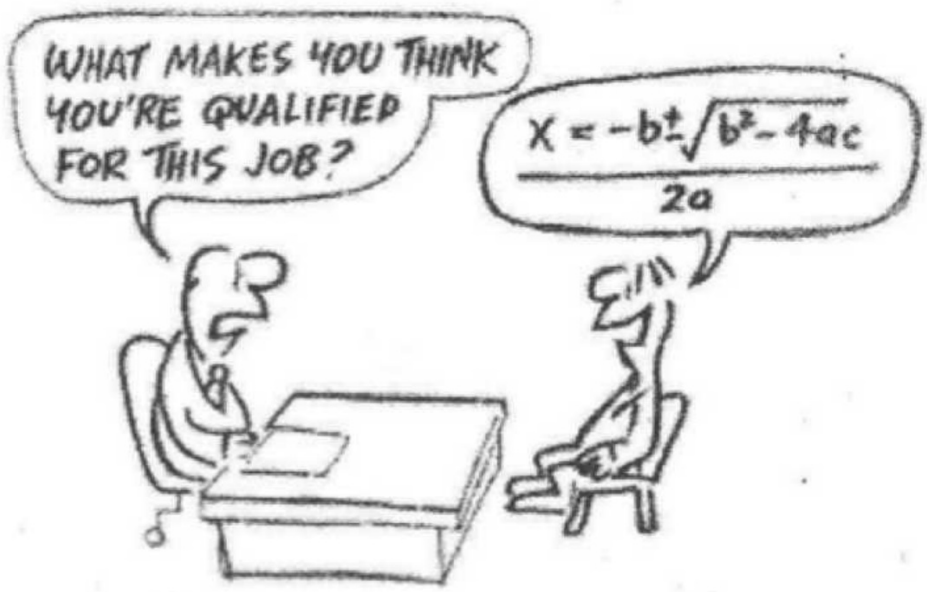
1.7 Solving Quadratic Equations Using CTS
1.8 Quadratic Formula



Solving Quadratics By CTS

*Use CTS to solve a quadratic equation when...

"b" value is even, and the equation is not factorable

$x^2 + 8x + 1 = 0$

ex: Solve.

a) $x^2 - 4x - 10 = 0$

$\left(\frac{-4}{2}\right)^2 = 4$

$(x^2 - 4x + 4) - 4 - 10 = 0$

$\sqrt{(x-2)^2} = \sqrt{14}$

$|x-2| = \sqrt{14}$

$x - 2 = \pm\sqrt{14}$

$x = 2 \pm \sqrt{14}$

b) $x^2 - 14x + 103 = 0$

$x^2 - 14x + 49 - 49 + 103 = 0$

$\sqrt{(x-7)^2} = \sqrt{-54}$

$|x-7| = 3i\sqrt{6}$

$x - 7 = \pm 3i\sqrt{6}$

$x = 7 \pm 3i\sqrt{6}$

3 ± 5

$3+5 \quad 3-5$

$8 \quad -2$

c) $-2x^2+4x-17=0$

$-2(x^2-2x+1)+2-17=0$

$-2(x-1)^2=15$

$\sqrt{(x-1)^2}=\sqrt{\frac{-15}{-2}\cdot\frac{\sqrt{2}}{\sqrt{2}}}$

$|x-1|=\frac{i\sqrt{30}}{2}$

$x=1\pm\frac{i\sqrt{30}}{2}$

d) $4x^2+12x+1=0$

$4(x^2+3x\quad)$

odd

not friendly

Solving Quadratics Using the Quadratic Formula

Let $a,b,c \in R$ such that $a \neq 0$. The solutions of the quadratic equation $ax^2 + bx + c = 0$ are:

Quadratic Formula: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

*Use the Quadratic Formula to solve a quadratic equation when... other methods are not feasible

ex: Solve.

a) $x^2 + 3x = 2$

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

$a = 1$

$b = 3$

$c = -2$

$$x = \frac{-3 \pm \sqrt{3^2 - 4(1)(-2)}}{2(1)}$$

$$= \frac{-3 \pm \sqrt{17}}{2} = \frac{-3}{2} \pm \frac{\sqrt{17}}{2}$$

$9 + 8$

$$\frac{6 \pm 8\sqrt{3}}{2} = \frac{6}{2} \pm \frac{8\sqrt{3}}{2}$$

$3 \pm 4\sqrt{3}$

b) $-x^2+4x-5=0$

$a=-1$ $x=\dfrac{-4\pm\sqrt{16-4(-1)(-5)}}{2(-1)}$

$b=4$

$c=-5$ $x=\dfrac{-4\pm\sqrt{-4}}{-2}$

$=\dfrac{-4\pm 2i}{-2}=\dfrac{-4}{-2}\pm\dfrac{2i}{-2}$

$2\pm i$

Picking A Method

look for square method

look for 'factorable

CTS or quadratic formula

ex: Determine which method is best to solve each quadratic equation. Do not repeat a method. DO NOT SOLVE.

a)

1. $x^2 + 6x - 3 = 0$ CTS

2. $x^2 + 6x + 5 = 0$ Factor

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

4. $x^2 + 2x + 5 = 0$ quad form

b)

1. $14x^2 - 21x = 0$ factorable

2. $x^2 + 3x - 1 = 0$ Quad form

3. $2x^2 - 8x + 5 = 0$ CTS

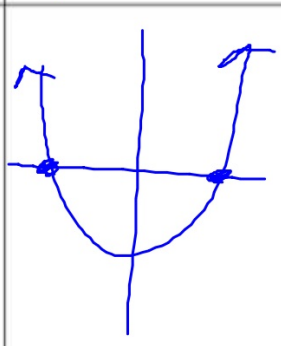
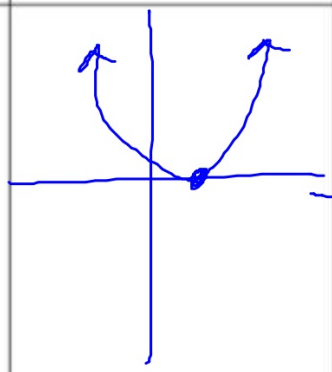
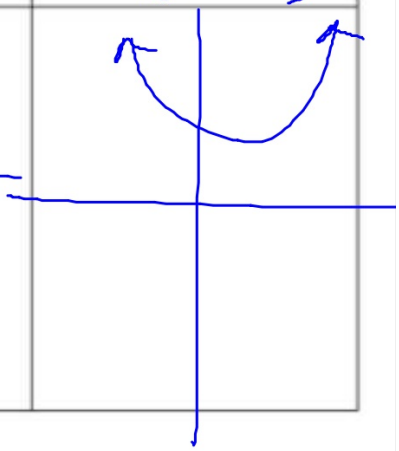
4. $x^2 - 80 = 0$ square root

The Discriminant:

- In the quadratic formula, the expression $b^2 - 4ac$ is called the discriminant.

- The discriminant is used to determine the types of solutions for the quadratic.

Using The Discriminant:

Value of discriminant	$D > 0$	$D = 0$	$D < 0$
Number of solutions	2	1	2
Type of solutions	real	real	imaginary
Graph of $y = ax^2 + bx + c$			

ex: Find the discriminant and give the number and type of solutions of the equation.

a) $x^2 - 8x + 13 = -4$

$x^2 - 8x + 17 = 0$

$a = 1$

$b = -8$

$c = 17$

$D = b^2 - 4ac$

$= (-8)^2 - 4(1)(17)$

$= 64 - 68$

$D = -4 < 0$

2 imag. solutions

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

$a = 1$

$b = -8$

$c = 16$

$D = (-8)^2 - 4(1)(16)$

$= 64 - 64$

$D = 0$

1 real

c) $8x^2 - 2x + 1 = x^2 + 6$

$7x^2 - 2x - 5 = 0$ $(7x + 5)(x - 1)$

$a = 7$

$b = -2$

$c = -5$

$D = (-2)^2 - 4(7)(-5)$

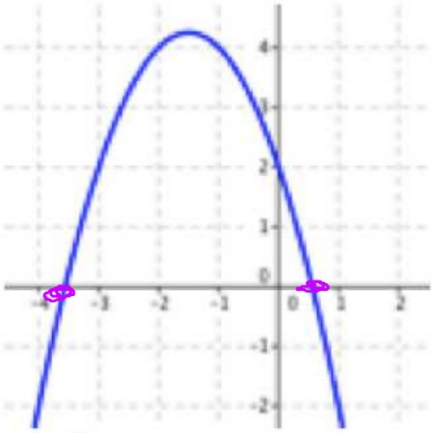
$= 4 + 140$

$= 144 > 0$

2 real

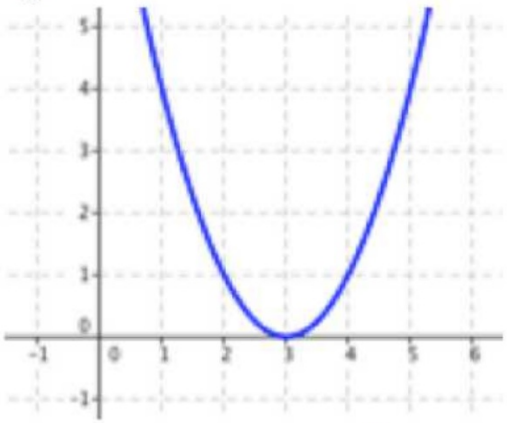
ex: The graph of $y = ax^2 + bx + c$ r the solutions of $ax^2 + bx + c = 0$ are given. Determine if the discriminant is positive, negative, or zero. Explain your reasoning.

a)



2 real $D > 0$

b)



1 real

D = 0

c) $x = 2 \pm 3i$

2 imaginary

$D < 0$

(negative)

ex: Consider the quadratic equation: $3x^2 + 12x + c = 0$

Find all values of c for which the equation has...

$a = 3 \quad b = 12$

a) two real solutions

$D > 0$

$b^2 - 4ac > 0$

$144 - 12c > 0$

$\frac{-12c}{-12} > \frac{-144}{-12}$

$c < 12$

b) one real solution

$$b^2 - 4ac = 0$$

$$144 - 12c = 0$$

$$c = 12$$

c) two imaginary solutions

$$b^2 - 4ac < 0$$

$$144 - 12c < 0$$

$$c > 12$$

Review

ex: $y = -(x-3)(x+1)$

a) Sketch.

b) State the domain and range in interval notation.

c) What is the maximum or minimum value?

Review

ex: Which number sets does the number belong to?

$$\sqrt{8}$$

Review

ex: Solve.

$$9x^2 - 12x = 0$$

Challenge! :)

ex: Solve $ax^2 + bx + c = 0$ by completing the square.