LESSON 7-6 Practice A
Adding and Subtracting Polynomials

Add or subtract.

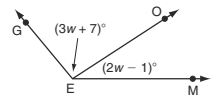
1. $3x^3 + 4 + x^3 - 10$ — $4x^3 - 6$
2. $6 - 12p^5 - 3p + 8 - 8p^5$ — $-20p^5 - 3p + 14$

Add.

3. $2m + 4$ + $m + 2$ — $3m + 6$
4. $3y^2 - y + 3$ + $2y^2 + 2y + 9$ — $5y^2 + y + 12$
5. $4z^3 + 3z^2 + 8$ + $2z^3 + z^2 - 3$ — $6z^3 + 4z^2 + 5$
6. $(10g^2 + 3g - 10) + (2g^2 + g + 9)$ — $12g^2 + 4g - 1$
7. $(4x^3 - x^2 + 2x) + (3x^3 + x^2 + 4x)$ — $7x^3 + 6x$

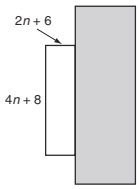
Subtract.

8. $12k + 3$ − $(4k + 2)$ — $8k + 1$
9. $6s^3 + 9s + 10$ − $(3s^3 + 4s - 10)$ — $3s^3 + 5s + 20$
10. $15a^4 + 6a^2 + a$ − $(6a^4 - 2a^2 + a)$ — $9a^4 + 8a^2$
11. $(11b^2 + 3b - 1) - (2b^2 + 2b + 8)$ — $9b^2 + b - 9$
12. $(c^3 - c^2 + 2c) - (-3c^3 - c^2 - 4c)$ — $4c^3 + 6c$
13. Write a polynomial that represents the difference between the measures of angle GEO and angle OEM.



$w + 8$

14. Becki is building an enclosure for her rabbits against the side of her house.



   a. Find the difference between the length and the width of the enclosure.
   $2n + 2$
   b. Find the perimeter of the enclosure not including the side of the house.
   $8n + 20$
   c. Find the perimeter of the enclosure if she built it in the yard with out the house as a wall.
   $12n + 28$

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LESSON 7-6 Practice B
Adding and Subtracting Polynomials

Add or subtract.

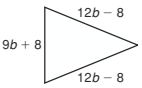
1. $3m^3 + 8m^3 - 3 + m^3 - 2m^2$ — $12m^3 - 2m^2 - 3$
2. $2pg - p^5 - 12pg + 5g - 6p^5$ — $-7p^5 - 10pg + 5g$

Add.

3. $3k^2 - 2k + 7$ + $k - 2$ — $3k^2 - k + 5$
4. $5x^2 - 2x + 3y$ + $6x^2 + 5x + 6y$ — $11x^2 + 3x + 9y$
5. $11hz^3 + 3hz^2 + 8hz$ + $9hz^3 + hz^2 - 3hz$ — $20hz^3 + 4hz^2 + 5hz$
6. $(ab^2 + 13b - 4a) + (3ab^2 + a + 7b)$ — $4ab^2 + 20b - 3a$
7. $(4x^3 - x^2 + 4x) + (x^3 - x^2 - 4x)$ — $5x^3 - 2x^2$

Subtract.

8. $12d^2 + 3dx + x$ − $(-4d^2 + 2dx - 8x)$ — $16d^2 + dx + 9x$
9. $2v^5 - 3v^4 - 8$ − $(3v^5 + 2v^4 - 8)$ — $-v^5 - 5v^4$
10. $-y^4 + 6ay^2 - y + a$ − $(-6y^4 - 2ay^2 + y)$ — $5y^4 + 8ay^2 - 2y + a$
11. $(-r^2 + 8pr - p) - (-12r^2 - 2pr + 8p)$ — $11r^2 + 10pr - 9p$
12. $(un - n^2 + 2un^3) - (3un^3 + n^2 + 4un)$ — $-3un - 2n^2 - un^3$
13. Antoine is making a banner in the shape of a triangle. He wants to line the banner with a decorative border. How long will the border be?



$33b - 8$

14. Darnell and Stephanie have competing refreshment stand businesses. Darnell's profit can be modeled with the polynomial $c^2 + 8c - 100$, where c is the number of items sold. Stephanie's profit can be modeled with the polynomial $2c^2 - 7c - 200$.
   a. Write a polynomial that represents the difference between Stephanie's profit and Darnell's profit.
   $c^2 - 15c - 100$
   b. Write a polynomial to show how much they can expect to earn if they decided to combine their businesses.
   $3c^2 + c - 300$

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LESSON 7-6 Practice C
Adding and Subtracting Polynomials

Add or subtract.

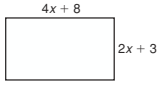
1. $-h^6 + 4h^5 - 3h^4 + 2h^5 - 9h^6$ — $-10h^6 + 6h^5 - 3h^4$
2. $6qw^4 + 9qw^3 - 13qw^4 + 14wq^3 - 7w^4$ — $-7qw^4 - 7w^4 + 9qw^3 + 14wq^3$

Add.

3. $-2m + 1$ + $6m^2 + m - 2$ — $6m^2 - m - 1$
4. $8yx^2 - x + 6y$ + $2yx^2 + 11x + 3y$ — $10yx^2 + 10x + 9y$
5. $7k^3 + 4zk^2 + 9zk$ + $5zk^3 - 10zk^2 - 8zk$ — $5zk^3 + 7k^3 - 6zk^2 + zk$
6. $(-cb^2 + 2b - 14c) + (3cb^2 + 3c - 3b)$ — $2cb^2 - b - 11c$
7. $(4a^4 - 9a^2 + 4a^3) + (a^3 - 11a^2 - 4a^5)$ — $4a^5 + 4a^4 + 5a^3 - 20a$

Subtract.

8. $13s^2 + 2sx + 8x$ − $(-2s^2 - 3sx + x)$ — $15s^2 + 5sx + 7x$
9. $8r^5 - 11ur^4 - 7$ − $(13r^5 + 2r^4 - 12)$ — $-5r^5 - 11ur^4 - 2r^4 + 5$
10. $-x^4 + 5ax^2 - x + a$ − $(-2x^4 - 5ax^2 - x + b)$ — $x^4 + 10ax^2 + a - b$
11. $(-3p + pm - m^2) - (2m^2 - 13p - 5pm)$ — $-3m^2 + 6pm + 10p$
12. $(ag^3 - g^2 + 2ag^3) - (3a^3g + g^2 - 4ag)$ — $3ag^3 - 3a^3g + 4ag - 2g^2$
13. Vince is going to frame the rectangular picture with dimensions shown. The frame will be $x + 1$ inches wide. Find the perimeter of the frame.



$20x + 30$

14. Mr. Watford owns two car dealerships. His profit from the first can be modeled with the polynomial $c^3 - c^2 + 2c - 100$, where c is the number of cars he sells. Mr. Watford's profit from his second dealership can be modeled with the polynomial $c^2 - 4c - 300$.
   a. Write a polynomial to represent the difference of the profit at his first dealership and the profit at his second dealership.
   $c^3 - 2c^2 + 6c + 200$
   b. What is the total amount of profit Mr. Watford earns from both dealerships?
   $c^3 - 2c - 400$

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LESSON 7-6 Reteach
Adding and Subtracting Polynomials

You can add or subtract polynomials by combining like terms.

The following are like terms: $4y$ and $7y$ — $8x^2$ and $2x^2$, $7m^5$ and m^5 — same variables raised to same power

The following are not like terms: $3x^2$ and $3x$ — same variable, different exponent; $4y$ and 7 — one with variable, one constant; $8m$ and $3n$ — same power, but different variable

Add $3x^2 + 4x + 5x^2 + 6x$.

$3x^2 + 4x + 5x^2 + 6x$	*Identify like terms.*
$3x^2 + 5x^2 + 4x + 6x$	*Rearrange terms so that like terms are together.*
$8x^2 + 10x$	*Combine like terms.*

Add $(5y^2 + 7y + 2) + (4y^2 + y + 8)$.

$(5y^2 + 7y + 2) + (4y^2 + y + 8)$	*Identify like terms.*
$(5y^2 + 4y^2) + (7y + y) + (2 + 8)$	*Rearrange terms so that like terms are together.*
$9y^2 + 8y + 10$	*Combine like terms.*

Determine whether the following are like terms. Explain.

1. $4x$ and x^4 — no; same variable raised to different power
2. $5y$ and $7y$ — yes; same variable raised to same power
3. $2z^3$ and $4x^3$ — no; different variable raised to same power

Add.

4. $2y^2 + 3y + 7y + y^2$ — $3y^2 + 10y$
5. $8m^4 + 3m - 4m^4$ — $4m^4 + 3m$
6. $12x^5 + 10x^4 + 8x^4$ — $12x^5 + 18x^4$
7. $(6x^2 + 3x) + (2x^2 + 6x)$ — $8x^2 + 9x$
8. $(m^2 - 10m + 5) + (8m + 2)$ — $m^2 - 2m + 7$
9. $(6x^3 + 5x) + (4x^3 + x^2 - 2x + 9)$ — $10x^3 + x^2 + 3x + 9$
10. $(2y^5 - 6y^3 + 1) + (y^5 + 8y^4 - 2y^3 - 1)$ — $3y^5 + 8y^4 - 8y^3$

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LESSON 7-6

Reteach

Adding and Subtracting Polynomials (continued)

To subtract polynomials you must remember to add the opposite.

Find the opposite of $(5m^3 - m + 4)$.

$(5m^3 - m + 4)$

$-(5m^3 - m + 4)$ *Write the opposite of the polynomial.*

$-5m^3 + m - 4$ *Write the opposite of each term in the polynomial.*

Subtract $(4x^3 + x^2 + 7) - (2x^3)$.

$(4x^3 + x^2 + 7) - (2x^3)$

$(4x^3 + x^2 + 7) + (-2x^3)$ *Rewrite subtraction as addition of the opposite.*

$(\underline{4x^3} + x^2 + 7) + (\underline{-2x^3})$ *Identify like terms.*

$(\underline{4x^3} - \underline{2x^3}) + x^2 + 7$ *Rearrange terms so that like terms are together.*

$2x^3 + x^2 + 7$ *Combine like terms.*

Subtract $(6y^4 + 3y^2 - 7) - (2y^4 - y^2 + 5)$.

$(6y^4 + 3y^2 - 7) - (2y^4 - y^2 + 5)$

$(6y^4 + 3y^2 - 7) + (-2y^4 + y^2 - 5)$ *Rewrite subtraction as addition of the opposite.*

$(\underline{6y^4} + \underline{3y^2} - \underline{7}) + (\underline{-2y^4} + \underline{y^2} - \underline{5})$ *Identify like terms.*

$(\underline{6y^4} - \underline{2y^4}) + (\underline{3y^2} + \underline{y^2}) + (\underline{-7} - \underline{5})$ *Rearrange terms so that like terms are together.*

$4y^4 + 4y^2 - 12$ *Combine like terms.*

Find the opposite of each polynomial.

11. $x^2 + 7x$ — $-x^2 - 7x$

12. $-3x^3 + 4x - 8$ — $3x^3 - 4x + 8$

13. $-5x^4 + x^3 - 7x^2 - 3$ — $5x^4 - x^3 + 7x^2 + 3$

Subtract.

14. $(9x^3 - 5x) - (3x)$ — $9x^3 - 8x$

15. $(6t^4 + 3) - (-2t^4 + 2)$ — $8t^4 + 1$

16. $(2x^3 + 4x - 2) - (4x^3 - 6)$ — $-2x^3 + 4x + 4$

17. $(t^3 - 2t) - (t^2 + 2t + 6)$ — $t^3 - t^2 - 4t - 6$

18. $(4c^5 + 8c^2 - 2c - 2) - (c^3 - 2c + 5)$ — $4c^5 - c^3 + 8c^2 - 7$

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LESSON 7-6

Challenge

Polynomial Functions

A **polynomial function** is a function whose rule is a polynomial. For example, $P(x) = 2x^3 - 4x^2 + 3x - 2$ is a polynomial function.

Like other functions, polynomial functions can be evaluated by substituting a value for the variable and simplifying.

1. For $P(x) = 2x^3 - 4x^2 + 3x - 2$, find $P(2)$. — 4

A variable, or variable expression, can be substituted for the variable in a function as well. For example, if $P(x) = 5x + 3$, then $P(a) = 5a + 3$.

2. For $P(x) = -4x^3 + x - 6$, find $P(b)$. — $-4b^3 + b - 6$

Suppose $P(x) = 3x - 2$. Then $P(c) + P(c + 1) = 3c - 2 + 3(c + 1) - 2$

$= 3c - 2 + 3c + 3 - 2$

$= 6c - 1$

3. For $P(x) = 10 - 4x$, find $P(d) + P(2d) - P(3)$.

$22 - 12d$

4. For $P(x) = -3x^4 - 7x^3 + 2x^2 - x + 8$, find $P(g^2) + P(g)$.

$-3g^8 - 7g^6 - g^4 - 7g^3 + g^2 - g + 16$

Give an example of $Q(x)$ and $S(x)$ for each situation.

5. $Q(x)$ is a quartic binomial. $S(x)$ is a quartic trinomial.
$Q(x) + S(x)$ is a quartic trinomial.
$Q(x) = x^4 + 1$; $S(x) = x^4 + x^3 + 1$

6. $Q(x)$ is a cubic trinomial. $S(x)$ is a cubic binomial.
$Q(x) - S(x)$ is a quadratic monomial.
$Q(x) = x^3 + x^2 + 1$; $S(x) = x^3 + 1$

7. $Q(x)$ is a cubic trinomial. $S(x)$ is a cubic trinomial.
$Q(x) + S(x)$ is a quadratic binomial.
$Q(x) = x^3 + x^2 + 1$; $S(x) = -x^3 + x^2 + 1$

8. $Q(x)$ is a quintic trinomial. $S(x)$ is a quartic trinomial.
$Q(x) + S(x)$ is a quintic polynomial with five terms.
$Q(x) = x^5 + x^4 + 1$; $S(x) = x^4 + x^3 + x^2$

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LESSON 7-6

Problem Solving

Adding and Subtracting Polynomials

Write the correct answer.

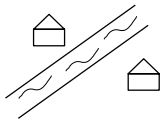
1. There are two boxes in a storage unit. The volume of the first box is $4x^3 + 4x^2$ cubic units. The volume of the second box is $6x^3 - 18x^2$ cubic units. Write a polynomial for the total volume of the two boxes.

$10x^3 - 14x^2$ cubic units

2. The recreation field at a middle school is shaped like a rectangle with a length of $15x$ yards and a width of $10x - 3$ yards. Write a polynomial for the perimeter of the field. Then calculate the perimeter if $x = 2$.

$50x - 6$;
94 yards

3. Two cabins on opposite banks of a river are $12x^2 - 7x + 5$ feet apart. One cabin is $9x + 1$ feet from the river. The other cabin is $3x^2 + 4$ feet from the river. Write the polynomial that represents the width of the river where it passes between the two cabins. Then calculate the width if $x = 3$.



$9x^2 - 16x$; 33 feet

The circle graph represents election results for the president of the math team. Use the graph for questions 4–6. Select the best answer.

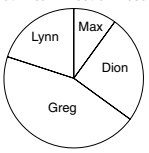
4. The angle value of Greg's sector can be modeled by $x^2 + 6x + 2$. The angle value of Dion's sector can be modeled by $7x + 20$. Which polynomial represents both sectors combined?

A $x^2 + x + 18$ **C** $6x^2 + 7x + 18$
B $x^2 + 13x + 22$ **D** $7x^2 + 6x + 22$

5. The sum of Greg and Lynn's sectors is $2x^2 + 4x - 6$. The sum of Max and Dion's sectors is $10x + 26$. Which polynomial represents how much greater Greg and Lynn's combined sectors are than Max and Dion's?

F $2x^2 + 6x + 32$ **H** $2x^2 - 6x - 32$
G $2x^2 - 6x + 20$ **J** $2x^2 + 14x + 20$

Math Team Election Results



6. The sum of Lynn's sector and Max's sector is $2x^2 - 9x - 2$. Max's sector can be modeled by $3x + 6$. Which polynomial represents the angle value of Lynn's sector?

A $2x^2 - 6x + 4$ **C** $2x^2 - 12x + 8$
B $2x^2 - 6x - 4$ **D** $2x^2 - 12x - 8$

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LESSON 7-6

Reading Strategies

Connecting Concepts

The process for adding and subtracting polynomials is the same as the process for simplifying linear expressions. Look at the connections below.

Simplify $7 - 3(x + 8) + 4x$.	**Subtract $(x^2 + 8x - 4) - (3x^2 - 3x + 2)$.**
$7 - 3(x + 8) + 4x$	$(x^2 + 8x - 4) - (3x^2 - 3x + 2)$
Step 1: Use the Distributive Property.	
$= 7 - 3x - 24 + 4x$	$= x^2 + 8x - 4 - 3x^2 + 3x - 2$
Step 2: Rearrange so like terms are together.	
$= -3x + 4x + 7 - 24$	$= x^2 - 3x^2 + 8x + 3x - 4 - 2$
Step 3: Combine all the sets of like terms.	
$= x - 17$	$= -2x^2 + 11x - 6$

Complete the following based on the examples above.

1. What is being distributed in the linear expression on the left? — -3

2. What is being distributed in the polynomial subtraction on the right? — -1

3. Identify the sets of like terms that were combined in the expression on the left.
$-3x$ and $4x$; 7 and -24

4. Identify the sets of like terms that were combined in the polynomial subtraction on the right.
x^2 and $-3x^2$; $8x$ and $3x$; -4 and -2

Add or subtract the polynomials.

5. $5x^3 + 2x + 1 - 3x^3 + 6$ — $2x^3 + 2x + 7$

6. $x - 3x^5 + 2x^4 - 5x^5 - x$ — $-8x^5 + 2x^4$

7. $(2x^2 + 10x + 4) + (7x^2 + 6x - 2)$ — $9x^2 + 16x + 2$

8. $(x^3 - 6) + (9 - 2x^2 + x^3)$ — $2x^3 - 2x^2 + 3$

9. $(6x^4 + 8x - 2) - (2x^4 + 6x)$ — $4x^4 + 2x - 2$

10. $(3x^2 - 9x) - (x + 2x^3 - 4)$ — $-2x^3 + 3x^2 - 10x + 4$

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