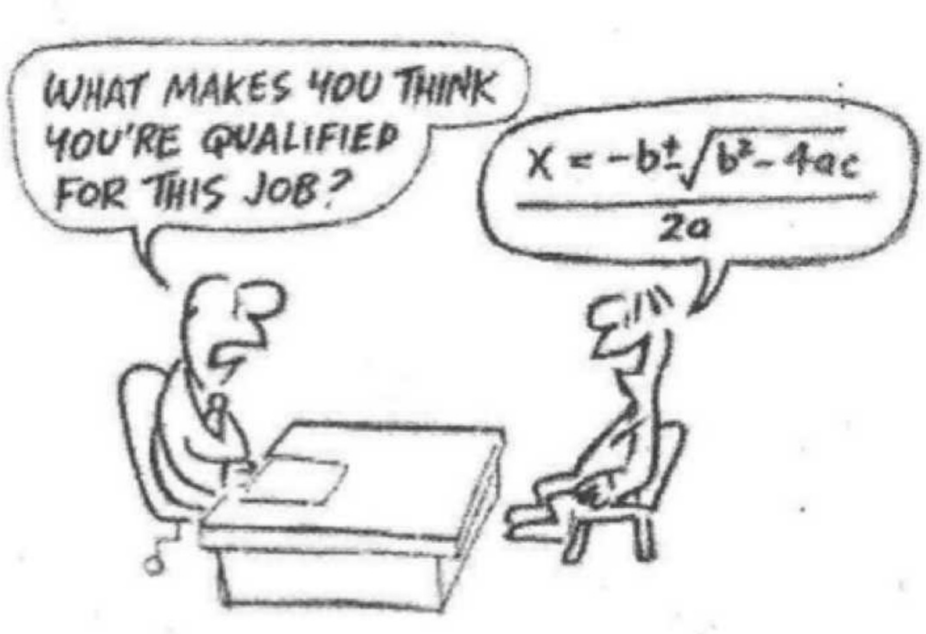
1.7 Solving Quadratic Equations Using CTS
1.8 Quadratic Formula



Solving Quadratics By CTS

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

"b" value is even

ex: Solve.

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

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

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

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

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:

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

*Use the Quadratic Formula to solve a quadratic equation when... the values of a, b, + c are small and the quadratic is not factorable.

ex: Solve.

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

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

$a = 1$

$b = 3$

$c = -2$

$$x = \frac{-3 \pm \sqrt{3^2 - 4(1)(-2)}}{2(1)} = \frac{-3 \pm \sqrt{17}}{2}$$

or

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

b) $\cancel{-x^2+4x-5=0}$

$-x^2+5x-4=x+1$

$-1(-x^2+4x-5=0)$

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

$a=1$
$b=-4$
$c=5$

$$x=\frac{-(-4)\pm\sqrt{(-4)^2-4(1)(5)}}{2(1)}$$

$$x=\frac{4\pm\sqrt{-4}}{2}$$

$$x=\frac{4\pm 2i}{2}=\frac{4}{2}+\frac{2i}{2}$$

$$=2\pm i$$

c) $x^2 = 6x - 4$

$x^2 - 6x + 4 = 0$

$a = 1$

$b = -6$

$c = 4$

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

$$x = \frac{6 \pm \sqrt{20}}{2} = \frac{6 \pm 2\sqrt{5}}{2}$$

$$= 3 \pm \sqrt{5}$$

Picking A Method

a.) $2x^2-6x+1=0$ quad. form.

b.) $-2x^2-7x+15=0$ factor

c.) $6-2(x+1)^2=0$ square root

d.) $3x^2-12x-14=0$ CTS

a.) $2x^2 - 6x + 1 = 0$

$a = 2$

$b = -6$

$c = 1$

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

$$X = \frac{6 \pm \sqrt{28}}{4} = \frac{6 \pm 2\sqrt{7}}{4}$$

$$\frac{6}{4} \pm \frac{2\sqrt{7}}{4} = \frac{3}{2} \pm \frac{\sqrt{7}}{2}$$

b.) $-2x^2-7x+15=0$

$$2x^2+7x-15=0$$

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

$$x=\frac{3}{2},\ -5$$

2 1

-3 5

c.) $6-2(x+1)^2=0$

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

$$\sqrt{(x+1)^2}=\sqrt{3}$$

$$|x+1|=\sqrt{3}$$

$$x+1=\pm\sqrt{3}$$

$$x=-1\pm\sqrt{3}$$

d.) $3(x^2 - 4x + 4) - 12 - 14 = 0$

$$3(x-2)^2 = 26$$

$$\sqrt{(x-2)^2} = \sqrt{\frac{26}{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$$

$13 \cdot 2 \cdot 3$

$$|x-2| = \frac{\sqrt{78}}{3}$$

$$x = 2 \pm \frac{\sqrt{78}}{3}$$

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

a)

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

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

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

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

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 or Quad $x=-3\pm2\sqrt{3}$

2. $x^2+6x+5=0$ Factor $x=-1,-5$

3. $2(x+1)^2-4=0$ Sq. root $x=-1\pm\sqrt{2}$

4. $x^2+2x+5=0$ CTS or Quad $x=-1\pm2i$

b)

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

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

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

4. $x^2 - 80 = 0$

b)

factor 1. $14x^2 - 21x = 0$ $\quad x = 0, \frac{3}{2}$

Quad form 2. $x^2 + 3x - 1 = 0$ $\quad x = \frac{-3 \pm \sqrt{13}}{2}$

CTS 3. $2x^2 - 8x + 5 = 0$ $\quad x = 2 \pm \frac{\sqrt{6}}{2}$

Sq. root 4. $x^2 - 80 = 0$ $\quad x = \pm 4\sqrt{5}$

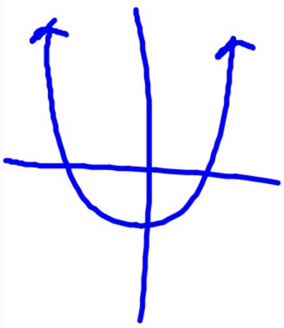
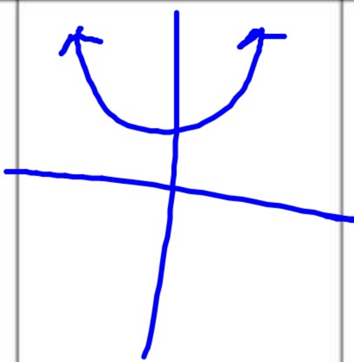
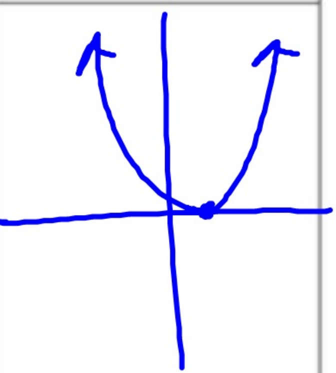
The Discriminant:

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

- The discriminant is used to determine the the nature of the roots (or solutions) of the quadratic equation.

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

Using The Discriminant:

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

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

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

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

$a = 1$

$b = -8$

$c = 17$

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

$= 64 - 68$

-4 ; 2 imaginary solutions.

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

$a = 1$

$b = -8$

$c = 16$

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

$= 64 - 64$

$= 0$

1 real solution

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

factorable!

$7x^2 - 2x - 5 = 0$

$a = 7$

$b = -2$

$c = -5$

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

$= 4 + 140$

$= 144$; 2 real

perfect square

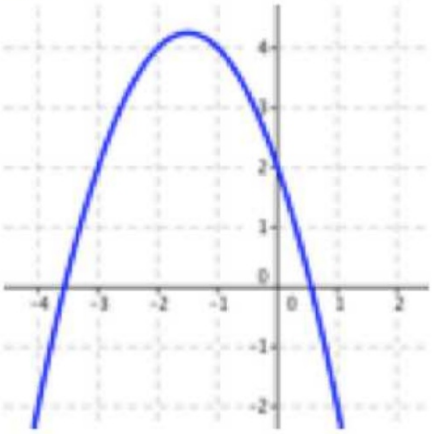
7 1

5 -1

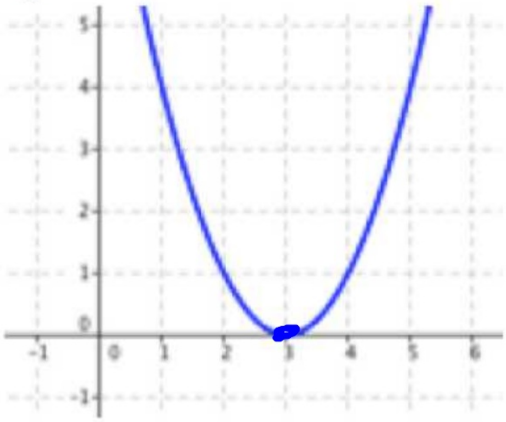
$(7x+5)(x-1)=0$

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)



b)



zero

c) $x = 2 \pm 3i$

D is negative

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

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

a) two real solutions

$D > 0$

$b^2 - 4ac > 0$

$144 - 12c > 0$

$c < 12$

b) one real solution

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

$$144 - 12c = 0$$

$$c = 12$$

c) two imaginary solutions

$b^2 - 4ac < 0$

$144 - 12c < 0$

$c > 12$