

Study Guide and Intervention

Factoring Trinomials: $x^2 + bx + c$

Factor $x^2 + bx + c$ To factor a trinomial of the form $x^2 + bx + c$, find two integers, m and n , whose sum is equal to b and whose product is equal to c .

Factoring $x^2 + bx + c$	$x^2 + bx + c = (x + m)(x + n)$, where $m + n = b$ and $mn = c$.
--	--

Example 1 Factor each trinomial.

a. $x^2 + 7x + 10$

In this trinomial, $b = 7$ and $c = 10$.

Factors of 10	Sum of Factors
1, 10	11
2, 5	7

Since $2 + 5 = 7$ and $2 \cdot 5 = 10$, let $m = 2$ and $n = 5$.

$$x^2 + 7x + 10 = (x + 5)(x + 2)$$

b. $x^2 - 8x + 7$

In this trinomial, $b = -8$ and $c = 7$.

Notice that $m + n$ is negative and mn is positive, so m and n are both negative.

Since $-7 + (-1) = -8$ and $(-7)(-1) = 7$, $m = -7$ and $n = -1$.

$$x^2 - 8x + 7 = (x - 7)(x - 1)$$

Example 2 Factor $x^2 + 6x - 16$.

In this trinomial, $b = 6$ and $c = -16$. This means $m + n$ is positive and mn is negative. Make a list of the factors of -16 , where one factor of each pair is positive.

Factors of -16	Sum of Factors
1, -16	-15
-1 , 16	15
2, -8	-6
-2 , 8	6

Therefore, $m = -2$ and $n = 8$.

$$x^2 + 6x - 16 = (x - 2)(x + 8)$$

Exercises

Factor each trinomial.

1. $x^2 + 4x + 3$

2. $m^2 + 12m + 32$

3. $r^2 - 3r + 2$

4. $x^2 - x - 6$

5. $x^2 - 4x - 21$

6. $x^2 - 22x + 121$

7. $c^2 - 4c - 12$

8. $p^2 - 16p + 64$

9. $9 - 10x + x^2$

10. $x^2 + 6x + 5$

11. $a^2 + 8a - 9$

12. $y^2 - 7y - 8$

13. $x^2 - 2x - 3$

14. $y^2 + 14y + 13$

15. $m^2 + 9m + 20$

16. $x^2 + 12x + 20$

17. $a^2 - 14a + 24$

18. $18 + 11y + y^2$

19. $x^2 + 2xy + y^2$

20. $a^2 - 4ab + 4b^2$

21. $x^2 + 6xy - 7y^2$

Study Guide and Intervention (continued)

Factoring Trinomials: $x^2 + bx + c$

Solve Equations by Factoring Factoring and the Zero Product Property from Lesson 9-2 can be used to solve many equations of the form $x^2 + bx + c = 0$.

Example 1 Solve $x^2 + 6x = 7$. Check your solutions.

$x^2 + 6x = 7$	Original equation
$x^2 + 6x - 7 = 0$	Rewrite equation so that one side equals 0.
$(x - 1)(x + 7) = 0$	Factor.
$x - 1 = 0$ or $x + 7 = 0$	Zero Product Property
$x = 1$ $x = -7$	Solve each equation.

The solution set is $\{1, -7\}$. Since $1^2 + 6 = 7$ and $(-7)^2 + 6(-7) = 7$, the solutions check.

Example 2 **ROCKET LAUNCH** A rocket is fired with an initial velocity of 2288 feet per second. How many seconds will it take for the rocket to hit the ground?

The formula $h = vt - 16t^2$ gives the height h of the rocket after t seconds when the initial velocity v is given in feet per second.

$h = vt - 16t^2$	Formula
$0 = 2288t - 16t^2$	Substitute.
$0 = 16t(143 - t)$	Factor.
$16t = 0$ or $143 - t = 0$	Zero Product Property
$t = 0$ $t = 143$	Solve each equation.

The value $t = 0$ represents the time at launch. The rocket returns to the ground in 143 seconds, or a little less than 2.5 minutes after launch.

Exercises

Solve each equation. Check your solutions.

- | | | |
|-----------------------|-----------------------|-------------------------|
| 1. $x^2 - 4x + 3 = 0$ | 2. $y^2 - 5y + 4 = 0$ | 3. $m^2 + 10m + 9 = 0$ |
| 4. $x^2 = x + 2$ | 5. $x^2 - 4x = 5$ | 6. $x^2 - 12x + 36 = 0$ |
| 7. $c^2 - 8 = -7c$ | 8. $p^2 = 9p - 14$ | 9. $-9 - 8x + x^2 = 0$ |
| 10. $x^2 + 6 = 5x$ | 11. $a^2 = 11a - 18$ | 12. $y^2 - 8y + 15 = 0$ |
| 13. $x^2 = 24 - 10x$ | 14. $a^2 - 18a = -72$ | 15. $b^2 = 10b - 16$ |

Use the formula $h = vt - 16t^2$ to solve each problem.

16. **FOOTBALL** A punter can kick a football with an initial velocity of 48 feet per second. How many seconds will it take for the ball to return to the ground?
17. **BASEBALL** A ball is thrown up with an initial velocity of 32 feet per second. How many seconds will it take for the ball to return to the ground?
18. **ROCKET LAUNCH** If a rocket is launched with an initial velocity of 1600 feet per second, when will the rocket be 14,400 feet high?

