Math 1

1.4 Solving Quadratics

Unit 1

SWBAT solve quadratic equations by factoring and using the Quadratic Formula.

Greatest Common Factor
$ax + bx = x(a + b)$

Difference of Squares
$x^2 - y^2 = (x + y)(x - y)$

SOLVE BY FACTORING!

Set all equations equal to zero before beginning!

Step 1: Factor Away!

Step 2: Set each factor = 0

Step 3: Solve for x.

Factoring Trinomials (X-Factor)
$ax^2 + bx + c$

Grouping
Four-term polynomials

Directions: Solve each of the following by factoring. Check your solutions by graphing.

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

$2x+1=0$ $\quad 3x-4=0$

$2x=-1 \quad 3x=4$

$x=-\frac{1}{2} \quad x=4/3$

$\{-1/2, 4/3\}$

2. $x(3x + 9) = 0$

$x=0 \quad 3x+9=0$

$3x=-9$

$x=-3$

$\{0, -3\}$

3. $-x^2 = -121$

$x^2-121=0$

$(x-11)(x+11)=0$ $\quad \{-11, 11\}$

$x-11=0 \quad x+11=0$

$x=11 \quad x=-11$

4. $5x^2 + 32x = -28x$

$5x^2+60x=0$

$5x(x+12)=0$

$5x=0 \quad x+12=0$

$x=0 \quad x=-12$

$\{0, -12\}$

5. $45x^2 + 56x = -16$

720: 20, 36

$45x^2+56x+16=0$

$(45x^2+20x)+(36x+16)=0$

$5x(9x+4)+4(9x+4)=0$

$5x+4=0 \quad 9x+4=0$

$5x=-4 \quad 9x=-4$

$x=-4/5 \quad x=-4/9$

$\{-\frac{4}{5}, -\frac{4}{9}\}$

6. $3x^2 + 8x + 5 = 0$

15: 5, 3; 8

$(3x^2+3x)+(5x+5)=0$

$3x(x+1)+5(x+1)=0$

$3x+5=0 \quad x+1=0$

$3x=-5 \quad x=-1$

$x=-5/3$

$\{-1, -5/3\}$

7. The product of two consecutive negative integers is 1122. What are the numbers?

1st: x

2nd: $x+1$

$x(x+1)=1122$

$x^2+1x=1122$

$x^2+1x-1122=0$

1122: 34, −33; 1

$(x+34)(x-33)=0$

$x+34=0 \quad x-33=0$

$x=-34 \quad x=33$ ↑ not negative

-34
-33

8. The width of a rectangle is (x+1) and the length is (x-6). What is the length and width of the rectangle if the area is 30 square feet?

$(x+1)(x-6)=30$

$x^2-5x-6=30$

$x^2-5x-36=0$

−36: −9, 4; −5

$(x-9)(x+4)=0$

$x-9=0 \quad x+4=0$

$x=9 \quad x=-4$ ↑ Width can't be negative.

width $= 9+1 =$ 10 ft

length $= 9-6 =$ 3 ft

9. The area of a triangular lot is 225 square feet. The base of the lot is 7 more than its height. Find the length of the base and the height.

base $= h+7$

height $= h$

$A=\frac{bh}{2}$

$\frac{h(h+7)}{2}=225$

−450: 25, −18; 7

$h^2+7h=450$

$h^2+7h-450=0$

$(h+25)(h-18)=0$

$h+25=0 \quad h-18=0$

$h=-25 \quad h=18$ ↑ height can't be negative

base = 25

height = 18

The Quadratic Formula

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

Step 1: Set the equation equal to 0.

Step 2: Label the "a", "b" and "c" terms.

Step 3: Substitute each value into the discriminant.

Step 4: Substitute back into formula and simplify.

Step 5: Split the equation into the + and - solutions

Step 6: Solve for x.

Using the Quadratic Formula

What are the roots of the equation $2x^2 - 4x + 7 = 0$? Use the quadratic formula to solve.

$a = 2$

$b = -4$

$c = 7$

$$X = \frac{4 \pm \sqrt{(-4)^2-4(2)(7)}}{2(2)}$$

$$X = \frac{4 \pm \sqrt{-40}}{4}$$

$$X = \frac{4 \pm i\sqrt{40}}{4}$$

$40 = 4 \cdot 10 = 2 \cdot 2 \cdot 2 \cdot 5$

$$x = \frac{4 \pm 2i\sqrt{10}}{4}$$

← Don't divide the radicand! we already simplified it!

$$X = \frac{2 \pm 1i\sqrt{10}}{2}$$

$$\left\{\frac{2+i\sqrt{10}}{2}, \frac{2-i\sqrt{10}}{2}\right\}$$

What are the solutions of $x^2 - 34x + 289 = 0$? Use the quadratic formula to solve.

$a = 1$

$b = -34$

$c = 289$

$$X = \frac{34 \pm \sqrt{(-34)^2-4(1)(289)}}{2(1)}$$

$$X = \frac{34 \pm \sqrt{0}}{2}$$

$$X = \frac{34 \pm 0}{2}$$

$$X = \frac{34+0}{2}$$

$$X = 17$$

$$X = \frac{34-0}{2}$$

$$X = 17$$

$$\{17\}$$

What are the roots of the equation $x^2 - 8x = 33$? Use the quadratic formula to solve.

$x^2 - 8x - 33 = 0$

$a = 1$

$b = -8$

$c = -33$

$$X = \frac{8 \pm \sqrt{(-8)^2-4(1)(-33)}}{2(1)}$$

$$X = \frac{8 \pm \sqrt{196}}{2}$$

$$X = \frac{8 \pm 14}{2}$$

$$X = \frac{8+14}{2}$$

$$X = 11$$

$$X = \frac{8-14}{2}$$

$$X = -3$$

$$\{-3, 11\}$$