LESSON 7-5

Practice A

Polynomials

Find the degree and number of terms of each polynomial.

1. $4w^2$ — Degree: 2; Terms: 1
2. $9x^3 + 2x$ — Degree: 3; Terms: 2
3. $4p^5 - p^3 + p^2 + 11$ — Degree: 5; Terms: 4

Fill in each blank with *monomial*, *binomial*, or *trinomial*.

4. A trinomial is a polynomial with three terms.
5. A monomial is a polynomial with one term.
6. A binomial is a polynomial with two terms.

Write each polynomial in standard form. Then, give the leading coefficient.

7. $12 + 3x^2 - x$	$3x^2 - x + 12$	3
8. $g^4 - 2g^3 - g^5$	$-g^5 + g^4 - 2g^3$	−1
9. $k^2 + k^4 - k^3 + 1$	$k^4 - k^3 + k^2 + 1$	1

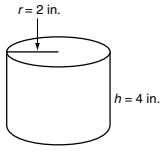
First, classify each polynomial by its degree (*linear*, *quadratic*, *cubic*, or *quartic*). Then, classify it by its number of terms (*monomial*, *binomial*, or *trinomial*).

10. $109z^2$ — quadratic monomial
11. $3x + 11$ — linear binomial
12. $b^3 - 2 + 2b^4$ — quartic trinomial

13. Complete the table by evaluating the polynomial for each value of z.

Polynomial	$z = 0$	$z = 1$	$z = 2$	$z = -1$	$z = -2$
$2z + 3z^2 - 3$	−3	2	13	−2	5

14. The surface area of a cylinder is approximated by the polynomial $6r^2 + 6rh$, where r is the radius and h is the height of the cylinder. Find the approximate surface area of the cylinder at right.



72 in^2

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LESSON 7-5

Practice B

Polynomials

Find the degree and number of terms of each polynomial.

1. $14h^3 + 2h + 10$ — 3; 3
2. $7y - 10y^2$ — 2; 2
3. $2a^2 - 5a + 34 - 6a^4$ — 4; 4

Write each polynomial in standard form. Then, give the leading coefficient.

4. $3x^2 - 2 + 4x^8 - x$	$4x^8 + 3x^2 - x - 2$	4
5. $7 + 50j - 3j^3 - 4j^2$	$-3j^3 - 4j^2 + 50j + 7$	−3
6. $6k + 5k^4 - 4k^3 + 3k^2$	$5k^4 - 4k^3 + 3k^2 + 6k$	5

Classify each polynomial by its degree and number of terms.

7. $-5t^2 + 10$ — quadratic binomial
8. $8w + 32 + 9w^4$ — quartic trinomial
9. $b - b^3 - 2b^2 + 5b^4$ — quartic polynomial

Evaluate each polynomial for the given value.

10. $3m + 8 - 2m^3$ for $m = -1$ — 7
11. $4y^5 - 6y + 8y^2 - 1$ for $y = -1$ — 9
12. $2w + w^3 - \frac{1}{2}w^2$ for $w = 2$ — 10

13. An egg is thrown off the top of a building. Its height in meters above the ground can be approximated by the polynomial $300 + 2t - 4.9t^2$, where t is the time since it was thrown in seconds.

a. How high is the egg above the ground after 5 seconds?

187.5 m

b. How high is the egg above the ground after 6 seconds?

135.6 m

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LESSON 7-5

Practice C

Polynomials

Find the degree and number of terms of each polynomial.

1. $5t^5 + 60 + 3t^3$ — 5; 3
2. $9p + 31p^9 + 6p^2 - 42$ — 9; 4
3. $-50 + 4r - r^3 + r^2 - 4r^5$ — 5; 5

Simplify and write each polynomial in standard form. Then, give the leading coefficient.

4. $4g^3 + 8g - 4g^3 + 2g^2$	$2g^2 + 8g$	2
5. $13 - 5h^3 + h^2 - h$	$-5h^3 + h^2 - h + 13$	−5
6. $2(3x + 4) - 4x + 8x^2$	$8x^2 + 2x + 8$	8

Classify each polynomial according to its degree and number of terms.

7. $6t^3 + 54t^4 - 1$ — quartic trinomial
8. $14 \cdot 3w^2 + w$ — quadratic binomial
9. $4(4s^2 - s) - 11 + s^7$ — 7th degree polynomial

Evaluate each polynomial for the given value.

10. $4m - 4 - 4m^3$ for $m = -2$ — 20
11. $12y^7 - 6y^2 + 8y^3 - y$ for $y = -1$ — −25
12. $-3a + a^3 - \frac{1}{3}a^2$ for $a = 3$ — 15

13. A certain company's profit in dollars can be modeled with the polynomial $-\frac{1}{2}x^2 + 100x - 200$ where x is the number of items produced and sold.

a. What is the profit if they produce and sell 10 of their products? $750

b. What is the profit if they produce and sell 100 of their products? $4800

c. Evaluate the company's profit polynomial for $x = 0$. What does this number represent? −200

It represents how much money they will lose ($200) for not producing or selling anything.

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LESSON 7-5

Reteach

Polynomials

A **monomial** is a number, a variable, or a product of numbers and variables with whole-number exponents. A **polynomial** is a monomial or a sum or difference of monomials.

The degree of the monomial is the sum of the exponents in the monomial.

Find the degree of $8x^2y^3$.

$8x^2y^3$ *The exponents are 2 and 3.*

The degree of the monomial is $2 + 3 = 5$.

Find the degree of $-4a^6b$.

$-4a^6b$ *The exponents are 6 and 1.*

The degree of the monomial is $6 + 1 = 7$.

The degree of the polynomial is the degree of the term with the greatest degree.

Find the degree of $2x^4y^3 + 9x^5$.

$\underbrace{2x^4y^3}_{7} + \underbrace{9x^5}_{5}$ Degree of the polynomial is 7.

Find the degree of $4ab + 9a^3$.

$\underbrace{4ab}_{2} + \underbrace{9a^3}_{3}$ Degree of the polynomial is 3.

The **standard form of a polynomial** is written with the terms in order from the greatest degree to the least degree. The coefficient of the first term is the **leading coefficient**.

Write $5x + 6x^3 + 4 + 2x^4$ in standard form.

$\underbrace{5x}_{1} + \underbrace{6x^3}_{3} + \underbrace{4}_{0} - \underbrace{2x^4}_{4}$ *Find the degree of each term.*

$2x^4 + 6x^3 + 5x + 4$ *Write the terms in order of degree.*

The leading coefficient is 2.

Find the degree of each monomial.

1. $7m^3n^5$ — 8
2. $6xyz$ — 3
3. $4x^2y^2$ — 4

Find the degree of each polynomial.

4. $x^5 + x^5y$ — 6
5. $4x^2y^3 + y^4 + 7$ — 5
6. $x^2 + xy + y$ — 2

Write each polynomial in standard form. Then give the leading coefficient.

7. $x^3 - 5x^4 - 6x^5$	$-6x^5 - 5x^4 + x^3$	−6
8. $2x + 5x^2 - x^3$	$-x^3 + 5x^2 + 2x$	−1
9. $8x + 7x^2 - 1$	$7x^2 + 8x - 1$	7

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LESSON 7-5 Reteach
Polynomials (continued)

Polynomials have special names based on their degree and the number of terms they have.

Degree	0	1	2	3	4	5	6 or more
Name	Constant	Linear	Quadratic	Cubic	Quartic	Quintic	6th degree ...

Terms	1	2	3	4 or more
Name	Monomial	Binomial	Trinomial	Polynomial

Classify $7x^4 + 5x + 3$ according to its degree and number of terms.

$7x^4 + 5x + 3$ is a quartic trinomial. (Degree: 4; Terms: 3)

Polynomials can be evaluated.

A ball is thrown straight up in the air from a height of 4 feet at a speed of 65 feet per second. The height of the ball in feet is given by $-16t^2 + 65t + 4$ where t is the time in seconds. How high is the ball after 2 seconds?

Evaluate for $t = 2$.

$-16t^2 + 65t + 4$

$-16(2)^2 + 65(2) + 4$ (Substitute 2 for t.)

$-16(4) + 65(2) + 4$

$-64 + 130 + 4$ (Follow the order of operations to simplify.)

70

After 2 seconds, the ball is 70 feet high.

Classify each polynomial according to its degree and number of terms.

10. $7x^2 - 5x$ — quadratic binomial

11. $b^3 + 2b^2 - 4b + 1$ — cubic polynomial

12. A ball is thrown straight up in the air from a height of 6 feet at a speed of 80 feet per second. The height of the ball in feet is given by $-16t^2 + 80t + 6$ where t is the time in seconds. What is the height of the ball after 3 seconds?

102 feet

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LESSON 7-5 Challenge
Pick the Polynomial

Match each polynomial with the correct clue. Each polynomial can be used only once. Not every polynomial will be used.

Use these polynomials for 1 – 7.

$x^5 + x^3 + x$	$2x^4y^4 + 3x^2y^5$
$2x^4$	$x^5y - 3x^2y + xy$
$3x + 3y + 3z$	$-3xy^4$
$2xy + 5xy$	$2x^2y + 5xy^2$
$4x^2 - 3x^5 + x$	$4xyz^2 + xyz$

Use these polynomials for 8 – 14.

$4xy + 3x^2y$	$x^3 + x^2 + x$
$x^2 + x - 3$	$x^4 + x^3 + x^2$
$-3 + x + 4x^2$	$2x^2 - 3x^3 + 1$
$x^3y - 3xyz + z$	$x - 3$
$-x + 3$	$x^2 + y^2 + z^2 + w^2$

1. I am a monomial with degree 5. Who am I? $-3xy^4$

2. I am a sum of monomials with degree 8. Who am I? $2x^4y^4 + 3x^2y^5$

3. I am a trinomial with degree 5. Who am I? $x^5 + x^3 + x$

4. I am a binomial. Both of my terms have degree 2. Who am I? $2xy + 5xy$

5. I am a monomial with degree 4. Who am I? $2x^4$

6. I am a binomial with degree 4. Who am I? $4xyz^2 + xyz$

7. I am a trinomial. When you put me in standard form, my leading coefficient is –3. Who am I? $4x^2 - 3x^5 + x$

8. I am a linear expression. My constant is –3. Who am I? $x - 3$

9. I am a quartic trinomial. I have three different variables. Who am I? $x^3y - 3xyz + z$

10. I am a cubic binomial. Who am I? $4xy + 3x^2y$

11. I am a quadratic polynomial. I have no constants. Who am I? $x^2 + y^2 + z^2 + w^2$

12. I am a cubic trinomial with one variable. Who am I? $x^3 + x^2 + x$

13. I am a quadratic trinomial. When you put me in standard form, my leading coefficient is 4. Who am I? $-3 + x + 4x^2$

14. I am a quartic trinomial. Who am I? $x^4 + x^3 + x^2$

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LESSON 7-5 Problem Solving
Polynomials

Write the correct answer.

1. The surface area of a cylinder is given by the polynomial $2\pi r^2 + 2\pi rh$. A cylinder has a radius of 2 centimeters and a height of 5 centimeters. Find the surface area of the cylinder. Use 3.14 for π.

87.92 square centimeters

2. A firework is launched from the ground at a velocity of 180 feet per second. Its height after t seconds is given by the polynomial $-16t^2 + 180t$. Find the height of the firework after 2 seconds and after 5 seconds.

2 s: 296 feet

5 s: 500 feet

3. In the United Kingdom, transportation authorities use the polynomial $\frac{1}{20}v^2 + v$ for calculating the number of feet needed to stop on dry pavement. In the United States, many use the polynomial $0.096v^2$. Both formulas are based on speed v in miles per hour. Calculate the stopping distances for a car traveling 45 miles per hour in both the U.S. and the UK.

UK: 146.25 feet

US: 194.4 feet

4. A piece of cardboard that measures 2 feet by 3 feet can be folded into a box if notches are cut out of the corners. The length of the side of the notch will be the same as the height h of the resulting box. The volume of the box is given by $4h^3 - 10h^2 + 6h$. Find the volume of the box for $h = 0.25$ and $h = 0.5$.

$h = 0.25$: 0.9375 cubic feet

$h = 0.5$: 1 cubic foot

The height of a rocket in meters t seconds after it is launched is approximated by the polynomial $0.5at^2 + vt + h$ where a is always -9.8, v is the initial velocity, and h is the initial height. Use this information with the data in the chart for questions 5 – 7. Select the best answer.

Model Number	Initial Velocity (m/s)
300X	250
Q99	90
4400*i*	125

5. A 300X was launched from a height of 10 meters. What was its height after 3 seconds?

(A) 715.9 m C 755.5 m
B 745.3 m D 760 m

6. Marie and Bob launched their rockets at the same time from a platform 5 meters above the ground. Marie launched the 4400*i* and Bob launched the Q99. How much higher was Marie's rocket after 2 seconds?

F 35 meters H 140 meters
(G) 70 meters J 320 meters

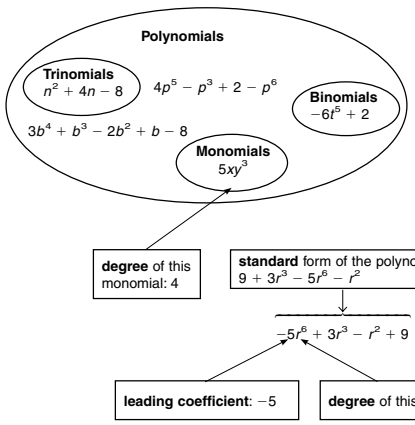
7. The 4400*i* was launched from the ground at the same time the Q99 was launched from 175 meters above the ground. After how many seconds were the rockets at the same height?

A 2 s (C) 5 s
B 4 s D 6 s

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LESSON 7-5 Reading Strategies
Understanding Vocabulary

There is a great deal of introductory vocabulary related to polynomials. The meaning of and relationships among the terms are shown below.



Classification	Degree
Constant	0
Linear	1
Quadratic	2
Cubic	3
Quartic	4
Quintic	5
6th degree	6
7th degree	7
etc.	etc.

Complete each of the following.

1. How many terms are in a trinomial? 3 a monomial? 1

2. Why does $5xy^3$ have a degree of 4? (*Hint*: Look at the exponents on the variables.)
The exponents on the variables have a sum of 4.

3. Classify $4n^3 + 6$ by degree. cubic by number of terms. binomial

Use the polynomial $8g + 1 - 4g^2$ to complete the following.

4. Write the polynomial in standard form. $-4g^2 + 8g + 1$

5. What is the leading coefficient? -4

6. What is the degree of the polynomial? 2

7. Classify the polynomial by number of terms. trinomial

8. Classify the polynomial by degree. quadratic

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