

## Solving Quadratic Equations by Factoring

### I. Model Problems

In the following examples you will solve quadratic equations by factoring.

**Example 1: Solve:  $x^2 - 3x - 20 = 8$ .**

Write down the equation.

Rearrange so the equation is equal to zero ( $ax^2 + bx + c = 0$ ).

Factor.

Apply Zero Product Principle: if the product is zero, either one of the factors or both of the factors equal zero.

Apply additive inverse.

The solutions are:

$$\begin{array}{r} x^2 - 3x - 20 = 8 \\ -8 \quad -8 \\ \hline \end{array}$$

$$\begin{array}{r} x^2 - 3x - 28 = 0 \\ (x + 4)(x - 7) = 0 \\ \swarrow \quad \searrow \end{array}$$

$$\begin{array}{r} (x + 4) = 0 \quad (x - 7) = 0 \\ -4 \quad -4 \quad \quad +7 \quad +7 \\ \hline \end{array}$$

$$\begin{array}{r} x = -4 \quad x = 7 \\ x = -4, 7 \end{array}$$

**Example 1: Solve:  $x^2 - 3x - 20 = 8$ .**

Write down the equation.

Factor.

Apply Zero Product Principle: if the product is zero, either one of the factors or both of the factors equal zero.

Apply additive inverse.

Apply multiplicative inverse.

The solutions are:

$$\begin{array}{r} 3x^2 + x - 6 = 0 \\ (3x + 3)(x - 2) = 0 \\ \swarrow \quad \searrow \end{array}$$

$$\begin{array}{r} (3x + 3) = 0 \quad (x - 2) = 0 \\ -3 \quad -3 \quad \quad +2 \quad +2 \\ \hline \end{array}$$

$$\begin{array}{r} 3x/3 = -3/3 \quad x = 2 \\ x = -1, 2 \end{array}$$

**Example 3: Solve:  $3x^2 - 27x + 54 = 0$ .**

Write down the equation.

First check that equation is set equal to zero.

Next check to see if you can factor a GCF.

Finish factoring.

Apply Zero Product Principle. We can ignore the factor of 3- it does not equal 0.

Apply additive inverse.

The solutions are:

$$3x^2 - 27x + 54 = 0$$

$$\begin{array}{r} 3(x^2 - 9x + 18) = 0 \\ 3(x - 6)(x - 3) = 0 \\ \swarrow \quad \searrow \end{array}$$

$$\begin{array}{r} (x - 6) = 0 \quad (x - 3) = 0 \\ +6 \quad +6 \quad \quad +3 \quad +3 \\ \hline \end{array}$$

$$\begin{array}{r} x = 6 \quad x = 3 \\ x = 3, 6 \end{array}$$

## II. Practice solving quadratics by factoring.

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

3.  $a^2 - 9a + 18 = 0$

5.  $x^2 + 15x + 30 = -6$

7.  $2x^2 + 6x + 4 = 0$

9.  $c^2 - 6c + 9 = 0$

11.  $h^2 - 7 = 9$

13.  $d^2 + 10d + 18 = -7$

15.  $11a^2 - 32a + 17 = 20$

17.  $5x^2 - 11x - 3 = 2x + 3$

19.  $12h^2 + 40h + 32 = 0$

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

4.  $t^2 + 2t - 19 = 5$

6.  $d^2 + 10d = -16$

8.  $3a^2 - 12a = 15$

10.  $5x^2 - 14x + 8 = 0$

12.  $7t^2 - 15t + 6 = 4$

14.  $4x^2 - 46 = 3$

16.  $4n^2 + 12n + 9 = 0$

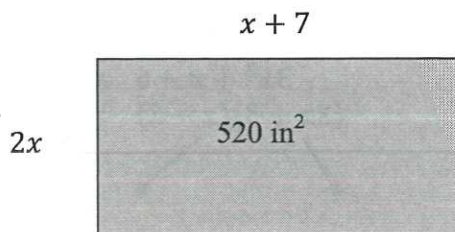
18.  $6t^2 - 15t - 36 = 0$

## III. Challenge Problems

20.  $3x^3 + 21x^2 + 36x = 0$

22.  $x^4 - 13x^2 + 36 = 0$

24. Find the dimensions of the rectangle below.



21.  $2a^3 - 18a^2 + 36a = 0$

23.  $x^4 + 3x^2 - 4 = 0$

25. Find the dimensions of the rectangle below.

