GRADE ALG

Factor Polynomials of the Form ax^2+bx+c where $a \neq 1$

By DataWORKS Educational Research

Learning Objective

We will factor polynomials of the form **$ax^2 + bx + c$** where $a \neq 1$.

CFU

What are we going to do?

Activate Prior Knowledge

<u>**To factor a polynomial**</u> means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the <u>reverse</u> of multiplying polynomials.*
- *The polynomial* **$ax^2 + bx + c$** *<u>factors</u> into the product of <u>two binomial factors</u>.*

1.) $w^2 + 4w - 12 = (w - 2)(w + 6)$

a = 1 b = 4 c = −12

Check

$(w - 2)(w + 6)$

$w^2 + 6w - 2w - 12$

$w^2 + 4w - 12$ ✓

<u>Factor pairs of -12</u>

1 and -12

-1 and 12

2 and -6

$\boxed{-2 \text{ and } 6}$

3 and -4

-3 and 4

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+ 8}_{3 + 5} x \underbrace{+ 15}_{3 \bullet 5} = (x + 3)(x + 5)$$

2.) $x^2 - 5x + 6 = (x - 2)(x - 3)$

a = 1 b = −5 c = 6

Check

$(x - 2)(x - 3)$

$x^2 - 3x - 2x + 6$

$x^2 - 5x + 6$ ✓

<u>Factor pairs of 6</u>

1 and 6

-1 and -6

2 and 3

$\boxed{-2 \text{ and } -3}$

Make Connection

Students, you already know how to factor a polynomial of the form $ax^2 + bx + c$ where $a = 1$. Now, we will use this skill to factor $ax^2 + bx + c$ where $a \neq 1$.

<u>To factor a polynomial</u> means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the <u>reverse</u>[1] of multiplying polynomials.*
- *The polynomial* $ax^2 + bx + c$ *<u>factors</u> into the product of <u>two binomial factors</u>.*

Factoring the Polynomial $ax^2 + bx + c$ where $a \neq 1$

$$3x^2 - 5x + 2 \cdot 3 \xrightarrow{\text{Rewrite}} x^2 - 5x + 6$$

$$= \left(x - \frac{2}{3}\right)\left(x - \frac{3}{3}\right)$$

$$= (3x - 2)(x - 1)$$

Factor pairs of 6

1 and 6
-1 and -6
3 and 2
-3 and -2

$3x^2 - 5x + 2$ factors to **(3x – 2) (x – 1)**

Factoring $a\,x^2 + b\,x + c$

multiplies to

$$2x^2 + 9x - 5 = (2x - 1)(x + 5)$$

factors to

✓ *Check*

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

Some polynomials <u>CANNOT</u> be factored.

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

Factor pairs of 6

1 and 6
-1 and -6
2 and 3
-2 and -3

*The trinomial <u>CANNOT</u> be factored; <u>none</u> of the factor pairs of **6** add to **-4***

CFU

Show the following polynomial factored: $3x^2 + 13x + 4$
How do you know the polynomial is factored?

A $3x^2 + 13x + 4 = 3x^2 + x + 12x + 4$
[✓ B] $3x^2 + 13x + 4 = (3x + 10)(x + 4)$

After factoring a polynomial, explain how you would check your work.

Use the factor pairs of 6 to explain why you cannot factor the following trinomial:
$6x^2 + 8x - 1$

Vocabulary

[1] opposite (synonym)

Explanation why it works

Skill Development/Guided Practice

To factor a polynomial means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the reverse of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+ 8}_{3+5} x \underbrace{+ 15}_{3 \bullet 5} = (x + 3)(x + 5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
❷ Rewrite the polynomial as $x^2 + bx + c \bullet a$
❸ Factor using factoring method$_2$ for $1x^2 + bx + c$.
❹ Divide the constant terms of the binomial factors by a; reduce, if possible.
❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret$_3$ the factorization. "________ *factors to* ____________"

CFU

❶ How did I/you identify a, b, and c in the polynomial?
❷ How did I/you rewrite the polynomial?
❺ How did I/you rewrite the factorization?

1.) $5m^2 - 11m + 2 \xrightarrow{\text{Rewrite}} m^2 - 11m + 10$

a = 5 b = −11 c = 2

$= \left(m - \frac{1}{5}\right)\left(m - \frac{10}{5}\right)$

$\boxed{= (5m - 1)(m - 2)}$

Check

$(5m - 1)(m - 2)$

$5m^2 - 10m - m + 2$

$5m^2 - 11m + 2$ ✓

Factor pairs of 10

1 and 10
$\boxed{\text{-1 and -10}}$
2 and 5
-2 and -5

2.) $7n^2 + 5n - 2 \xrightarrow{\text{Rewrite}} n^2 + 5n - 14$

a = 7 b = 5 c = −2

$= \left(n - \frac{2}{7}\right)\left(n + \frac{7}{7}\right)$

$\boxed{= (7n - 2)(n + 1)}$

Check

$(7n - 2)(n + 1)$

$7n^2 + 7n - 2n - 2$

$7n^2 + 5n - 2$ ✓

Factor pairs of -14

1 and -14
-1 and 14
2 and -7
$\boxed{\text{-2 and 7}}$

Vocabulary

[2] way something is done
[3] explain

Skill Development/Guided Practice (continued)

<u>To factor a polynomial</u> means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the <u>reverse</u> of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+ 8}_{3 + 5} x \underbrace{+ 15}_{3 \cdot 5} = (x + 3)(x + 5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
❷ Rewrite the polynomial as $x^2 + bx + c \bullet a$
❸ Factor using factoring method for $1x^2 + bx + c$.
❹ Divide the constant terms of the binomial factors by a; reduce, if possible.
❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ____________"

CFU

❶ How did I/you identify a, b, and c in the polynomial?
❷ How did I/you rewrite the polynomial?
❺ How did I/you rewrite the factorization?

3.) $6x^2 - 7x + 2 \xrightarrow{\text{Rewrite}} x^2 - 7x + 12$

a = <u>6</u> b = <u>−7</u> c = <u>2</u>

$$= \left(x - \frac{3}{6}\right)\left(x - \frac{4}{6}\right)$$

$$\boxed{= (2x - 1)(3x - 2)}$$

Check

$(2x - 1)(3x - 2)$

$6x^2 - 4x - 3x + 2$

$6x^2 - 7x + 2$ ✓

<u>Factor pairs of 12</u>

1 and 12
-1 and -12
2 and 6
-2 and -6
3 and 4
$\boxed{\text{-3 and -4}}$

4.) $8x^2 + 14x + 3 \xrightarrow{\text{Rewrite}} x^2 + 14x + 24$

a = <u>8</u> b = <u>14</u> c = <u>3</u>

$$= \left(x + \frac{2}{8}\right)\left(x + \frac{12}{8}\right)$$

$$\boxed{= (4x + 1)(2x + 3)}$$

Check

$(4x + 1)(2x + 3)$

$8x^2 + 12x + 2x + 3$

$8x^2 + 14x + 3$ ✓

<u>Factor pairs of 24</u>

1 and 24
$\boxed{\text{2 and 12}}$
3 and 8
4 and 6
-1 and -24
-2 and -12
-3 and -8
-4 and -6

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Skill Development/Guided Practice (continued)

To factor a polynomial means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the reverse of multiplying polynomials.*

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

1. Identify a, b, and c in the polynomial.
2. Rewrite the polynomial as $x^2 + bx + c \bullet a$
3. Factor using factoring method for $1x^2 + bx + c$.
4. Divide the constant terms of the binomial factors by a; reduce, if possible.
5. Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
6. Check and interpret the factorization. "________ *factors to* ____________"

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+ 8}_{3 + 5} x \underbrace{+ 15}_{3 \bullet 5} = (x + 3)(x + 5)$$

CFU

1. How did I/you identify a, b, and c in the polynomial?
2. How did I/you rewrite the polynomial?
5. How did I/you rewrite the factorization?

5.) $2x^2 + 5x + 7 \xrightarrow{\text{Rewrite}} x^2 + 5x + 14$

a = 2 b = 5 c = 7

Cannot be factored since none of the factor pairs of 14 add to 5.

Check

Factor pairs of 14

1 and 14
-1 and -14
2 and 7
-2 and -7

6.) $4p^2 - 7p - 3 \xrightarrow{\text{Rewrite}} p^2 - 7p - 12$

a = 4 b = –7 c = –3

Cannot be factored since none of the factor pairs of -12 add to -7.

Check

Factor pairs of -12

1 and -12
-1 and 12
2 and -6
-2 and 6
3 and -4
-3 and 4

Relevance

To factor a polynomial means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the reverse of multiplying polynomials.*

1 *Factoring polynomials will help you solve quadratic equations.*

Solve the following quadratic equation.

$$4x^2 + 9x + 5 = 0$$

$$x^2 + 9x + 20$$

$$(x + 4)(x + 5)$$

$$(x + 1)(4x + 5) = 0$$

$$x + 4 = 0 \qquad 4x + 5 = 0$$

$$x = -4 \qquad x = \frac{-5}{4}$$

2 *Factoring polynomials will help you do well on tests.*

Sample Test Question:

55. Which of the following shows $9x^2 + 12x + 4$ factored completely?

A $(3x + 2)^2$
B $(3x + 4)(3x + 1)$
C $(3x + 4)(3x + 1)$
D $9x^2 + 12x + 4$

CFU

Does anyone else have another reason why it is relevant to factor polynomials? (Pair-Share) Why is it relevant to factor polynomials? You may give me one of my reasons or one of your own. Which reason is more relevant to you? Why?

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To factor a polynomial means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the reverse of multiplying polynomials.*

Factoring 1 x^2 + b x + c

$$x^2 \underbrace{+\,8}_{3+5}\,x \underbrace{+\,15}_{3 \bullet 5} = (x+3)(x+5)$$

Skill Closure

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
❷ Rewrite the polynomial as $x^2 + bx + c \bullet a$
❸ Factor using factoring method for $1x^2 + bx + c$.
❹ Divide the constant terms of the binomial factors by a; reduce, if possible.
❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ____________"

1.) $2n^2 + 9n + 7 \xrightarrow{\text{Rewrite}} n^2 + 9n + 14$

$= \left(n + \frac{2}{2}\right)\left(n + \frac{7}{2}\right)$

$\boxed{= (n+1)(2n+7)}$

a = 2 b = 9 c = 7

Check

$(n+1)(2n+7)$

$2n^2 + 7n + 2n + 7$

$2n^2 + 9n + 7$ ✓

Factor pairs of 14

1 and 14	-1 and -14
$\boxed{2 \text{ and } 7}$	-2 and -7

2.) $9m^2 + 3m - 2 \xrightarrow{\text{Rewrite}} m^2 + 3m - 18$

$= \left(m - \frac{3}{9}\right)\left(m + \frac{6}{9}\right)$

$\boxed{= (3m-1)(3m+2)}$

a = 9 b = 3 c = −2

Check

$(3m-1)(3m+2)$

$9m^2 + 6m - 3m - 2$

$9m^2 + 3m - 2$ ✓

Factor pairs of - 18

1 and -18	-1 and 18
2 and -9	-2 and 9
3 and -6	$\boxed{-3 \text{ and } 6}$

Constructed Response Closure

2x + 3 is a factor of **$4x^2 + 4x - 3$**. Without factoring, which of the following is the other factor of **$4x^2 + 4x - 3$**? How do you know?

$(2x+3)(\ \ ?\ \ ) = 4x^2 + 4x - 3$

A $4x - 1$
B $2x + 1$
C $4x + 1$
D $2x - 1$

Summary Closure

What did you learn today about factoring polynomials of the form $ax^2 + bx + c$ where $a \neq 1$? (Pair-Share)

Independent Practice

<u>To factor a polynomial</u> means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the <u>reverse</u> of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+\,8}_{3+5}\,x \underbrace{+\,15}_{3 \bullet 5} = (x+3)(x+5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
❷ Rewrite the polynomial as $x^2 + bx + c \bullet a$
❸ Factor using factoring method for $1x^2 + bx + c$.
❹ Divide the constant terms of the binomial factors by a; reduce, if possible.
❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ___________"

1.) $2p^2 + 5p + 3 \xrightarrow{\text{Rewrite}} p^2 + 5p + 6$

a = 2 b = 5 c = 3

$$= \left(p + \frac{2}{2}\right)\left(p + \frac{3}{2}\right)$$

$$\boxed{= (p + 1)(2p + 3)}$$

Check

$(p + 1)(2p + 3)$

$2p^2 + 3p + 2p + 3$

$2p^2 + 5p + 3$ ✓

<u>Factor pairs of 6</u>

1 and 6
-1 and -6
$\boxed{\text{2 and 3}}$
-2 and -3

2.) $4m^2 - 3m - 1 \xrightarrow{\text{Rewrite}} m^2 - 3m - 4$

a = 4 b = –3 c = –1

$$= \left(m + \frac{1}{4}\right)\left(m - \frac{4}{4}\right)$$

$$\boxed{= (4m + 1)(m - 1)}$$

Check

$(4m + 1)(m - 1)$

$4m^2 - 4m + m - 1$

$4m^2 - 3m - 1$ ✓

<u>Factor pairs of - 4</u>

$\boxed{\text{1 and -4}}$
-1 and 4
2 and -2
-2 and 2

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Independent Practice (continued)

<u>To factor a polynomial</u> means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the <u>reverse</u> of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+\,8}_{3+5}\,x \underbrace{+\,15}_{3 \bullet 5} = (x+3)(x+5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
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❸ Factor using factoring method for $1x^2 + bx + c$.
❹ Divide the constant terms of the binomial factors by a; reduce, if possible.
❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ____________"

3.) $6x^2 + x - 2 \xrightarrow{\text{Rewrite}} x^2 + x - 12$

a = 6 b = 1 c = −2

$$= \left(x - \frac{3}{6}\right)\left(x + \frac{4}{6}\right)$$

$$\boxed{= (2x - 1)(3x + 2)}$$

Check

$(2x - 1)(3x + 2)$

$6x^2 + 4x - 3x - 2$

$6x^2 + x - 2$ ✓

<u>Factor pairs of -12</u>

1 and -12
-1 and 12
2 and -6
-2 and 6
3 and -4
$\boxed{-3 \text{ and } 4}$

4.) $4x^2 + 8x + 3 \xrightarrow{\text{Rewrite}} x^2 + 8x + 12$

a = 4 b = 8 c = 3

$$= \left(x + \frac{2}{4}\right)\left(x + \frac{6}{4}\right)$$

$$\boxed{= (2x + 1)(2x + 3)}$$

Check

$(2x + 1)(2x + 3)$

$4x^2 + 6x + 2x + 3$

$4x^2 + 8x + 3$ ✓

<u>Factor pairs of 12</u>

1 and 12
-1 and -12
$\boxed{2 \text{ and } 6}$
-2 and -6
3 and 4
-3 and -4

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<u>To factor a polynomial</u> means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the <u>reverse</u> of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+ 8}_{3+5} x \underbrace{+ 15}_{3 \bullet 5} = (x+3)(x+5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
❷ Rewrite the polynomial as $x^2 + bx + c \bullet a$
❸ Factor using factoring method for $1x^2 + bx + c$.
❹ Divide the constant terms of the binomial factors by a; reduce, if possible.
❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ___________"

5.) $5m^2 - 9m + 2 \xrightarrow{\text{Rewrite}} m^2 - 9m + 10$

a = 5 b = –9 c = 2

Cannot be factored since <u>none</u> of the factor pairs of 10 add to -9.

<u>Check</u>

<u>Factor pairs of 10</u>

1 and 10
-1 and -10
2 and 5
-2 and -5

6.) $3y^2 - 8y - 4 \xrightarrow{\text{Rewrite}} y^2 - 8y - 12$

a = 3 b = –8 c = –4

Cannot be factored since <u>none</u> of the factor pairs of -12 add to -8.

<u>Check</u>

<u>Factor pairs of -12</u>

1 and -12
-1 and 12
2 and -6
-2 and 6
3 and -4
-3 and 4

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To factor a polynomial means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the reverse of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+\,8}_{3+5}\, x \underbrace{+\,15}_{3\,\bullet\,5} = (x + 3)(x + 5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
❷ Rewrite the polynomial as $x^2 + bx + c \bullet a$
❸ Factor using factoring method for $1x^2 + bx + c$.
❹ Divide the constant terms of the binomial factors by a; reduce, if possible.
❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. “________ *factors to* ____________”

1.) $2n^2 + 15n + 7 \xrightarrow{\text{Rewrite}} n^2 + 15n + 14$

a = 2 b = 15 c = 7

$$= \left(n + \frac{1}{2}\right)\left(n + \frac{14}{2}\right)$$

$$\boxed{= (2n + 1)(n + 7)}$$

Check

$(2n + 1)(n + 7)$

$2n^2 + 14n + n + 7$

$2n^2 + 15n + 7$ ✓

Factor pairs of 14

$\boxed{1 \text{ and } 14}$
-1 and -14
2 and 7
-2 and -7

2.) $6x^2 + 7x + 2 \xrightarrow{\text{Rewrite}} x^2 + 7x + 12$

a = 6 b = 7 c = 2

$$= \left(x + \frac{3}{6}\right)\left(x + \frac{4}{6}\right)$$

$$\boxed{= (2x + 1)(3x + 2)}$$

Check

$(2x + 1)(3x + 2)$

$6x^2 + 4x + 3x + 2$

$6x^2 + 7x + 2$ ✓

Factor pairs of 12

1 and 12
-1 and -12
2 and 6
-2 and -6
$\boxed{3 \text{ and } 4}$
-3 and -4

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To factor a polynomial means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the reverse of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+8}_{3+5} x \underbrace{+15}_{3 \bullet 5} = (x+3)(x+5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
❷ Rewrite the polynomial as $x^2 + bx + c \bullet a$
❸ Factor using factoring method for $1x^2 + bx + c$.
❹ Divide the constant terms of the binomial factors by a; reduce, if possible.
❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ____________"

3.) $4w^2 + 3w - 1 \xrightarrow{\text{Rewrite}} w^2 + 3w - 4$

a = 4 b = 3 c = −1

$$= \left(w - \frac{1}{4}\right)\left(w + \frac{4}{4}\right)$$

$$\boxed{= (4w - 1)(w + 1)}$$

Check

$(4w - 1)(w + 1)$

$4w^2 + 4w - w - 1$

$4w^2 + 3w - 1$ ✓

Factor pairs of - 4

1 and -4
$\boxed{\text{-1 and 4}}$
2 and -2
-2 and 2

4.) $3n^2 + 11n + 6 \xrightarrow{\text{Rewrite}} n^2 + 11n + 18$

a = 3 b = 11 c = 6

$$= \left(n + \frac{2}{3}\right)\left(n + \frac{9}{3}\right)$$

$$\boxed{= (3n + 2)(n + 3)}$$

Check

$(3n + 2)(n + 3)$

$3n^2 + 9n + 2n + 6$

$3n^2 + 11n + 6$ ✓

Factor pairs of 18

1 and 18
-1 and -18
$\boxed{\text{2 and 9}}$
-2 and -9
3 and 6
-3 and -6

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Periodic Review I (continued)

To factor a polynomial means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the reverse of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+\,8}_{3+5}\, x \underbrace{+\,15}_{3 \bullet 5} = (x + 3)(x + 5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
❷ Rewrite the polynomial as $x^2 + bx + c \bullet a$
❸ Factor using factoring method for $1x^2 + bx + c$.
❹ Divide the constant terms of the binomial factors by a; reduce, if possible.
❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ___________"

5.) $2y^2 + 5y - 3 \xrightarrow{\text{Rewrite}} y^2 + 5y - 6$

a = 2 b = 5 c = –3

$$= \left(y - \frac{1}{2}\right)\left(y + \frac{6}{2}\right)$$

$$\boxed{= (2y - 1)(y + 3)}$$

Check

$(2y - 1)(y + 3)$

$2y^2 + 6y - y - 3$

$2y^2 + 5y - 3$ ✓

Factor pairs of - 6

1 and -6
$\boxed{\text{-1 and 6}}$
2 and -3
-2 and 3

6.) $9x^2 + 12x + 4 \xrightarrow{\text{Rewrite}} x^2 + 12x + 36$

a = 9 b = 12 c = 4

$$= \left(x + \frac{6}{9}\right)\left(x + \frac{6}{9}\right)$$

$$\boxed{= (3x + 2)(3x + 2)}$$

Check

$(3x + 2)(3x + 2)$

$9x^2 + 6x + 6x + 4$

$9x^2 + 12x + 4$ ✓

Factor pairs of 36

1 and 36	-1 and -36
2 and 18	-2 and -18
3 and 12	-3 and -12
4 and 9	-4 and -9
$\boxed{\text{6 and 6}}$	-6 and -6

To factor a polynomial means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the reverse of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+8}_{3+5} x \underbrace{+15}_{3 \bullet 5} = (x+3)(x+5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
❷ Rewrite the polynomial as $x^2 + bx + c \bullet a$
❸ Factor using factoring method for $1x^2 + bx + c$.
❹ Divide the constant terms of the binomial factors by a; reduce, if possible.
❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ____________"

7.) $3n^2 + 7n + 3 \xrightarrow{\text{Rewrite}} n^2 + 7n + 9$

a = 3 b = 7 c = 3

Cannot be factored since none of the factor pairs of 9 add to 7.

Check

Factor pairs of 9

1 and 9
-1 and -9
3 and 3

8.) $10x^2 + x - 2 \xrightarrow{\text{Rewrite}} x^2 + x - 20$

a = 10 b = 1 c = -2

$$= \left(x - \frac{4}{10}\right)\left(x + \frac{5}{10}\right)$$

$$\boxed{= (5x - 2)(2x + 1)}$$

Check

$(5x - 2)(2x + 1)$

$10x^2 + 5x - 4x - 2$

$10x^2 + x - 2$ ✓

Factor pairs of 20

1 and -20
2 and -10
4 and -5

-1 and 20
-2 and 10
$\boxed{-4 \text{ and } 5}$

DataWORKS Educational Research

<u>To factor a polynomial</u> means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the <u>reverse</u> of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+\,8}_{3+5} x \underbrace{+\,15}_{3 \bullet 5} = (x+3)(x+5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
❷ Rewrite the polynomial as $x^2 + bx + c \bullet a$
❸ Factor using factoring method for $1x^2 + bx + c$.
❹ Divide the constant terms of the binomial factors by a; reduce, if possible.
❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ____________"

1.) $2p^2 + 5p + 3 \xrightarrow{\text{Rewrite}} p^2 + 5p + 6$

a = 2 b = 5 c = 3

$$= \left(p + \frac{2}{2}\right)\left(p + \frac{3}{2}\right)$$

$$\boxed{= (p + 1)(2p + 3)}$$

Check

$(p + 1)(2p + 3)$

$2p^2 + 3p + 2p + 3$

$2p^2 + 5p + 3$ ✓

Factor pairs of 6

1 and 6
-1 and -6
$\boxed{2 \text{ and } 3}$
-2 and -3

2.) $2n^2 + 3n + 5 \xrightarrow{\text{Rewrite}} n^2 + 3n + 10$

a = 2 b = 3 c = 5

Cannot be factored since <u>none</u> of the factor pairs of 10 add to 3.

Check

Factor pairs of 10

1 and 10
-1 and -10
2 and 5
-2 and -5

To factor a polynomial means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the reverse of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+ 8}_{3 + 5} x \underbrace{+ 15}_{3 \bullet 5} = (x + 3)(x + 5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
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❻ Check and interpret the factorization. "________ *factors to* ____________"

3.) $7y^2 + 6y - 1 \xrightarrow{\text{Rewrite}} y^2 + 6y - 7$

a = 7 b = 6 c = −1

$$= \left(y - \frac{1}{7}\right)\left(y + \frac{7}{7}\right)$$

$$\boxed{= (7y - 1)(y + 1)}$$

Factor pairs of - 7

1 and -7
$\boxed{\text{-1 and 7}}$

Check

$(7y - 1)(y + 1)$

$7y^2 + 7y - y - 1$

$7y^2 + 6y - 1$ ✓

4.) $4x^2 + 8x + 3 \xrightarrow{\text{Rewrite}} x^2 + 8x + 12$

a = 4 b = 8 c = 3

$$= \left(x + \frac{2}{4}\right)\left(x + \frac{6}{4}\right)$$

$$\boxed{= (2x + 1)(2x + 3)}$$

Factor pairs of 12

1 and 12
-1 and -12
$\boxed{\text{2 and 6}}$
-2 and -6
3 and 4
-3 and -4

Check

$(2x + 1)(2x + 3)$

$4x^2 + 6x + 2x + 3$

$4x^2 + 8x + 3$ ✓

DataWORKS Educational Research

<u>To factor a polynomial</u> means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the <u>reverse</u> of multiplying polynomials.*

Factoring 1 x^2 + b x + c

$$x^2 \underbrace{+\,8}_{3\,+\,5}\,x \underbrace{+\,15}_{3\,\bullet\,5} = (x+3)(x+5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
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❻ Check and interpret the factorization. "________ *factors to* ____________"

5.) $2y^2 + 5y - 3 \xrightarrow{\text{Rewrite}} y^2 + 5y - 6$

a = 2 b = 5 c = −3

$$= \left(y - \frac{1}{2}\right)\left(y + \frac{6}{2}\right)$$

$$\boxed{= (2y - 1)(y + 3)}$$

Check

$(2y - 1)(y + 3)$

$2y^2 + 6y - y - 3$

$2y^2 + 5y - 3$ ✓

<u>Factor pairs of - 6</u>

1 and -6
☐ -1 and 6
2 and -3
-2 and 3

6.) $10x^2 - x - 3 \xrightarrow{\text{Rewrite}} x^2 - x - 30$

a = 10 b = −1 c = −3

$$= \left(x + \frac{5}{10}\right)\left(x - \frac{6}{10}\right)$$

$$\boxed{= (2x + 1)(5x - 3)}$$

Check

$(2x + 1)(5x - 3)$

$10x^2 - 6x + 5x - 3$

$10x^2 - x - 3$ ✓

<u>Factor pairs of -30</u>

1 and -30	-1 and 30
2 and -15	-2 and 15
3 and -10	-3 and 10
$\boxed{\text{5 and -6}}$	-5 and 6

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<u>To factor a polynomial</u> means to represent a polynomial as a **multiplication** of **polynomials**.

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Factoring $1x^2 + bx + c$

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Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

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❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ___________"

1.) $6n^2 + 11n - 2 \xrightarrow{\text{Rewrite}} n^2 + 11n - 12$

a = 6 b = 11 c = −2

$$= \left(n - \frac{1}{6}\right)\left(n + \frac{12}{6}\right)$$

$$\boxed{= (6n - 1)(n + 2)}$$

Check

$(6n - 1)(n + 2)$

$6n^2 + 12n - n - 2$

$6n^2 + 11n - 2$ ✓

<u>Factor pairs of -12</u>

1 and -12
$\boxed{\text{-1 and 12}}$
2 and -6
-2 and 6
3 and -4
-3 and 4

2.) $4p^2 - 8p + 3 \xrightarrow{\text{Rewrite}} p^2 - 8p + 12$

a = 4 b = −8 c = 3

$$= \left(p - \frac{2}{4}\right)\left(p - \frac{6}{4}\right)$$

$$\boxed{= (2p - 1)(2p - 3)}$$

Check

$(2p - 1)(2p - 3)$

$4p^2 - 6p - 2p + 3$

$4p^2 - 8p + 3$ ✓

<u>Factor pairs of 12</u>

1 and 12
-1 and -12
2 and 6
$\boxed{\text{-2 and -6}}$
3 and 4
-3 and -4

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Periodic Review 3 (continued)

To factor a polynomial means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the reverse of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+8}_{3+5} x \underbrace{+15}_{3 \bullet 5} = (x+3)(x+5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

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❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ____________"

3.) $2k^2 + 9k + 7$ Rewrite $\Rightarrow$ $k^2 + 9k + 14$

a = 2 b = 9 c = 7

$$= \left(k + \frac{2}{2}\right)\left(k + \frac{7}{2}\right)$$

$$\boxed{= (k+1)(2k+7)}$$

Check

$(k + 1)(2k + 7)$

$2k^2 + 7k + 2k + 7$

$2k^2 + 9k + 7$ ✓

Factor pairs of 14

1 and 14
-1 and -14
$\boxed{\text{2 and 7}}$
-2 and -7

4.) $6x^2 + 7x - 1$ Rewrite $\Rightarrow$ $x^2 + 7x - 6$

a = 6 b = 7 c = −1

Cannot be factored since none of the factor pairs of -6 add to 7.

Check

Factor pairs of -6

1 and -6
-1 and 6
2 and -3
-2 and 3

DataWORKS Educational Research

<u>To factor a polynomial</u> means to represent a polynomial as a **multiplication** of **polynomials**.

- *Factoring a polynomial is the <u>reverse</u> of multiplying polynomials.*

Factoring $1x^2 + bx + c$

$$x^2 \underbrace{+\,8}_{3+5}\,x \underbrace{+\,15}_{3 \bullet 5} = (x+3)(x+5)$$

Factor polynomials of the form $ax^2 + bx + c$ where $a \neq 1$.

❶ Identify a, b, and c in the polynomial.
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❺ Rewrite the factorization with the denominator as the leading coefficient of the binomial factors.
❻ Check and interpret the factorization. "________ *factors to* ___________"

5.) $15x^2 - 2x - 1 \xrightarrow{\text{Rewrite}} x^2 - 2x - 15$

a = <u>15</u> b = <u>–2</u> c = <u>–1</u>

$$= \left(x + \frac{3}{15}\right)\left(x - \frac{5}{15}\right)$$

$$\boxed{= (5x + 1)(3x - 1)}$$

Check

$(5x + 1)(3x - 1)$

$15x^2 - 5x + 3x - 1$

$15x^2 - 2x - 1$ ✓

<u>Factor pairs of -15</u>

1 and -15
-1 and 15
$\boxed{\text{3 and -5}}$
-3 and 5

6.) $8x^2 + 14x + 3 \xrightarrow{\text{Rewrite}} x^2 + 14x + 24$

a = <u>8</u> b = <u>14</u> c = <u>3</u>

$$= \left(x + \frac{2}{8}\right)\left(x + \frac{12}{8}\right)$$

$$\boxed{= (4x + 1)(2x + 3)}$$

Check

$(4x + 1)(2x + 3)$

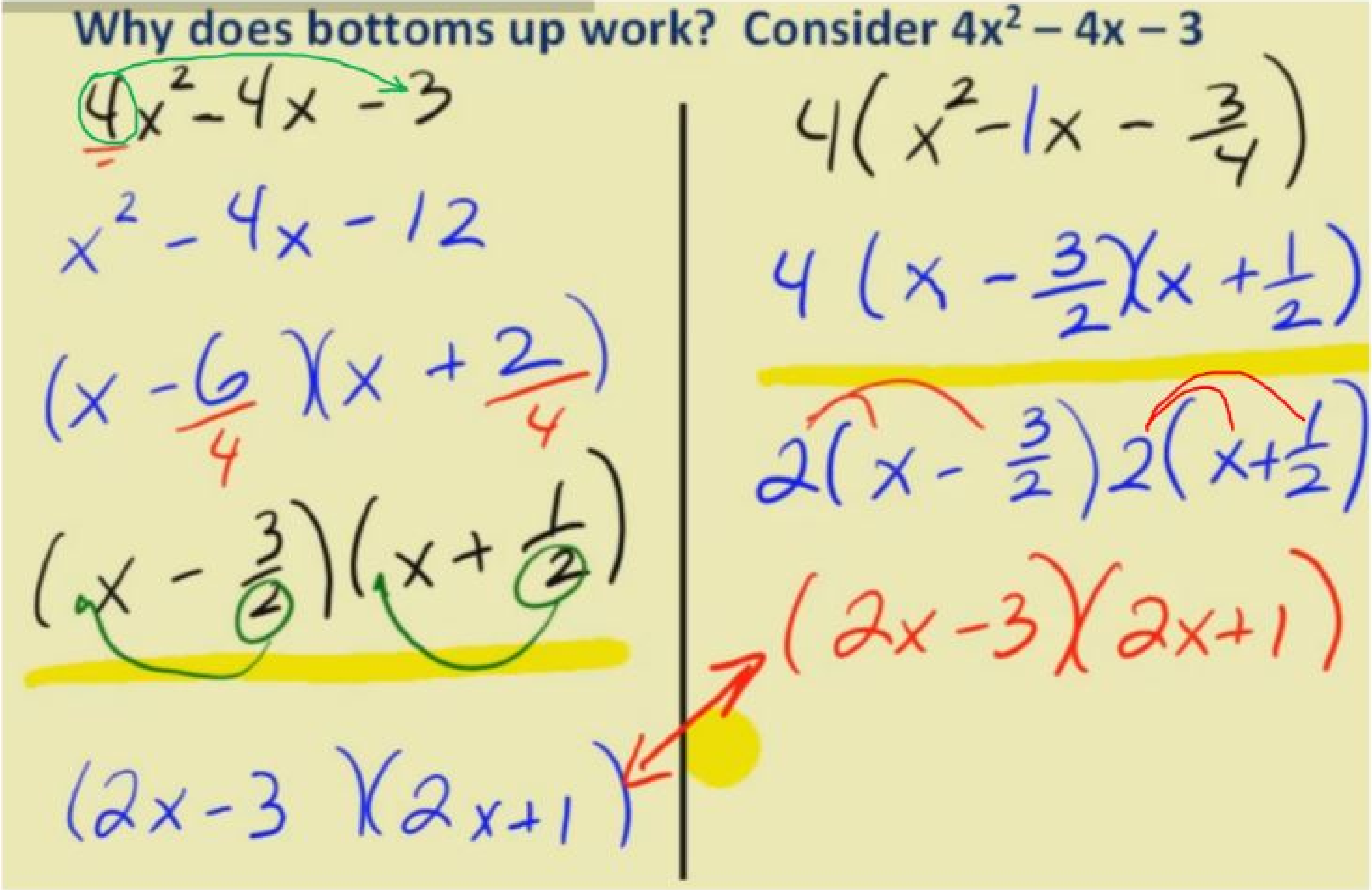
$8x^2 + 12x + 2x + 3$

$8x^2 + 14x + 3$ ✓

<u>Factor pairs of 24</u>

1 and 24
$\boxed{\text{2 and 12}}$
3 and 8
4 and 6

-1 and -24
-2 and -12
-3 and -8
-4 and -6



Why does bottoms up work? Consider $4x^2 - 4x - 3$

$\boxed{4}x^2-4x-3$

$x^2-4x-12$

$\left(x-\frac{6}{4}\right)\left(x+\frac{2}{4}\right)$

$\left(x-\frac{3}{2}\right)\left(x+\frac{1}{2}\right)$

$(2x-3)(2x+1)$

$4\left(x^2-1x-\frac{3}{4}\right)$

$4\left(x-\frac{3}{2}\right)\left(x+\frac{1}{2}\right)$

$2\left(x-\frac{3}{2}\right)2\left(x+\frac{1}{2}\right)$

$(2x-3)(2x+1)$

Return to Concept Development