

9.6 Factor $ax^2 + bx + c$

Goal • Factor trinomials of the form $ax^2 + bx + c$.

Your Notes

Example 1 Factor when b is negative and c is positive

Factor $2x^2 - 11x + 5$.

Solution

Because b is negative and c is positive, both factors of c must be _____. You must consider the _____ of the factors of 5, because the x -terms of the possible factorizations are different.

Factors of 2	Factors of 5	Possible factorization	Middle term when multiplied
1, 2	-1, _____	$(x - 1)(2x \text{ _____})$	_____ - 2x = _____
1, 2	-5, _____	$(x - 5)(2x \text{ _____})$	_____ - 10x = _____

$$2x^2 - 11x + 5 = (x - \text{___})(2x \text{ _____})$$

Example 2 Factor when b is positive and c is negative

Factor $5n^2 + 2n - 3$.

Solution

Because b is positive and c is negative, the factors of c have _____.

Factors of 5	Factors of -3	Possible factorization	Middle term when multiplied
1, 5	1, _____	$(n + 1)(5n \text{ _____})$	_____
1, 5	-1, _____	$(n - 1)(5n \text{ _____})$	_____
1, 5	3, _____	$(n + 3)(5n \text{ _____})$	_____
1, 5	-3, _____	$(n - 3)(5n \text{ _____})$	_____

$$5n^2 + 2n - 3 = (n \text{ _____})(5n \text{ _____})$$

Your Notes

✔ **Checkpoint** Factor the trinomial.

1. $3x^2 - 5x + 2$	2. $2m^2 + m - 21$
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Example 3 Factor when *a* is negative

Factor $-4x^2 + 4x + 3$.

Solution

Step 1 Factor _____ from each term of the trinomial.

$$-4x^2 + 4x + 3 = \underline{\hspace{2cm}} (\underline{\hspace{2cm}})$$

Step 2 Factor the trinomial _____. Because *b* and *c* are both _____, the factors of *c* must have _____.

Factors of 4	Factors of -3	Possible factorization	Middle term when multiplied
1, 4	1, _____	$(x + 1)(4x \underline{\hspace{1cm}})$	_____
1, 4	3, _____	$(x + 3)(4x \underline{\hspace{1cm}})$	_____
1, 4	-1, _____	$(x - 1)(4x \underline{\hspace{1cm}})$	_____
1, 4	-3, _____	$(x - 3)(4x \underline{\hspace{1cm}})$	_____
2, 2	1, _____	$(2x + 1)(2x \underline{\hspace{1cm}})$	_____
2, 2	-1, _____	$(2x - 1)(2x \underline{\hspace{1cm}})$	_____

Remember to include the _____ that you factored out in Step 1.

$$-4x^2 + 4x + 3 = \underline{\hspace{2cm}}$$

✔ **Checkpoint** Complete the following exercise.

3. Factor $-2y^2 - 11y - 5$.

Example 4 Write and solve a polynomial equation

Tennis An athlete hits a tennis ball at an initial height of 8 feet and with an initial vertical velocity of 62 feet per second.

- Write an equation that gives the height (in feet) of the ball as a function of the time (in seconds) since it left the racket.
- After how many seconds does the ball hit the ground?

Solution

- Use the _____ to write an equation for the height h (in feet) of the ball.

$$h = -16t^2 + vt + s$$

$$h = -16t^2 + \underline{\quad} t + \underline{\quad} \quad v = \underline{\quad} \text{ and } s = \underline{\quad}$$

- To find the number of seconds that pass before the ball lands, find the value of t for which the height of the ball is _____. Substitute _____ for h and solve the equation for t .

$$\underline{\quad} = -16t^2 + \underline{\quad} t + \underline{\quad} \quad \text{Substitute } \underline{\quad} \text{ for } h.$$

$$\underline{\quad} = \underline{\quad} (\underline{\quad}) \quad \text{Factor out } \underline{\quad}.$$

$$\underline{\quad} = \underline{\quad} (\underline{\quad})(\underline{\quad}) \quad \text{Factor the trinomial.}$$

$$\underline{\quad} \quad \text{or} \quad \underline{\quad} \quad \text{Zero-product property}$$

$$\underline{\quad} \quad \text{or} \quad \underline{\quad} \quad \text{Solve for } t.$$

A negative solution does not make sense in this situation. The tennis ball hits the ground after _____.

Checkpoint Complete the following exercise.

Homework

- What If?** In Example 4, suppose another athlete hits the tennis ball with an initial vertical velocity of 20 feet per second from a height of 6 feet. After how many seconds does the ball hit the ground?