}{20} = \frac{1}{10}$ Ex.- $\frac{1}{3} \div \frac{5}{6} = \frac{1}{3} \bullet \frac{6}{5} = \frac{6}{15} = \frac{2}{5}$

Simplify the following fractions:

1. $\frac{8}{24} =$
2. $\frac{21}{14} =$
3. $\frac{5}{20} =$

Perform the following operations and simplify if necessary:

4. $\frac{5}{4} + \frac{3}{4} =$
5. $\frac{7}{8} - \frac{1}{2} =$
6. $\frac{6}{7} + \frac{3}{2} =$
7. $\frac{9}{2} + \frac{7}{5} =$
8. $\frac{15}{8} - \frac{12}{5} =$
9. $-\frac{3}{5} - \frac{2}{7} =$
10. $\frac{2}{3} \bullet \frac{5}{8} =$
11. $-\frac{5}{3} \bullet \frac{2}{5} =$
12. $\frac{4}{7} \bullet \frac{8}{3} =$
13. $\frac{1}{3} \div \frac{5}{2} =$
14. $\frac{1}{9} \div \frac{7}{8} =$
15. $-\frac{4}{5} \div \frac{1}{6} =$
16. $6 \bullet \frac{4}{5} =$
17. $15 \div \frac{3}{8} =$
18. $\frac{2}{7} \bullet 14 =$

Order of Operations

Hints/Guide:

The rules for multiplying integers are:

positive x positive = positive   negative x negative = positive
positive x negative = negative   negative x positive = negative

The rules for dividing integers are the same as for multiplying integers.

REMEMBER: Order of Operations (PEMDAS)

P – parentheses
E – exponents
M/D – multiply/divide which comes first
A/S – add/subtract which comes first

Exercises: Solve the following problems. Show all work.

1. $\frac{100-15}{9+8}$

2. $3+4[13-2(6-3)]$

3. $32\div(-7+5)^3$

4. $14+6\bullet2-8\div4$

Use grouping symbols to make the equation true.

5. $6 + 8 \div 4 \cdot 2 = 7$

Solving Equations

Hints/Guide:

Equation Solving Procedure:

1. Multiply on both sides to clear the equation of fractions or decimals.
2. Distribute.
3. Collect like terms on each side, if necessary.
4. Get all terms with variables on one side and all constant terms on the other side.
5. Multiply or divide to solve for the variable.
6. Check all possible solutions in the original equation.

Example: $5(x-2)+7=3(x+1)-2$	Distribute.
$5x-10+7=3x+3-2$	Combine like terms. Simplify.
$5x-3=3x+1$	Move all terms with variables to one side.
$2x=4$	Divide to isolate the variable.
$x=2$	

Exercises: Solve each equation. Show all work.

1. $3(r-6)=-21$

2. $5(t+3)+9=-6$

3. $2(x+4)-20=-3(x-6)$

4. $a+(a-3)=a+2-(a+1)$

Table of Powers

Please complete the following table of powers except for the shaded areas.

	x^1	x^2	x^3	x^4	x^5
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
20					
25					

Exponents

Hints/Guide:

Rules of Exponents

$a^0 = 1$ $\qquad a^1 = a$

Negative Exponents: $a^{-n} = \dfrac{1}{a^n}$

Product Rule: $a^m a^n = a^{m+n}$

Quotient Rule: $\dfrac{a^m}{a^n} = a^{m-n}$

Power Rule: $(a^m)^n = a^{mn}$

Quotient to a Power: $\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}$

Product to a Power: $(ab)^n = a^n b^n$

Exercises: Simplify using the Rules of Exponents.

1. $6^{-2} \cdot 6^{-3}$
2. $x^6 \cdot x^2 \cdot x$
3. $(4a)^3 \cdot (4a)^8$
4. $\dfrac{3^5}{3^2}$
5. $\dfrac{x^3}{x^8}$
6. $\dfrac{(2x)^5}{(2x)^5}$
7. $(x^3)^2$
8. $(-3y^2)^3$
9. $(2a^3b)^4$
10. $(3x^2)^3(-2x^5)^3$
11. $(2x^3y^{-2})^3$
12. $(2x)^2(-3x)^4$

Express using a positive exponent.

13. 5^{-3}

14. $\dfrac{1}{y^{-8}}$

Radicals

Hints/Guide:

Roots or radicals are the opposite operation of applying exponents; you can "undo" a power with a radical, and a radical can "undo" a power. For instance, if you square 2, you get 4, and if you "take the square root of 4", you get 2. To simplify a square root, you "take out" anything that is a "perfect square"; that is, you take out front anything that has two copies of the same factor.

Ex.- $\sqrt{25x^2} = \sqrt{5\cdot 5\cdot x\cdot x} = 5x$

To simplifying multiplied radicals,we use the fact that the product of two radicals is the same as the radical of the product, and vice versa. $\sqrt{ab} = \sqrt{a}\sqrt{b}$

Ex.- $\sqrt{24}\sqrt{6} = \sqrt{144} = 12$

Just as with regular numbers, square roots can be added together. But you might not be able to simplify the addition all the way down to one number. Just as "you can't add apples and oranges", so also you cannot combine "unlike" radicals. To add radical terms together, they have to have the same radical part.

Ex.- $2\sqrt{3} + 3\sqrt{3} = 5\sqrt{3}$

Exercises: Simplify the radicals.

1. $\sqrt{9}$
2. $\sqrt{144}$
3. $\sqrt{196}$
4. $\sqrt{49}$
5. $\sqrt{25x^2}$
6. $\sqrt{27y^3}$
7. $\sqrt{64x^5}$
8. $\sqrt{12x^7y^6z}$

Multiply the radicals.

9. $\sqrt{2}\sqrt{8}$
10. $\sqrt{3}\sqrt{6}$
11. $\sqrt{6}\sqrt{15}\sqrt{10}$
12. $\sqrt{4x}\sqrt{5x^3}$
13. $\sqrt{5xy^2}\sqrt{15x^2y}$
14. $\sqrt{4x^4}\sqrt{16x^3}$

Add or subtract the radicals.

15. $\sqrt{3} + 3\sqrt{3}$
16. $\sqrt{9} + \sqrt{25}$
17. $\sqrt{5} + 2\sqrt{3} + 3\sqrt{5}$
18. $3\sqrt{4} - 2\sqrt{4}$
19. $\sqrt{9} - \sqrt{4}$
20. $\sqrt{8} + 5\sqrt{2}$

Addition, Subtraction and Multiplication of Polynomials

Hints/Guide:

- Only like terms can be added or subtracted.
- Like terms have the same variables with the same exponents.
- Only the coefficients (numbers) are added or subtracted.
- A subtraction sign in front of the parentheses changes each term in the parentheses to the opposite.
- Multiply the coefficients and use the rules of exponents for the variables.
- Remember: FOIL F – first O – outers I – inners L – last **OR** Box Method

Examples:

1) Add the polynomials.

$$(3x^2-2x+2)+(5x^3-2x^2+3x-4)$$
$$=5x^3+3x^2-2x^2-2x+3x+2-4$$
$$=5x^3+x^2+x-2$$

2) Subtract the polynomials.

$$(9x^5+x^3-2x^2+4)-(2x^5+x^4-4x^3-3x^2)$$
$$=(9x^5+x^3-2x^2+4)-2x^5-x^4+4x^3+3x^2$$
$$=7x^5-x^4+5x^3+x^2+4$$

3) Multiply the polynomials.

$$(x^2+4)(x^2+2x-3)$$
$$=x^2(x^2+2x-3)+4(x^2+2x-3)$$
$$=x^4+2x^3-3x^2+4x^2+8x-12$$
$$=x^4+2x^3+x^2+8x-12$$

Exercises: Add, subtract, or multiply the polynomials. Show all work.

1. $(3x+2)+(-4x+3)$
2. $(-6x+2)+(x^2+x-3)$
3. $(6x+1)-(-7x+2)$
4. $(3x^2-5x+4)-(x^2+8x-9)$
5. $-3x(x-1)$
6. $-4x(2x^3-6x^2-5x+1)$
7. $(x+5)(x-2)$
8. $(x-5)(2x-5)$
9. $(x-1)(x^2+x+1)$
10. $(x+5)^2$

Factoring Polynomials

Hints/Guide:

- Always look for the greatest common factor first.
- Don't forget to include the variable in the common factor.
- Factor into two parentheses, if possible.
- Check your answer by multiplying.

Examples:

Factor $15x^5 + 12x^4 + 27x^3 - 3x^2$

Question: What factor is common to the coefficients of 15, 12, 27, and 3?

Answer: 3

Question: What exponent is common to variables of x^5, x^4, x^3, and x^2?

Answer: x^2

$= 3x^2(5x^3 - 4x^2 + 9x - 1)$

Factor $t^2 + 5t - 24$ Think: What multiplies to -24 and adds to +5?

$= (t-3)(t+8)$

Pairs of Factors	Sums of Factors
-1, 24	23
-2, 12	10
-3, 8	5
-4, 6	2

Exercises: Find the GCF from the lists of factors for each pair of numbers.

1. 12: 1, 2, 3, 4, 6, 12
   8: 1, 2, 3, 4, 6, 9, 18
2. 36:1, 2, 3, 4, 6, 9, 12, 18, 36
   54:1, 2, 3, 6, 9, 18, 27, 54
3. 8: 1, 2, 4 ,8
   12: 1, 2, 3, 4, 6, 12

Factor the polynomials. Show all work.

1. $21x + 35$
2. $x^2 - 4x$
3. $10x^2 - 5x$
4. $x^2 + 5x + 6$
5. $y^2 - 81$
6. $x^2 - 8x + 15$
7. $x^2 + 2x - 15$
8. $2x^2 + 8x + 6$
9. $2x^2 - 7x - 4$

Solving Systems of Equations by Substitution

Hints/Guide:

- Solve one equation for one of the variables with a coefficient of 1.
- Substitute what the variable equals into the other equation of the original pair. (The new equation should now have only one variable.)
- Solve for that variable.
- Use that answer to solve for the other variable.
- Answers are ordered pairs: (x, y).

Example:

Solve $x - 2y = 6$
$3x + 2y = 4.$

Solve the first equation for x: $x = \mathbf{6 + 2y}$

Substitute your answer above into the second equation: $3(\mathbf{6 + 2y}) + 2y = 4$

Distribute: $18 + 6y + 2y = 4$

Combine like terms: $18 + 8y = 4$

Collect like terms to one side (subtract 18 from both sides): $8y = -14$

Isolate the variable (divide by 8 on both sides): $y = -\frac{14}{8}$ or $-\frac{7}{4}$

Substitute the y value into an original equation to solve for x: $x - 2\left(-\frac{7}{4}\right) = 6$

$$x - \left(-\frac{14}{4}\right) = 6$$

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

The solution to the system of equations: $\left(\frac{5}{2}, -\frac{7}{4}\right)$

Exercises: Solve the system of equations using the substitution method. Show all work.

1. $s + t = -4$
   $s - t = 2$

2. $x - y = 6$
   $x + y = -2$

3. $y - 2x = -6$
   $2y - x = 5$

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

Solving Systems of Equations by Elimination

Hints/Guide:

- Answers are ordered pairs (x, y).
- Eliminate one variable by adding the two equations together.
- Sometimes, one equation must be multiplied by a number to have a variable with the same coefficient and opposite sign.

Examples:

1. Solve $2x + 3y = 8$
   $x + 3y = 7$

$$\begin{aligned} 2x + 3y &= 8 \\ \underline{-x - 3y} &\underline{= -7} \\ x + 0y &= 1 \\ \mathbf{x} &\mathbf{= 1} \end{aligned}$$

Multiply the equation by -1 to make the y coefficients opposite:
Add the equations together and solve for x:

Substitute the value of x into the original equation: $2(1) + 3y = 8$
Solve the equation for y: $3y = 6$

$\mathbf{y = 2}$

The solution for this system: **(1,2)**

2. Solve $3x + 6y = -6$
   $5x - 2y = 14$

$$\begin{aligned} 3x + 6y &= -6 \\ \underline{15x - 6y} &\underline{= 42} \\ 18x + 0y &= 36 \\ \mathbf{x} &\mathbf{= 2} \end{aligned}$$

Multiply the second equation by 3 to make the y coefficients opposites:
Add the equations together and solve for x:

Substitute the value of x into the original equation: $3(2) + 6y = -6$
Solve the equation for y: $6y = -12$

$\mathbf{y = -2}$

The solution for this system: **(2,-2)**

Exercises: Solve the systems of equations by elimination. Show all work.

1. $x + y = 10$, $x - y = 8$
2. $x - y = 7$, $x + y = 3$
3. $3x - y = 8$, $x + 2y = 5$
4. $4x - y = 1$, $3x + y = 13$

Quadratic Formula

Hints/Guide:

- **Assume that the radical extends over the whole expression $b^2 - 4ac$.**
- Equation must be in the form $ax^2 + bx + c = 0$ (standard form) to begin.
- Try to factor first.
- If you cannot find factors, then use the quadratic formula.

Quadratic Formula

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

Example:

Solve $x^2 = 4x + 7$

Write the equation in standard form: $x^2 - 4x - 7 = 0$

Identify a, b, and c for the formula: a = 1, b = -4, c = -7

Substitute into the formula: $x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-7)}}{2(1)}$

Simplify: $x = \frac{4 \pm \sqrt{16 + 28}}{2}$

Separate into two solutions: $x = \frac{4 + \sqrt{44}}{2}$ and $x = \frac{4 - \sqrt{44}}{2}$

Solutions: $x = 5.32$ and $x = -1.32$

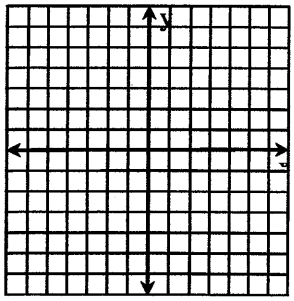
Exercises: Solve using the quadratic formula. Show all work.

1. $x^2 - 4x = 21$
2. $x^2 = 6x - 9$
3. $3y^2 - 7y + 4 = 0$

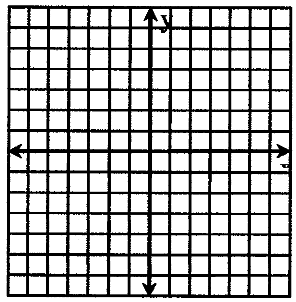
Graphing Functions

Use slope (m) and y-intercept (b) to graph the following linear equations y = mx + b.

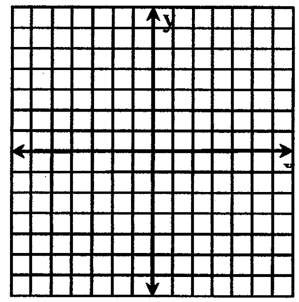
1. $y = x + 1$



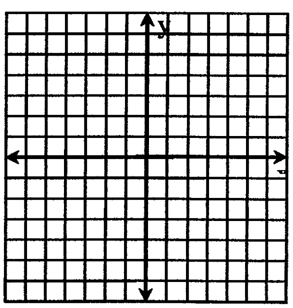
2 $y = 2x - 3$



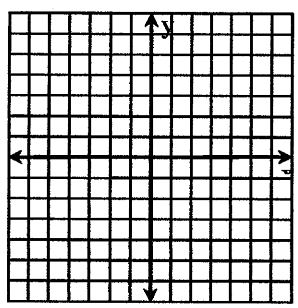
3. $y = 5x - 2.5$



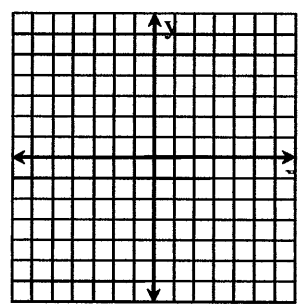
4. $y = -3x + 1$



5. $y = \frac{1}{4}x - 1$



6. $y = \frac{2}{3}x + 2$



******* Questions 1 through 9 are for Honors Algebra 2 ONLY *******

1. Line k passes through the point (8, -3) and is parallel to the line y = 3x – 4. Write an equation for line k.

2. Line *m* is perpendicular to y = 4x – 1and passes through the origin. What is the equation of line *m?*

3. Use $A = \begin{bmatrix} 12 & 7 \\ -1 & -3 \end{bmatrix}$ and $B = \begin{bmatrix} -5 & 6 \\ 14 & 0 \end{bmatrix}$ to perform the indicated operations.
   a. A + B

   b. 2B – A

   c. -4A

4. Simplify the expressions.
   a. $(x^3+3x^2-2)+(5x^3+x+8)-(9x^3-x^2+4)$

   b. $(4x-3y)(x+5y)$

   c. $(3x^2+x+1)(2x-1)$

   d. $\dfrac{16x^4-12x^5y^3}{2x^3y^2}$

   e. $(5x-2)^2$

   f. $2(x^3-5x^2+6x)-(x^2+3x)$

5. Factor completely.

   a. $9x^2y^3-3x^3y^2-15xy$

   b. $2x^2y-4xy-30y$

   c. x^2-x-30

   d. $4x^2-81$

   e. x^3+4x^2+3x

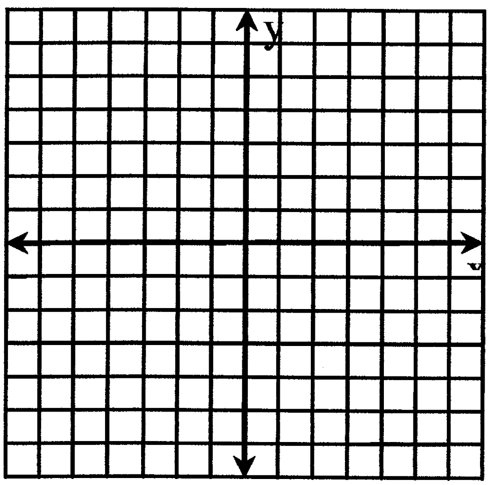
   f. $2x^2-5x-3$

6. A car salesman's weekly salary is base amount plus an additional amount for each car sold. The table below shows a person's weekly salary earned for the last three weeks.

Cars Sold (C)	Weekly Salary (S)
4	$500
9	$1000
12	$1300

What is the person's weekly salary when 13 cars are sold? Justify your answer.

7. Sketch a graph of $f(x) = x^2 - x - 2$. Then complete the characteristics below.



Domain:

Range:

Axis of Symmetry:

Increasing Interval:

Decreasing Interval

x-intercepts:

y-intercept:

Minimum Value:

Maximum Value:

Vertex:

Continuous?

8. What can you say about the x-coordinates of two distinct points on a vertical line?

9. Simplify each of the following using exact answers – no decimals. (Leave your answers in radical form.)

a. $\sqrt{32}$ b. $\sqrt{\frac{9}{4}}$ c. $\sqrt{\frac{3}{2}}$ d. $\sqrt{8} + \sqrt{18} - \sqrt{32}$

e. $\sqrt{21} \bullet \sqrt{14}$