

WSCA Summer Assignment

Pre-Calculus

Summer Math Instructions and Information

Please read and follow all instructions. If you do not, you may lose points on the assignment.

1. Each class has 6-8 topics to review from previous classes. I have provided worked-out examples of each topic and a list of student problems for you to complete.
2. All the problems are to be completed in the packet. You may do your work on the same page as the problems, or use a separate sheet of paper.
3. Please number the problems as you complete them and circle/box your final answers.
4. Please staple your completed problems in the same order that they are posted online and put your name on the front page.
5. Please draw ALL graphs on graph paper OR graphs printed off the internet (you can Google search "Blank Coordinate Plane").

Algebra 1: You should do all problems without a calculator. Many of these topics will be reviewed during the first two weeks of school and you WILL NOT be able to use a calculator for the first quiz and test.

How will you be graded?

1. There will NOT be a quiz on the material during the first week of school. Instead, you will hand in all completed problems by the 2nd day of school (any day after the 2nd will result in loss of points). Two problems from each section will be graded on accuracy. The rest will be graded for completion.
2. Your completion grade is based on an attempt of every problem. You should show your work and use the examples provided to complete each problem. You will not receive completion credit for writing random numbers as your answers.
3. You will not know which problems will be graded for accuracy, so treat each problem as if it were being graded.

Topic: Graphing Quadratic Functions

Example Problems: Graph the functions using at least three points. Always include the vertex.

1. Standard Form

$$y = ax^2 + bx + c$$

$$y = -x^2 + 2x + 1$$

$$\text{vertex: } x = \frac{-b}{2a} = \frac{-(2)}{2(-1)} = \frac{-2}{-2} = 1$$

$$y = -(1)^2 + 2(1) + 1$$

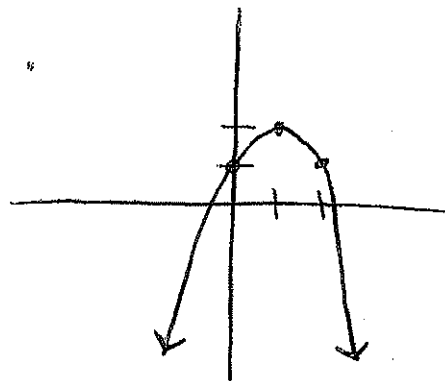
$$= -1 + 2 + 1$$

$$= 2$$

$$(1, 2)$$

y-intercept: $y = c$

$$(0, 1)$$



Pick one more x-value (you can pick any x-value, then plug it into the equation to find y).

$$x = 2$$

$$y = -(2)^2 + 2(2) + 1$$

$$= -4 + 4 + 1$$

$$= 1 \quad (2, 1)$$

2. Vertex form

$$y = a(x-h)^2 + k$$

$$y = 2(x-3)^2 - 1$$

Vertex: (h, k) *Remember to always change the sign of h .

$$(3, -1)$$

Pick 2 more x -values; one on each side of the vertex.

$$x = 0$$

$$y = 2(0-3)^2 - 1$$

$$= 2(-3)^2 - 1$$

$$= 2(9) - 1$$

$$= 18 - 1 = 17$$

$$(0, 17)$$

$$x = 4$$

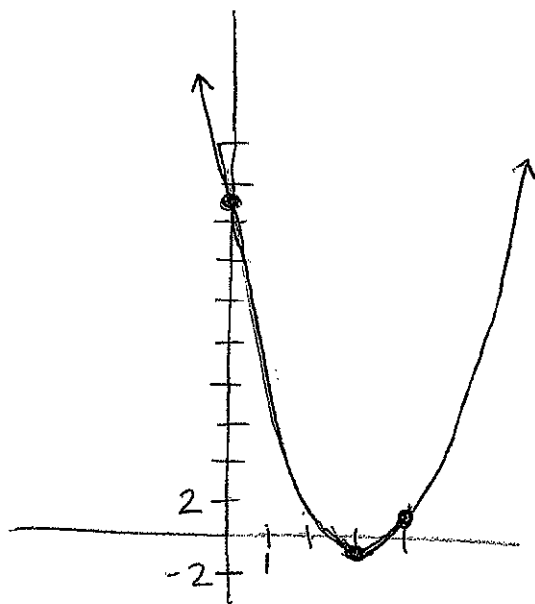
$$y = 2(4-3)^2 - 1$$

$$y = 2(1)^2 - 1$$

$$= 2(1) - 1$$

$$= 2 - 1 = 1$$

$$(4, 1)$$



Student Problems: You may work on a separate piece of paper, or do your work directly on this sheet. Please use a pencil and include your work. I have chosen 2-4 problems to grade for accuracy. The rest will be graded for completion.

When graphing, please use graph paper or print blank graphs off the internet. Find at least three points, including the vertex.

1. $y = x^2 - 8x + 13$

2. $y = 2x^2 - 16x + 33$

3. $y = (x - 3)^2 + 1$

4. $y = \frac{1}{2}(x - 4)^2 - 2$

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

6. $y = -(x + 1)^2 + 2$

Topic: Solving Quadratic Equations by Factoring
 or the Quadratic Formula

Example Problems:

Solve the quadratic equations by factoring:

1. $x^2 - 11x + 19 = -5$ *Must equal zero first

$x^2 - 11x + 24 = 0$ *Find numbers that multiply to 24 and add to -11.

$(x-3)(x-8) = 0$

$x-3=0$ $x-8=0$

$x=3$ $x=8$

$\frac{24}{-3 \quad -8}$

2. $6x^2 - 13x + 6 = 0$ $6 \cdot 6 = 36$

$6x^2 - 9x - 4x + 6 = 0$ $-9 \quad -4$

$3x(2x-3) - 2(2x-3) = 0$

$(3x-2)(2x-3) = 0$

$3x-2=0$ $2x-3=0$

$3x=2$ $2x=3$

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

Solve the quadratic equation using the Quadratic Formula:

3. $15x^2 - 3x = 3 - 7x$ *Must equal zero.

$15x^2 + 4x - 3 = 0$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$x = \frac{-4 \pm \sqrt{4^2 - 4(15)(-3)}}{2(15)} = \frac{-4 \pm \sqrt{16 + 180}}{30} = \frac{-4 \pm \sqrt{196}}{30} = \frac{-4 \pm 14}{30}$

$\frac{-4+14}{30} = \frac{10}{30} = \frac{1}{3}$ $\frac{-4-14}{30} = \frac{-18}{30} = \frac{-3}{5}$

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Solve by factoring:

1. $x^2 + 7x + 15 = 5$

2. $x^2 - 7x - 30 = 0$

3. $6x^2 + 11x = -3$

4. $3x^2 + 10x - 20 = -x$

5. $8x^2 + 24x = 14x + 42$

Solve using the quadratic formula:

6. $3x^2 + 7x + 2 = 0$

7. $4x^2 + 1 = 4x$

8. $40x + 25 = -16x^2$

Topic: Adding, Subtracting, Multiplying, and
Example Problems: Dividing Polynomial Expressions

1. Adding / Subtracting: Combine like terms

$$a. \quad \underline{\underline{-2x^2 - 3x^3 + 5x + 4}} + \underline{\underline{-2x^3 + 7x - 6}}$$

$$\boxed{-5x^3 - 2x^2 + 12x - 2}$$

$$b. \quad (-6x^3 - 6x^2 + 7x - 1) - (3x^3 - 5x^2 - 2x + 8)$$

$$(-6x^3 - 6x^2 + 7x - 1) + (-3x^3 + 5x^2 + 2x - 8)$$

$$\boxed{-9x^3 - x^2 + 9x - 9}$$

* Distribute
the negative
sign first.

2. Multiplying:

$$a. \quad (2x - 5)(3x^2 + 5x - 2)$$

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

$$6x^3 + 10x^2 - 4x - 15x^2 - 25x + 10$$

$$\boxed{6x^3 - 5x^2 - 29x + 10}$$

$$b. \quad (8x - 3)^2$$

$$(8x - 3)(8x - 3)$$

$$64x^2 - 24x - 24x + 9$$

$$64x^2 - 48x + 9$$

3. Dividing:

a. $(x^3 + 3x^2 - 4x - 12) \div (x - 2)$

Long division:

$$\begin{array}{r} x^2 + 5x + 6 \\ x - 2 \overline{) x^3 + 3x^2 - 4x - 12} \\ \underline{- x^3 - 2x^2} \\ 5x^2 - 4x \\ \underline{- 5x^2 - 10x} \\ 6x - 12 \\ \underline{6x - 12} \\ 0 \end{array}$$

* you can use synthetic division b/c you are dividing by a polynomial in the form $(x - r)$.

Synthetic division:

$$\begin{array}{r|rrrr} 2 & 1 & 3 & -4 & -12 \\ & & 2 & 10 & 12 \\ \hline & 1 & 5 & 6 & 0 \end{array}$$

$x^2 + 5x + 6$

b. $(x^3 + 3x^2 - 13x - 15) \div (x^2 - 2x - 3)$

* CANNOT use synthetic division.

$$\begin{array}{r} x + 5 \\ x^2 - 2x - 3 \overline{) x^3 + 3x^2 - 13x - 15} \\ \underline{- x^3 - 2x^2 - 3x} \\ 5x^2 - 10x - 15 \\ \underline{5x^2 - 10x - 15} \\ 0 \end{array}$$

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

$$2. (1 - 5x + x^3) - (2x^4 + 5x^3 - 10x^2)$$

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

$$4. (x+2)(x^2+4x+1)$$

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

$$6. (x^2+5x-1)(x^2+7x+3)$$

$$7. (x^3+3x^2-33x-35) \div (x+1)$$

$$8. (2x^3+9x^2+6x+8) \div (x+4)$$

$$9. (x^3+6x^2-x-30) \div (x^2+8x+15)$$

Topic: Properties of Exponents

Example Problems:

Product Property: $x^m \cdot x^n = x^{m+n}$

$$x^5 \cdot x^2 = x^7$$

Quotient Property: $\frac{x^m}{x^n} = x^{m-n}$

$$\frac{x^8}{x^3} = x^{8-3} = x^5$$

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

$$(x^5)^3 = x^{15}$$

Power of a Product: $(xy)^m = x^m y^m$

$$(x^2 y)^5 = x^{10} y^5$$

Negative Exponent: $x^{-m} = \frac{1}{x^m}$

$$\frac{1}{x^{-m}} = x^m$$

Examples:

1. $(3x^2 y^{-2})(-2x^3 y^{-4})$

$$-6x^5 y^{-6}$$

$$\boxed{\frac{-6x^5}{y^6}}$$

2. $\left(\frac{y^7}{2z^{12}y^3}\right)^4$

$$\frac{y^{28}}{16z^{48}y^{12}}$$

$$\boxed{\frac{y^{16}}{16z^{48}}}$$

$$\begin{aligned} * 2^4 &= 2 \cdot 2 \cdot 2 \cdot 2 \\ &= 16 \end{aligned}$$

$$3. \left(\frac{-3x^2y^5}{z^2y^7} \right)^{-3}$$

$$\frac{(-3)^3 x^6 y^{15}}{z^6 y^{21}}$$

$$\frac{-27x^6 y^{-6}}{z^6}$$

$$\boxed{\frac{-27x^6}{y^6 z^6}}$$

$$4. \left(\frac{x^{-2}}{4t} \right)^{-3} \cdot \left(\frac{5y}{x^{-7}} \right)^{-2}$$

$$\left(\frac{x^{-9}}{4^3 y^3} \right) \left(\frac{5^2 y^2}{x^{-14}} \right) \quad \begin{array}{l} 5^2 = 25 \\ 4^3 = 64 \end{array}$$

$$\frac{25x^{-9} y^2}{64x^{-14} y^3} \quad \begin{array}{l} -9 - (-14) = 5 \\ 2 - 3 = -1 \end{array}$$

$$\boxed{\frac{25x^5}{y^1}}$$

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Simplify the expressions:

1. $(-2x^3)(5xy^4)$

2. $\frac{x^5 y^4}{x y^{-4}}$

3. $\left(\frac{2x^4}{y^2}\right)^3$

4. $\left(\frac{3x^4}{y^{-2}}\right)^5$

5. $(a^{-3} b^2)^4 \cdot (-2a^3 b^7)^3$

6. $\left(\frac{15x^2 y^{-2}}{-3xy^{-3}}\right)^2$

7. $\left(\frac{y^3}{z^4}\right)^{-2} \cdot \left(\frac{y^{-4}}{2z}\right)^3$

8. $\left(\frac{8y^{-1}}{x^2 z^3}\right) \cdot \left(\frac{2x^2 y}{3z^2}\right)^2$

Topic: Solving Polynomial Equations

Example Problems:

1. Quadratic Form. Solve for x .

$$18x^4 - 21x^2 + 3 = 0 \quad 18 \cdot 3 = \frac{54}{-18 \quad -3}$$

$$18x^4 - 18x^2 - 3x^2 + 3 = 0$$

$$18x^2(x^2 - 1) - 3(x^2 - 1) = 0$$

$$(18x^2 - 3)(x^2 - 1) = 0$$

$$18x^2 - 3 = 0$$

$$18x^2 = 3$$

$$x^2 = \frac{3}{18} = \frac{1}{6}$$

$$x = \pm \sqrt{\frac{1}{6}} = \frac{\pm 1}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \boxed{\frac{\pm \sqrt{6}}{6}}$$

$$x^2 - 1 = 0$$

$$x^2 = 1$$

$$x = \pm \sqrt{1}$$

$$= \boxed{\pm 1}$$

2. $4x^4 - 8x^2 + 3 = 0 \quad 4 \cdot 3 = 12$

$$4x^4 - 6x^2 - 2x^2 + 3 = 0 \quad -6 \quad -2$$

$$2x^2(2x^2 - 3) - 1(2x^2 - 3) = 0$$

$$(2x^2 - 1)(2x^2 - 3) = 0$$

$$2x^2 - 1 = 0$$

$$x^2 = \frac{1}{2}$$

$$x = \pm \sqrt{\frac{1}{2}} = \frac{\pm 1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \boxed{\frac{\pm \sqrt{2}}{2}}$$

$$2x^2 - 3 = 0$$

$$x^2 = \frac{3}{2}$$

$$x = \pm \sqrt{\frac{3}{2}} = \frac{\pm \sqrt{3}}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \boxed{\frac{\pm \sqrt{6}}{2}}$$

3. Sum and Difference of Cubes

$$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$x^3 - 216 = 0$$

$$(x)^3 - (6)^3 = 0$$

$$(x-6)(x^2 + 6x + 36) = 0$$

$$x-6=0$$

$$x=6$$

$$x^2 + 6x + 36 = 0$$

* Not factorable, so use quadratic formula.

$$x = \frac{-6 \pm \sqrt{6^2 - 4(1)(36)}}{2(1)}$$

$$= \frac{-6 \pm \sqrt{36 - 144}}{2}$$

$$= \frac{-6 \pm \sqrt{-108}}{2}$$

$$= \frac{-6 \pm \sqrt{-36 \cdot 3}}{2}$$

$$= \frac{-6 \pm 6i\sqrt{3}}{2}$$

$$= \boxed{-3 \pm 3i\sqrt{3}}$$

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Solve for x :

1. $x^4 + x^2 - 90 = 0$

2. $x^4 - 7x^2 - 44 = 0$

3. $9x^4 - 27x^2 + 20 = 0$

4. $4x^4 - 5x^2 - 6 = 0$

5. $x^3 + 64 = 0$

6. $8x^3 - 27 = 0$

Topic: Solve square root and cube root equations

Example Problems:

Solve the equations for x :

$$1. \sqrt{x+2} + 4 = 7$$
$$\quad \quad -4 \quad -4$$

$$\sqrt{x+2} = 3$$

$$(\sqrt{x+2})^2 = (3)^2$$

$$x+2 = 9$$

$$\boxed{x=7}$$

$$\text{check: } \sqrt{7+2} + 4 = 7$$

$$\sqrt{9} + 4 = 7$$

$$3 + 4 = 7$$

$$7 = 7 \checkmark$$

$$2. \sqrt{2x-7} = x-3$$

$$(\sqrt{2x-7})^2 = (x-3)^2$$

$$2x-7 = x^2-6x+9$$

$$x^2-8x+16=0$$

$$(x-4)(x-4)=0$$

$$x-4=0$$

$$x=4$$

$$\text{check: } \sqrt{2(4)-7} = 4-3$$

$$\sqrt{8-7} = 1$$

$$\sqrt{1} = 1$$

$$1 = 1 \checkmark$$

$$3. \sqrt{x-12} = 2 - \sqrt{x}$$

$$(\sqrt{x-12})^2 = (2-\sqrt{x})^2 \Rightarrow (2-\sqrt{x})(2-\sqrt{x})$$

$$x-12 = 4 - 4\sqrt{x} + x$$

$$-x - 4 \quad -4 \quad -x$$

$$-16 = -4\sqrt{x}$$

$$(-16)^2 = (-4\sqrt{x})^2$$

$$256 = 16(x)$$

$$\boxed{16=x} \text{ extraneous}$$

No Solution

$$\text{check: } \sqrt{16-12} = 2 - \sqrt{16}$$

$$\sqrt{4} = 2 - 4$$

$$2 = -2 \quad \times$$

$$4. 2\sqrt[3]{6x-3} - 4 = 0$$

$$2\sqrt[3]{6x-3} = 4$$

$$\sqrt[3]{6x-3} = 2$$

$$(\sqrt[3]{6x-3})^3 = 2^3$$

$$6x-3 = 8$$

$$6x = 11$$

$$x = \frac{11}{6}$$

* Do not have to
check cube
root equations

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Solve the equations for x . Remember to check your answers to the square root equations.

1. $\sqrt{x-4} + 6 = 10$

2. $2 + 4\sqrt{x} = 0$

3. $\sqrt[3]{x+8} - 6 = -3$

4. $\sqrt[3]{4x} + 3 = 5$

5. $x - 5 = \sqrt{3x - 11}$

6. $\sqrt{20-x} = x$

7. $\sqrt{x+15} = 5 + \sqrt{x}$

8. $\sqrt{x-6} = 3 - \sqrt{x}$