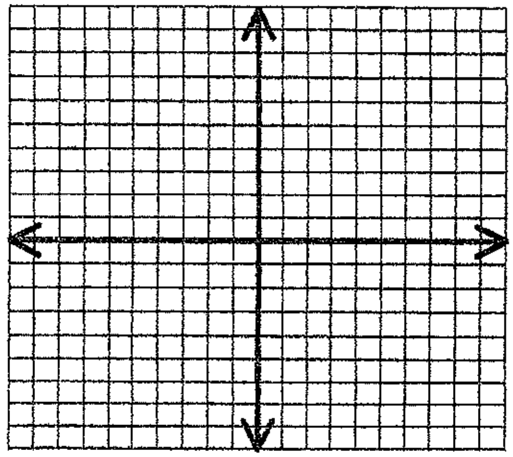
Algebra 1 Notes

Name________________

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

How does the graph of $y = \frac{1}{2}x^2 - 2x + 5$ differ from the graph of $y = x^2$?

x	0	1	2	3	4
y					



The graph $y = ax^2 + bx + c$ is a parabola that:	
opens up if	opens down if
is narrower than the graph of $y = x^2$ if	is wider than the graph of $y = x^2$ if
has an axis of symmetry of $x = \frac{-b}{2a}$	has a vertex with an x-coordinate of
has a y-intercept of	

EXAMPLES

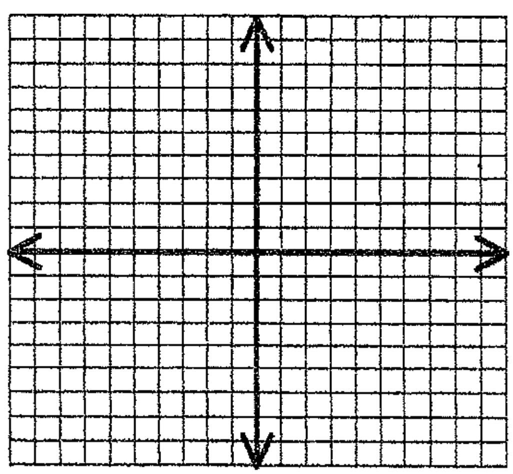
1. $y = -x^2 - 4x + 6$

opens: ________ AOS________

wider, narrower, or neither?

vertex ________ y-int ________

x					
y					

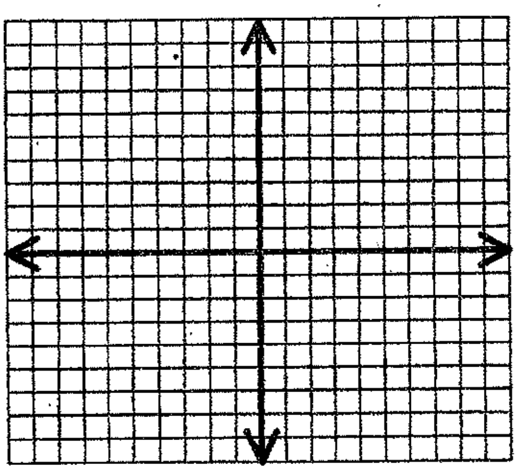


2. $y = -2x^2 - 12x - 8$

opens: ________ AOS________

wider narrower neither?

vertex ________ y-int _________



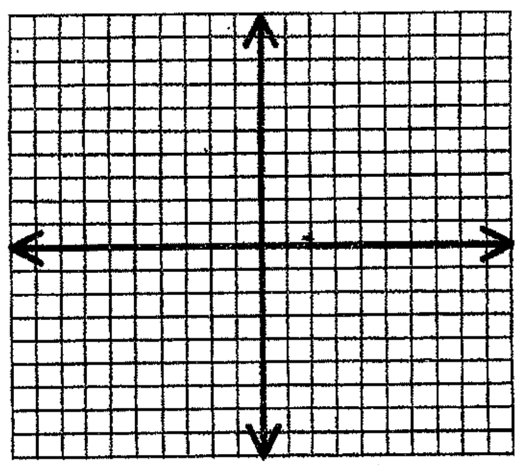
x					
y					

3. $y = \frac{1}{4}x^2 - x + 2$

opens ________ AOS ________

wider narrower neither?

vertex ________ y-int _________



x					
y					

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Use Square Roots to Solve Quadratic Equations

$\sqrt{\quad\#}$	$\sqrt{}$	$-\sqrt{}$	$\pm\sqrt{}$

A Radical Expression is in simplest form when:

1. No radicand has a perfect square factor other than 1.
2. The radicand contains no fractions.
3. No radicals appear in the denominator of a fraction. (You will explore this more in Algebra 2)

Examples of Rule #1: No radicand has a perfect square factor other than 1.

1. $\sqrt{9}$	2. $-\sqrt{49}$	3. $\sqrt{100}$	4. $\pm2\sqrt{16}$
5. $\sqrt{12}$	6. $-\sqrt{8}$	7. $\sqrt{192}$	8. $\pm\sqrt{27}$

Examples of Rule #2: The radicand contains no fractions.

9. $\sqrt{\frac{5}{4}}$	10. $\pm\sqrt{\frac{16}{81}}$

Examples of Rule #3: No radicals appear in the denominator of a fraction.

11. $\frac{5}{\sqrt{9}}$	12. $\frac{12}{-\sqrt{36}}$

Special cases: Is $-\sqrt{25}$ the same as $\sqrt{-25}$?

You can use square roots to solve quadratic equations in the form of $ax^2 + c = 0$.

A. Isolate the quadratic term x^2 to one side of the equation.
B. Take the square root of both sides to solve. **REMEMBER** to include both roots!!!
C. **Exact solutions** leave irrational #s in simplest radical form.
D. Use a calculator to find **approximate solutions** (round to the nearest hundredth).

Solve the following equations. List answers as **both** exact and approximate.

13. $2x^2 = 40$	**14.** $n^2 - 18 = -18$	**15.** $b^2 + 12 = -7$
16. $4x^2 = 9$	**17.** $4x^2 - 10 = 98$	**18.** $3x^2 - 35 = 45 - 2x^2$

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Solve Quadratic Equations by the Quadratic Formula

The Quadratic Formula

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

Used to solve **ANY** quadratic equation in the form of $ax^2 + bx + c = 0$.

1. Make sure the equation is set = 0!!
2. Identify the values for a, b, and c.
3. Substitute these values into the formula. Be very careful of signs and order of operations!!

Solve the following quadratic equations using the Quadratic Formula.

1. $3x^2 + 5x = 8$	2. $2x^2 - 4 = 3x$
3. $x^2 + 4x + 1 = 0$	4. $3x^2 = 12$

Homework:

Solve the following quadratic equations using the Quadratic Formula. Give BOTH exact and estimated values.

1. $x^2 - 5x = 14$	2. $2x^2 + 9x + 7 = 3$
3. $x^2 + 10x + 1 = 0$	4. $5x^2 - 3 = -2x$
5. $-2x^2 + 32 = 0$	6. $4x^2 - 12x + 9 = 0$

ZERO PRODUCT PROPERTY:	If a = 0 OR b=0 then ab=_______ a and b are known as ____________.

The <u>zero product property</u> is used to solve an equation when one side is 0 and the other side is a product of polynomials (factors). The solutions are called ___________.

7. $(x+5)(x-3)=0$	8. $(x-4)(2x-6)=0$	9. $x(2x-7)=0$

To factor and use the zero product property to solve polynomial equations, remember these steps:

1. Set each equation = 0;
2. Factor the polynomial (start by looking for a GCF);
3. Set each factor = 0;
4. Solve each equation;
5. Check your roots in the original equation.

10. $a^2+5a=0$	11. $3x^2=81x$	12. $12y^2=48y$
13. $(4x-2)(2x+3)=0$	14. $14x=21x^2$	15. $(x+6)(x-6)=0$

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Solving Quadratic Equations by Factoring

Date________________ Period____

Solve each equation by factoring. odds only

1) $(k+1)(k-5)=0$

2) $(a+1)(a+2)=0$

3) $(4k+5)(k+1)=0$

4) $(2m+3)(4m+3)=0$

5) $x^2-11x+19=-5$

6) $n^2+7n+15=5$

7) $n^2-10n+22=-2$

8) $n^2+3n-12=6$

9) $6n^2-18n-18=6$

10) $7r^2-14r=-7$

11) $n^2 + 8n = -15$

12) $5r^2 - 44r + 120 = -30 + 11r$

13) $-4k^2 - 8k - 3 = -3 - 5k^2$

14) $b^2 + 5b - 35 = 3b$

15) $3r^2 - 16r - 7 = 5$

16) $6b^2 - 13b + 3 = -3$

17) $7k^2 - 6k + 3 = 3$

18) $35k^2 - 22k + 7 = 4$

19) $7x^2 + 2x = 0$

20) $10b^2 = 27b - 18$

21) $8x^2 + 21 = -59x$

22) $15a^2 - 3a = 3 - 7a$

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Factoring Differences of Perfect Squares and Factoring Completely

1. Multiply: $(2x-3)(2x+3)$	2. Multiply: $(4x+5)(4x-5)$

What type of polynomial are these?

Which term is missing when written in descending order?

What is special about each term?

What operation is occurring?

To factor the **difference of perfect squares:** a^2-b^2 follow the pattern $(\quad)(\quad)$

Examples

3. $25x^2-16$	4. $81x^2-4$	5. x^2-1	6. x^2-y^2
7. $49-a^2$	8. $36x^2-121y^2$	9. $25x^4-4$	10. $196-9a^4$
11. $225p^2-100$	12. $625-121w^2$	13. $25x^6-81$	14. $400y^2-900a^2$

To factor a polynomial <u>completely</u> means to apply EVERY factoring technique that applies in a problem. *Please refer to the Factoring Flowchart given in class.*

Examples

15. $3x-12$	16. x^2-16	17. $5x^4-405$
18. x^2+16	19. $3x^2-12x+3$	20. $12x^2-x-6$
21. $4x^2-20x+16$	22. $12ab^2+10cb^2-12ad^2-10cd^2$	23. $2x^2+13x-7$
24. $5m^2+20m+40$	25. $3x^5y-243x^3y$	26. $-10x^2-5x+75$

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Simplify Radical Expressions

A radical Expression is in simplest form when the following conditions are met:

1.____

2.____

3.____

Properties of Radical Expressions: **Examples:**

$\sqrt{ab} = \sqrt{a} \bullet \sqrt{b}$	4. $\sqrt{3x} \bullet \sqrt{20x}$
$\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$	5. $\sqrt{\frac{x^2}{100}}$

Simplify each of the following.

6. $\sqrt{72}$	7. $\sqrt{3x^2}$	8. $\sqrt{45y^5}$	9. $-3\sqrt{12x^2}$
10. $\sqrt{5} \bullet \sqrt{10}$	11. $-2\sqrt{3x} \bullet 4\sqrt{15xy}$	12. $\sqrt{\frac{5}{81}}$	13. $\sqrt{\frac{2x^4}{9y^2}}$

Rationalizing the denominator:

A process used to eliminate a radical from the denominator of a fraction.

14. $\frac{5}{\sqrt{7}}$	15. $\sqrt{\frac{5}{7}}$
16. $\sqrt{\frac{3x}{50}}$	17. $\frac{9}{\sqrt{2x}}$

Sums and Differences of Radical Expressions: Combine Like Radicals!!!

18. $4\sqrt{10}+\sqrt{10}-9\sqrt{10}$	19. $5\sqrt{3}+\sqrt{48}$
20. $\sqrt{12}+6\sqrt{3}-\sqrt{20}$	21. $7\sqrt{28}+\sqrt{63}-2\sqrt{7}$

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Multiplying Radical Expressions odds only

Date________________ Period____

Simplify.

1) $3\sqrt{12} \cdot \sqrt{6}$

2) $\sqrt{5} \cdot \sqrt{10}$

3) $\sqrt{6} \cdot \sqrt{6}$

4) $\sqrt{5} \cdot -4\sqrt{20}$

5) $-4\sqrt{15} \cdot -\sqrt{3}$

6) $\sqrt{20x^2} \cdot \sqrt{20x}$

7) $\sqrt{15n^2} \cdot \sqrt{10n^3}$

8) $\sqrt{18a^2} \cdot 4\sqrt{3a^2}$

9) $-3\sqrt{7r^3} \cdot 6\sqrt{7r^2}$

10) $-4\sqrt{28x} \cdot \sqrt{7x^3}$

11) $\sqrt{3}(5 + \sqrt{3})$

12) $2\sqrt{5}(\sqrt{6} + 2)$

13) $-3\sqrt{3}(2 + \sqrt{6})$

14) $\sqrt{3}(-5\sqrt{10} + \sqrt{6})$

15) $-2\sqrt{15}(-3\sqrt{3}+3\sqrt{5})$

16) $5\sqrt{42x}(4+4\sqrt{7x})$

17) $\sqrt{14x}(3-\sqrt{2x})$

18) $\sqrt{6n}(7n^3+\sqrt{12})$

19) $\sqrt{3v}(\sqrt{6}+\sqrt{10})$

20) $\sqrt{21r}(5+\sqrt{7})$

21) $(-2\sqrt{3}+2)(\sqrt{3}-5)$

22) $(5-4\sqrt{5})(-2+\sqrt{5})$

23) $(-2-3\sqrt{5})(5-\sqrt{5})$

24) $(\sqrt{5}-\sqrt{3})(\sqrt{5}+\sqrt{3})$

25) $(5\sqrt{2x}+\sqrt{5})(-4\sqrt{2x}+\sqrt{5x})$

26) $(-3\sqrt{3k}+4)(\sqrt{3k}-5)$

27) $(5+4\sqrt{3})(3+\sqrt{3})$

28) $(3\sqrt{2}+\sqrt{5})(\sqrt{2}-3\sqrt{5r})$

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Solving Radical Equations

A radical Equation contains a radical expression with the variable in the radicand. To Solve:

1.____

2.____

Examples of squaring both sides of an equation:

1. $\sqrt{x} = 4$	2. $\sqrt{2x} = \sqrt{10}$

Squaring both sides of an equation sometimes results in **EXTRANEOUS VALUES.** Check your final answers to be sure they both work!! Only list the solutions true solutions.

Examples:

3. $3\sqrt{x} - 6 = 0$	4. $3\sqrt{4x-19} - 11 = 10$
5. $\sqrt{3x-3} = \sqrt{2x+8}$	6. $\sqrt{6-x} = x$

More examples:

7. $\sqrt{x+6}-\sqrt{x-6}=0$	8. $\sqrt{4x-19}-\sqrt{2x+12}=0$
9. $\sqrt{20-x}-x=0$	10. $4\sqrt{x-7}+12=28$