Solve using the quadratic formula:

Solve $x^2 - 9x - 22 = 0$ using the *quadratic formula*

When $ax^2 + bx + c = 0$

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

a is the coefficient of x^2 b is the coefficient of x c is the number (third term)

Notice the ± is what will give your two answers (just like you had when solving by factoring)

$x^2 - 9x - 22 = 0$

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

a = 1
b= - 9
c = -22

$$x = \frac{-(-9) \pm \sqrt{(-9)^2 - 4(1)(-22)}}{2(1)}$$ → ***(-9)² -4(1)(-22) can be done in one step in the calculator (leave out radical!!).***

$$x = \frac{9 \pm \sqrt{169}}{2}$$

Split and do the + side and - side

$$\frac{9 - 13}{2} \qquad \frac{9 + 13}{2}$$

x = -2 or x = 11

x = {-2,11}

**** Check in the ORIGINAL equation!***

Remember, ALL SUBSTITUTIONS must be done in PARENTHESES!!!!!!

1 of each the 4 possibilities you will come across:

Use videos on the Alg2a Page

Discriminant is a Perfect Square

1) $3x^2 + 2x = 5$

Discriminant is a Non-Perfect Square (I)

2) $4x^2 + 2 = -7x$

Discriminant is a Perfect Square (II)
(# that can be reduced)

3) $4x^2 = 10x - 3$

Discriminant is a NEGATIVE #
(imaginary numbers)

4) $4x^2 + 7 = -6x$

Solving each quadratic using the Quadratic Formula:

14) $2x^2 - 6x + 1 = 0$

15) $3x^2 + 2x = 3$

16) $4x^2 + 2 = -7x$

17) $7x^2 = 3x + 2$

18) $3x^2 + 6 = 5x$

19) $9x - 3 = 4x^2$

20) $4x^2 - 5x = 2$

21) $11x^2 - 3 = -4x$

Answer Key:

14) $x = \frac{3}{2} \pm \frac{\sqrt{7}}{2}$

15) $x = \frac{-1}{3} \pm \frac{\sqrt{10}}{3}$

16) $x = \frac{-7}{8} \pm \frac{\sqrt{17}}{8}$

17) $x = \frac{3}{14} \pm \frac{\sqrt{65}}{14}$

18) $x = \frac{5}{6} \pm \frac{i\sqrt{47}}{6}$

19) $x = \frac{9}{8} \pm \frac{\sqrt{33}}{8}$

20) $x = \frac{5}{8} \pm \frac{\sqrt{57}}{8}$

21) $x = \frac{-2}{11} \pm \frac{\sqrt{37}}{11}$

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

You must write the quadratic formula for each problem

1) $5x^2 - 3 = -4x$

2) $6x^2 = 12x - 5$

3) $2x^2 - 5x = 4$

4) $x^2 = -14x - 19$

5) $4x^2 = 6x + 3$

6) $7x^2 + x + 3 = 0$

7) $16x^2 + 1 = 12x$

8) $6x^2 = 7x + 1$

9) $12x^2 - 13x - 4 = 0$

10) $8x^2 + 16x + 3 = 0$

Answer Key:

1) $x = \frac{-2}{5} \pm \frac{\sqrt{19}}{5}$ ***2)*** $x = 1 \pm \frac{\sqrt{6}}{6}$ ***3)*** $x = \frac{5}{4} \pm \frac{\sqrt{57}}{4}$ ***4)*** $x = -7 \pm \sqrt{30}$

5) $x = \frac{3}{4} \pm \frac{\sqrt{21}}{4}$ ***6)*** $x = \frac{-1}{14} \pm \frac{i\sqrt{83}}{14}$ ***7)*** $x = \frac{3}{8} \pm \frac{\sqrt{5}}{8}$

8) $x = \frac{7}{12} \pm \frac{\sqrt{73}}{12}$ ***9)*** $x = \{-\frac{1}{4}, \frac{4}{3}\}$ ***10)*** $x = -1 \pm \frac{\sqrt{10}}{4}$

Factor:

1) $x^2 + 4x + 4$ 2) $x^2 - 6x + 9$ 3) $x^2 - 18x + 81$

4) $x^2 + 10x + 25$ 5) $x^2 - 20x + 100$ 6) $x^2 + 8x + 16$

7) $x^2 - 22x + 121$ 8) $x^2 + 32x + 256$ 9) $x^2 - 40x + 400$

Completing the Square

Completing the square is another method that is used to solve quadratic equations. This method is especially helpful when the quadratic equation cannot be solved by simply factoring.

Remember the standard form for a quadratic equation is: $ax^2 + bx + c = 0$.

Example:

1. $x^2 + 8x - 9 = 0$

$x^2 + 8x - 9 = 0$

$+9 \quad +9$

$x^2 + 8x = 9$

$\left(\frac{1}{2}(8)\right)^2 = (4)^2 = 16$

$x^2 + 8x + 16 = 9 + 16$

$x^2 + 8x + 16 = 25$

$(x + 4)(x + 4) = 25$

$(x + 4)^2 = 25$

$\sqrt{(x + 4)^2} = \sqrt{25}$

$x + 4 = \pm 5$

$x + 4 = 5$ $\qquad$ $x + 4 = -5$

$-4 \quad -4$ $\qquad$ $-4 \quad -4$

$x = 1$ $\qquad$ $x = -9$

$x = \{-9, 1\}$

Steps:

1. Be sure that the coefficient of the highest exponent is 1. If it is not divide each term by that value to create a leading coefficient of 1.

2. Move the constant term to the right hand side.

3. Prepare to add the needed value to create a perfect square trinomial. Be sure to balance the equation.

4. To create the perfect square trinomial:

   a) Take $\left(\frac{1}{2}b\right)^2$

   b) Add that value to both sides of the equation.

5. Factor the perfect square trinomial.

6. Rewrite the factors as a squared binomial.

7. Take the square root of both sides.

8. Split the solution into two equations

9. Solve for x.

10. Create your final answer.

Example:

1. $x^2 - 10x - 7 = 0$

$x^2 - 10x - 9 = 0$

$+7 \quad +7$

$x^2 - 10x = 7$

$\left(\frac{1}{2}(-10)\right)^2 = (-5)^2 = 25$

$x^2 + 10x + 25 = 7 + 25$

$x^2 + 10x + 25 = 32$

$(x-5)(x-5) = 32$

$(x-5)^2 = 32$

$\sqrt{(x-5)^2} = \sqrt{32}$

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

$+5 \quad +5$

X = 5 $\pm 4\sqrt{2}$

Steps:

1. Be sure that the coefficient of the highest exponent is 1. If it is not divide each term by that value to create a leading coefficient of 1.
2. Move the constant term to the right hand side.
3. Prepare to add the needed value to create a perfect square trinomial. Be sure to balance the equation.
4. To create the perfect square trinomial:
   a) Take $\left(\frac{1}{2}b\right)^2$
   b) Add that value to both sides of the equation.
5. Factor the perfect square trinomial.
6. Rewrite the factors as a squared binomial.
7. Take the square root of both sides.
8. ***Isolate X. Since you cannot combine it with $\pm 4\sqrt{2}$, you do not need to split it into two equations.***
9. Create your final answer

Completing the Square

Problems for videos:

Discriminant is a perfect square:

1) $x^2 - 16x + 28 = 0$

Discriminant is a non-perfect square

2) $x^2 + 6x - 66 = 0$

More Examples:

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

2) $x^2 - 16x + 60 = 0$

3) $x^2 - 8x + 7 = 0$

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

5) $x^2 - 8x - 11 = 0$

6) $x^2 + 6x - 36 = 0$

7) $x^2 + 4x - 44 = 0$

8) $x^2 + 24x + 24 = 0$

9) $x^2 - 16x - 6 = 0$

10) $x^2 + 6x + 4 = 0$

11) $x^2 - 10x + 5 = 0$

12) $x^2 + 2x - 47 = 0$

13) $x^2 + 4x - 92 = 0$

14) $x^2 - 28x + 4 = 0$

15) $x^2 - 12x - 20 = 0$

16) $x^2 + 18x + 1 = 0$

17) $x^2 - 22x - 39 = 0$

18) $x^2 + 8x - 164 = 0$

Q___ Quiz ___ Review

Solve each quadratic using completing the square:

1) $x^2 + 6x - 112 = 0$

2) $x^2 - 20x + 64 = 0$

3) $x^2 - 10x + 7 = 0$

4) $x^2 + 8x + 8 = 0$

5) $x^2 - 2x - 23 = 0$

6) $x^2 + 6x - 63 = 0$

7) $x^2 + 20x - 8 = 0$

8) $x^2 - 24x + 16 = 0$

9) $x^2 - 18x - 88 = 0$

10) $x^2 + 12x - 39 = 0$

11) $x^2 + 4x - 60 = 0$

12) $x^2 - 14x + 17 = 0$

\

13) $x^2 - 10x + 7 = 0$

14) $x^2 + 8x + 15 = 0$

15) $x^2 - 2x - 80 = 0$

16) $x^2 + 6x - 39 = 0$

17) $x^2 + 20x - 25 = 0$

18) $x^2 - 24x + 23 = 0$

19) $x^2 - 18x - 40 = 0$

20) $x^2 + 12x - 18 = 0$

21) $x^2 + 15x + 26 = 0$

22) $x^2 - 10x - 25 = 0$

Answer Key:

1) $x = \{-14,8\}$

2) $x = \{4,16\}$

3) $x = 5 \pm 4\sqrt{2}$

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

5) $x = 1 \pm 2\sqrt{6}$

6) $x = -3 \pm 6\sqrt{2}$

7) $x = -10 \pm 6\sqrt{3}$

8) $x = 12 \pm 8\sqrt{2}$

9) $x = \{-4,22\}$

10) $x = -6 \pm 5\sqrt{3}$

11) $x = \{-10,6\}$

12) $x = 7 \pm 4\sqrt{2}$

13) $x = 5 \pm 3\sqrt{2}$

14) $x = \{-5,-3\}$

15) $x = \{-8,10\}$

16) $x = -3 \pm 4\sqrt{3}$