Solving Quadratic Equations by the Quadratic Formula

Obj: To solve a quadratic equation using the quadratic formula.

* We will use the quadratic formula, but we NEED to be in standard form $\Rightarrow$ $ax^2 + bx + c = 0$.

Quadratic Formula

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

This means, that

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

OR

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

In-Class Practice Problems

Solve using the quadratic formula.

1) $x^2 + 3x - 28 = 0$

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

3) $9x^2 + 6x = 1$

4) $x^2 + 18 = 10x$

5) $4k^2 + 4k - 1 = 0$

Quadratic Formula:

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

4/3/14

Solutions to In-class problems

Solve using the quadratic formula.

1) $x^2+3x-28=0$

$$x=\frac{-3\pm\sqrt{3^2-4(1)(-28)}}{2}$$

$$x=\frac{-3\pm\sqrt{9+112}}{2}=$$ ~~$\sqrt{9+11}$~~

$$=\frac{-3\pm\sqrt{121}}{2}$$

$$=\frac{-3\pm 11}{2}$$

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

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

$$x=\frac{-3\pm\sqrt{17}}{4}$$

3) $9x^2+6x=1 \Rightarrow 9x^2+6x-1=0$

$$x=\frac{-6\pm\sqrt{(6)^2-4(9)(-1)}}{2(9)}$$

$$x=\frac{-6\pm\sqrt{36+36}}{18}=\frac{-6\pm\sqrt{72}}{18}$$

$$=\frac{-6\pm\sqrt{36}\sqrt{2}}{18}$$

$$=\frac{-6\pm 6\sqrt{2}}{18}=\frac{-1\pm\sqrt{2}}{3}$$

1,72
2,36
3,24
4,18
6,12
8,9

4) $x^2 + 18 = 10x \Rightarrow x^2 - 10x + 18 = 0$

(a, b, c)

$$x = \frac{10 \pm \sqrt{(-10)^2 - 4(1)(18)}}{2(1)}$$

$$x = \frac{10 \pm \sqrt{28}}{2} \rightarrow \begin{matrix} 2,14 \\ 4,7 \end{matrix}$$

$$x = \frac{10 \pm \sqrt{4}\sqrt{7}}{2} = \frac{10 \pm 2\sqrt{7}}{2}$$

$$= \frac{10}{2} \pm \frac{2\sqrt{7}}{2}$$

$$= 5 \pm \sqrt{7}$$

5) $4k^2 + 4k - 1 = 0$

$$x = \frac{-4 \pm \sqrt{4^2 - 4(4)(-1)}}{2(4)} \rightarrow \begin{matrix} 4,8 \\ 2,16 \end{matrix}$$

$$x = \frac{-4 \pm \sqrt{32}}{8} = \frac{-4 \pm 4\sqrt{2}}{8}$$

1) Solve $-3x^2 + 9x - 4 = 0$ using the Quadratic Formula.

$-3x^2 + 9x - 4 = 0$

a b c

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

$$x = \frac{-9 \pm \sqrt{(9)^2 - 4(-3)(-4)}}{2(-3)}$$

$$x = \frac{-9 \pm \sqrt{81 - 48}}{-6}$$

$$x = \frac{-9 \pm \sqrt{33}}{-6}$$

Quadratics (continued)

~~85~~%
error ± 3%

Solve: $6x^2 + 4x - 1 = 0$

(a, b, c)

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

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

$$x = \frac{-4 \pm \sqrt{16 + 24}}{12}$$

$$x = \frac{-4 \pm \sqrt{40}}{12}$$

$$= \frac{-4 \pm \sqrt{4}\sqrt{10}}{12}$$

$$= \frac{-4 \pm 2\sqrt{10}}{12} = \frac{-1 \pm \frac{1}{2}\sqrt{10}}{3}$$

$$\frac{-1 \pm \frac{\sqrt{10}}{6}}{3}$$

40
1, 40
2, 20
8, 5
10, 4
$2\sqrt{10}$

Solve using the Quadratic Formula

Ex) $3x^2 = 6x + 2$

$-3x^2 \qquad -3x^2$

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

$a \quad b \quad c$

$$x = \frac{-6 \pm \sqrt{6^2 - 4(-3)(2)}}{2(-3)}$$

$$x = \frac{-6 \pm \sqrt{36 + 24}}{-6}$$

$$x = \frac{-6 \pm \sqrt{60}}{-6}$$

$$x = \frac{-6 \pm \sqrt{4}\sqrt{15}}{-6}$$

$$x = \frac{-6 \pm 2\sqrt{15}}{-6}$$

60

1, 60

2, 30

4, 15

5, 12

$\sqrt{6 \cdot 10} =$

$\sqrt{3}\sqrt{2}\sqrt{2}\sqrt{5}$

Ex) Solve by using the Quadratic Formula

$$x^2 - 8x + 15 = 0$$

$$x = \frac{8 \pm \sqrt{(-8)^2 - 4(1)(15)}}{2(1)}$$

No negative

$$x = \frac{8 \pm \sqrt{64 - 60}}{2}$$

$$x = \frac{8 \pm \sqrt{4}}{2} = \frac{8 \pm 2}{2} = 4 \pm 1$$

$$\frac{8}{2} \pm \frac{2}{2}$$

4/7/2014

Solutions

Solve

① $4p(p+1)=1$

$4p^2+4p=1$

$-1 \quad -1$

$4p^2+4p-1=0$ → standard form

$a \quad b \quad c$

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

$$p=\frac{-4\pm\sqrt{16+16}}{8}=\frac{-4\pm4\sqrt{2}}{8}$$

$$=\frac{-4}{8}\pm\frac{4\sqrt{2}}{8}$$

$$=-\frac{1}{2}\pm\frac{\sqrt{2}}{2}$$

4/7/14 and 4/8/14

Solve

(#2) $3x^2+1=6x$

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

$a \quad b \quad c$

$$x=\frac{6\pm\sqrt{(-6)^2-4(3)(1)}}{2(3)}$$

$$x=\frac{6\pm\sqrt{36-12}}{6}$$

2, 12 ✓

(6, 4)

8, 3

$$x=\frac{6\pm\sqrt{24}}{6}=\frac{6\pm 2\sqrt{6}}{6}$$

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

$$=1\pm\frac{1\sqrt{6}}{3}$$

4/8/2014

Solutions

3) Solve

$(x-4)(x+3)=8$

Apply F.O.I.L

$x^2+3x-4x-12=8$

$x^2-x-20=0$

$$x=\frac{1\pm\sqrt{(-1)^2-4(1)(-20)}}{2(1)}$$

$$=\frac{1\pm\sqrt{1+80}}{2}=\frac{1\pm\sqrt{81}}{2}$$

$$=\frac{1\pm 9}{2}$$

$x=5$ OR $x=-4$

4/8/14

4) Solve

$-7r^2 = 5r + 3$

$0 = 3 + 5r + 7r^2$

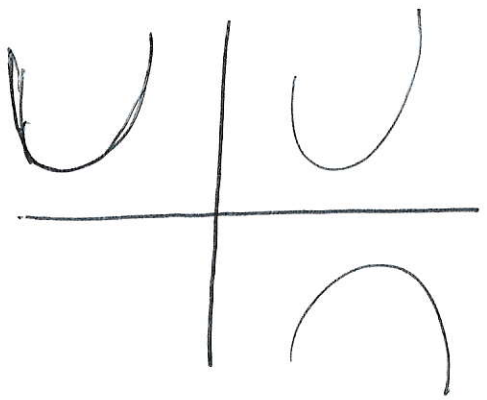
$c \quad b \quad a$

$$r = \frac{-5 \pm \sqrt{(5)^2 - 4(7)(3)}}{2(7)}$$

$$r = \frac{-5 \pm \sqrt{25 - 84}}{14}$$

$$r = \frac{-5 \pm \sqrt{-59}}{14} = \frac{-5}{14} \pm \frac{\sqrt{-59}}{14}$$

$$= \frac{-5}{14} \pm \frac{i\sqrt{59}}{14}$$



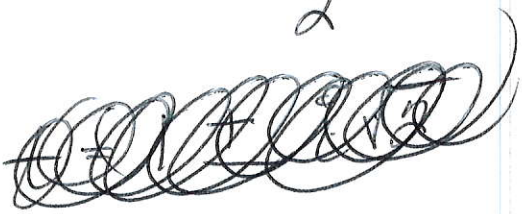
4/8/14

Solve

5) $t^2 - 2t + 3 = 0$

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

$$t = \frac{2 \pm \sqrt{-8}}{2} \rightarrow i\sqrt{4}\sqrt{2}$$



$$t = \frac{2 \pm i\sqrt{4}\sqrt{2}}{2}$$

$$t = \frac{2}{2} \pm \frac{2i\sqrt{2}}{2} = 1 \pm i\sqrt{2}$$

Quadratics (More Practice) 4/8/14

Solve

1) $-2t(t+2) = -3$

2) $(k+1)(k-7) = 1$

3) $x(3x+4) = -2$

4) $4k^2 - 28k + 49 = 0$

*5) $p^2 + \frac{p}{3} = \frac{1}{6}$

(Hint: First clear the fractions)

#2 $(K+1)(K-7)=1$

1st thing: FOIL

$K^2 - 7K + 1K - 7 = 1$

$K^2 - 6K - 7 = 1$

$K^2 - 6K - 8 = 0$

a b c

$$K = \frac{6 \pm \sqrt{(-6)^2 - 4(1)(-8)}}{2(1)}$$

$$K = \frac{6 \pm \sqrt{36 + 32}}{2}$$

$\sqrt{4}\sqrt{17}$

$$K = \frac{6 \pm \sqrt{68}}{2} = \frac{6 \pm 8}{2} = \frac{6 \pm 2\sqrt{17}}{2} = 3 \pm \sqrt{17}$$

$K = 7$ OR $K = -1$

(#4) $4K^2 - 28K + 49 = 0$

$a \quad b \quad c$

$$K = \frac{28 \pm \sqrt{(-28)^2 - 4(4)(49)}}{2(4)}$$

$$K = \frac{28 \pm \sqrt{784 - 784}}{8}$$

$$K = \frac{28 \pm 0}{8} = \frac{28}{8} = \frac{7}{2}$$

Solve:

$12\left(\frac{1}{4}t^2 - \frac{1}{3}t + \frac{5}{12} = 0\right)12$

(Hint: Clear the fractions first)

$3t^2 - 4t + 5 = 0$

$a \quad b \quad c$

$$t = \frac{4 \pm \sqrt{(-4)^2 - 4(3)(5)}}{2(3)}$$

$$t = \frac{4 \pm \sqrt{16 - 60}}{6} = \frac{4 \pm \sqrt{-44}}{6}$$

$$= \frac{4 \pm i\sqrt{44}}{6} \rightarrow \sqrt{4}\sqrt{11}$$

$$= \frac{4 \pm 2i\sqrt{11}}{6}$$

$$= \frac{2 \pm i\sqrt{11}}{3}$$