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- I. Model Problems.
- II. Practice
- III. Challenge Problems
- IV. Answer Key

Web Resources

 [Factoring Quadratic Equations](#)
[Different Methods for Solving Quadratic Equations](#)
[Quadratic Equation Grapher](#)

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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:

$$\begin{array}{r}
 x^2 - 3x - 20 = 8 \\
 -8 \quad -8 \\
 \hline
 x^2 - 3x - 28 = 0 \\
 (x + 4)(x - 7) = 0 \\
 \swarrow \quad \searrow \\
 (x + 4) = 0 \quad (x - 7) = 0 \\
 -4 \quad -4 \quad \quad +7 \quad +7 \\
 \hline
 x = -4 \quad x = 7 \\
 x = -4, 7
 \end{array}$$

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:

$$\begin{array}{r}
 3x^2 + x - 6 = 0 \\
 (3x + 3)(x - 2) = 0 \\
 \swarrow \quad \searrow \\
 (3x + 3) = 0 \quad (x - 2) = 0 \\
 -3 \quad -3 \quad \quad +2 \quad +2 \\
 \hline
 3x/3 = -3/3 \quad x = 2 \\
 x = -1, 2
 \end{array}$$

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:

$$\begin{array}{r}
 3x^2 - 27x + 54 = 0 \\
 3(x^2 - 9x + 18) = 0 \\
 3(x - 6)(x - 3) = 0 \\
 \swarrow \quad \searrow \\
 (x - 6) = 0 \quad (x - 3) = 0 \\
 +6 \quad +6 \quad \quad +3 \quad +3 \\
 \hline
 x = 6 \quad x = 3 \\
 x = 3, 6
 \end{array}$$

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

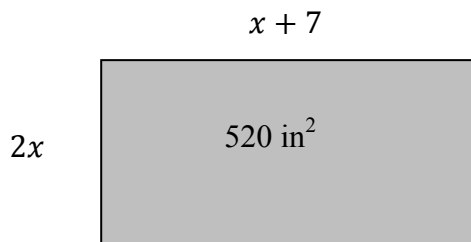
18. $6t^2 - 15t - 36 = 0$

III. Challenge Problems

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

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

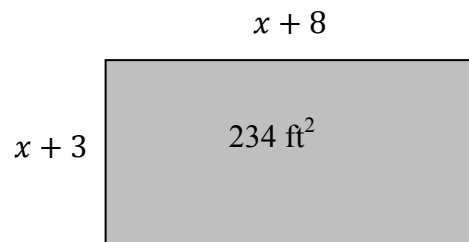
24. Find the dimensions of the rectangle below.



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

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

25. Find the dimensions of the rectangle below.



IV. Answer Key

1. $x = -2, 3$

2. $x = -3, 4$

3. $a = 3, 6$

4. $t = -6, 4$

5. $x = -3, -12$

6. $d = -8, -2$

7. $x = -2, -1$

8. $a = 5, -1$

9. $c = 3$

10. $x = \frac{4}{5}, 2$

11. $h = -4, 4$

12. $t = \frac{1}{7}, 2$

13. $d = -5$

14. $x = -\frac{7}{2}, \frac{7}{2}$

15. $a = -\frac{1}{11}, 3$

16. $n = -\frac{3}{2}$

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

18. $t = -\frac{3}{2}, 4$

19. $h = -\frac{4}{3}, -2$

20. $x = -4, -3, 0$

21. $x = 0, 3, 6$

22. $x = -2, 2, -3, 3$

23. $x = -1, 1$

24. 26 inches by 20 inches

25. 13 feet by 18 feet