

# ADDING AND SUBTRACTING POLYNOMIALS

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7.2

# Essential Question

How can you add polynomials? How can you subtract polynomials?

You can add or subtract polynomials using a **vertical** or **horizontal method** to combine like terms.

## Example 1

Find each sum.

a.  $(3a^2 + 8) + (5a - 1)$

**Vertical method:** Align like terms vertically and add.

$$\begin{array}{r} 3a^2 \phantom{+ 8} \\ + \phantom{3a^2} 5a - 1 \\ \hline 3a^2 + 5a + 7 \end{array}$$

Leave a space for the missing term.

b.  $(-x^2 + 5x + 4) + (3x^2 - 8x + 9)$

**Horizontal method:** Group like terms and simplify.

$$(-x^2 + 3x^2) + [5x + (-8x)] + (4 + 9)$$

$$= 2x^2 - 3x + 13$$

Remember to subtract, you add the opposite.

## Example 2

Find each difference.

a.  $(y^2 + 4y + 2) - (2y^2 - 5y - 3)$

b.  $(5x^2 + 4x - 1) - (2x^2 - 6)$

a. Use the vertical method.

$$\begin{array}{r} (y^2 + 4y + 2) \\ - (2y^2 - 5y - 3) \\ \hline \end{array} \quad \begin{array}{c} \text{Add the opposite.} \\ \rightarrow \end{array} \quad \begin{array}{r} y^2 + 4y + 2 \\ + (-2y^2 + 5y + 3) \\ \hline -y^2 + 9y + 5 \end{array}$$

b. Use the horizontal method.

$$\begin{aligned} (5x^2 + 4x - 1) - (2x^2 - 6) &= (5x^2 + 4x - 1) + (-2x^2 + 6) \\ &= [5x^2 + (-2x^2)] + 4x + (-1 + 6) \\ &= 3x^2 + 4x + 5 \end{aligned}$$

# On Your Own

Find the sum or difference.

$$\begin{aligned} 1. \quad & (b - 10) + (4b - 3) \\ & = 5b - 13 \end{aligned}$$

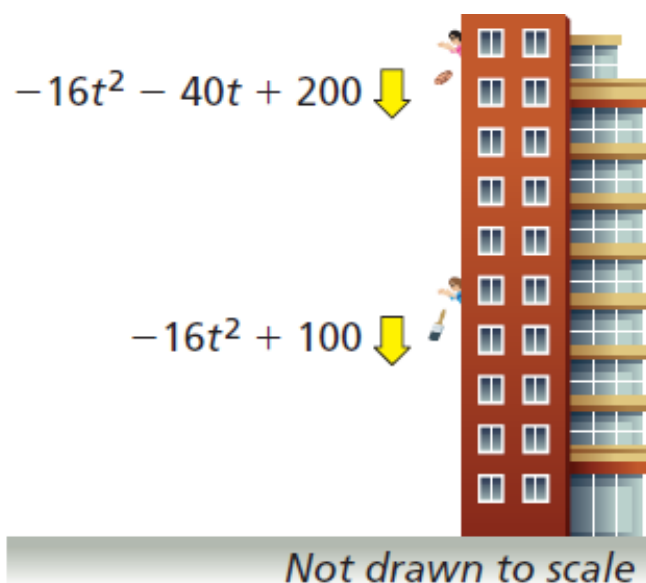
$$\begin{aligned} 2. \quad & (x^2 - x - 2) + (7x^2 - x) \\ & = 8x^2 - 2x - 2 \end{aligned}$$

$$\begin{aligned} 3. \quad & (p^2 + p + 3) - (-4p^2 - p + 3) \\ & = 5p^2 + 2p \end{aligned}$$

$$\begin{aligned} 4. \quad & (-k + 5) - (3k^2 - 6) \\ & = -3k^2 - k + 11 \end{aligned}$$

**EXAMPLE****3****Real-Life Application**

A penny is thrown straight downward from a height of 200 feet. At the same time, a paintbrush falls from a height of 100 feet. The polynomials represent the heights (in feet) of the objects after  $t$  seconds.



- a. Write a polynomial that represents the distance between the penny and the paintbrush after  $t$  seconds.

To find the distance between the objects after  $t$  seconds, subtract the polynomials.

<i>Penny</i>	<i>Paintbrush</i>
$(-16t^2 - 40t + 200)$	$(-16t^2 + 100)$

- The polynomial  $-40t + 100$  represents the distance between the objects after  $t$  seconds.

- b. What is the distance between the objects after 2 seconds?

$$\begin{aligned} -40t + 100 &= -40(2) + 100 \\ &= 20 \end{aligned}$$

- After 2 seconds, the distance between the objects is 20 feet.

# On Your Own

5. In Example 3, the polynomial  $-16t^2 - 25t + 200$  represents the height of the penny after  $t$  seconds. What is the distance between the objects after 1 second?

$$\begin{aligned} & \begin{array}{cc} \textit{Penny} & \textit{Paintbrush} \\ (-16t^2 - 25t + 200) & - (-16t^2 + 100) \end{array} \\ &= (-16t^2 - 25t + 200) + (16t^2 - 100) \\ &= (-16t^2 + 16t^2) + (-25t) + (200 - 100) \\ &= -25t + 100 \\ &= -25(1) + 100 \\ &= 75 \end{aligned}$$

The distance between the objects is 75 ft.