Honors Algebra II

Chapter 5 (Part I): Polynomials and Polynomial Functions

Objectives: I will be able to graph polynomial functions
I will be able to perform operations with polynomials
I will be able to solve polynomial equations and find zeros

Assignment			Pages	Problem Numbers
#1	5.1	Properties of Exponents	p. 333-335	#3-13 odd, 17-21 odd, 25-35 odd, 43-45
#2	5.2	Graph Polynomial Functions	p. 341-342	#3-8, 24-27, 29-35
#3	5.2	Evaluate Polynomial Functions	p. 341-342	#13-19 odd, 23, 38-45 (table of values/end beh.)
#4	5.3	Add, Subtract, Multiply	p. 349-350	#5-9 odd, 21-25 odd, 26-31, 40-48 even, 49
		Quiz 5.1-5.3		
#5	5.4	Factor and Solve	p. 356-357	#3-29 odd, 33-37 odd, 55
#6	5.4	Factor and Solve	**Worksheet 5.4A**	
#7	5.4	Factor and Solve	**Worksheet 5.4B**	
		Quiz 5.4		
#8	5.5	Remainder and Factor Theorems	p. 366-367	#7, 9-15 odd, 19-23
#9	5.5	Remainder and Factor Theorems	p. 366-367	#27-33 odd, 36-39
#10		Review	**Chapter 5 (5.1-5.5) Targets**	

Selected Even Solutions ...

p. 349-350

28. $x^3 - 7x^2 - 14x + 120$

30. $-z^3 - 2z^2 + 40x - 64$

40. $y^3 + 12y^2 + 48y + 64$

42. $27x^3 - 108x^2 + 144x - 64$

44. $343x^3 - 147x^2y + 21xy^2 - y^3$

46. $27z^3 + 189z^2y + 441zy^2 + 343y^3$

48. $3x^3 + 10x^2 + 3x$

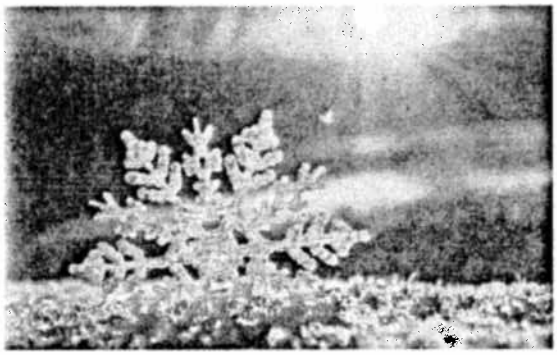
p. 366-367

20. should be $x^2 + 2x - 1 + \frac{1}{x-2}$

22. $(x-1)(x+3)(x+4)$

36. $2x + 5$

38c.) -3, 2, 6



H-Algebra II

Name _____

Chapter 5 (Part I) Targets

Chapter Objective: To graph, solve, and perform operations with polynomial functions.

5.1 Simplify Expressions Using the Properties of Exponents	
I can evaluate and simplify expressions using the properties of exponents	1. $\left(-5x^{2}y^{-5}z^{-7}\right)^{5}$ 2. $\left(5^{-1}+3^{-2}\right)^{-2}$ 3. $\dfrac{230x^{9}y^{-4}z^{5}}{-4x^{2}yz^{19}}$ 4. $\left(\dfrac{b^{-3}c}{a^{2}}\right)^{-4}$ 5. $\dfrac{\left(3x^{2}y^{3}\right)\bullet(6x)^{2}}{\left(9xy^{3}\right)^{2}}$
I can solve equations using the properties of exponents.	6. $5^{x-3}\bullet5^{x+1}=125$ 7. $\dfrac{10^{2x-1}}{10^{x-1}}=\left(10^{x}\right)^{3}$
5.2 Evaluate and Graph Other Polynomial Functions	
I can use substitution to find the remainder when dividing two polynomials.	Find the remainder using direct substitution AND synthetic substitution. 8. $\left(5x^{4}-7x^{3}+16x^{2}-4x-8\right)\div(x-2)$ 9. $\dfrac{8x^{5}-2x^{4}+4x^{2}-4x+1}{2x+1}$
I can determine the end behavior of polynomial functions	Determine the end behavior for each. Use x and f(x) notation. 10. $f(x)=4x^{8}+6x^{7}-8x^{6}+4x^{5}-6x^{4}-8x^{3}+4x^{2}+3x-8$ 11. $f(x)=-4x^{5}-6x^{6}+8x^{7}+4x^{2}+3x-8$
I can use end behavior and a table of values to graph polynomial functions	Determine the end behavior for each. Then graph using a table of values. 12. $f(x)=5x^{3}+19x^{2}+22x+8$ 13. $f(x)=-2x^{4}+3x^{3}-2x+1$
5.3 Add, Subtract, Multiply Polynomials	
I can add and subtract polynomials.	14. $3\left(x^{2}+8x-7\right)+\left(5x^{2}-9x-12\right)$
I can multiply polynomials	15. $\left(x^{2}-5x-3\right)\left(3x^{2}+4x-10\right)$ 16. $(2x-5)^{3}$

5.4 Factor and Solve Polynomial Equations			
I can factor using the difference of squares	17. $9x^2-16y^2$	18. $225x^4-64y^8$	19. $16a^4-81y^8$
I can factor using the sum and difference of perfect cubes	20. $27x^3+1$	21. $8a^3-y^3$	22. y^6+216
I can factor using the combination of perfect squares and cubes	23. x^6+y^{12}	24. $x^{12}-y^{24}$	
I can factor polynomials in quadratic form	25. $16x^4-40x^2+25$	26. $2x^9+10x^6+12x^3$	27. x^8-5x^4-36
I can factor by grouping	28. $2ax+6xc+ba+3bc$	29. $a^2-2ab+a-2b$	30. x^3+2x^2-x-2
	31. $x^2+6x+9-a^2$	32. x^2-n^2+2n-1	33. $ab+3a+b^2-9$
I can solve higher degree polynomial equations using the zero product property	34. $5x^4-50x^2-55=0$	35. $3x^5+15x=18x^3$	
5.5 Apply the Remainder and Factor Theorems			
I can divide polynomial using long division	36. $\left(2x^4+3x^3-2x+5\right)\div\left(x^2+x-2\right)$		
I can divide polynomials using synthetic division	37. $\left(5x^4-7x^3+6x^2+4x-7\right)\div(x-2)$		
	38. $\left(5x^6-3x^4+2x^2+4x+1\right)\div(x+3)$		
I can determine if a given value is a zero of a function.	39. Determine if $-\sqrt{2}$ is a zero of $f(x)=x^4-6x^2+8$.		
I can find the other zeros of a cubic function given one zero	40. $f(x)=10x^3-81x^2+71x+42$ for $x=7$		
	41. $f(x)=3x^3+34x^2+72x-64$ for $x=-4$		
	42. $g(x)=x^4-4x^3-7x^2+42x-36$ is factorable by $(x-3)^2$. Use this information to factor completely.		

✓ **GUIDED PRACTICE** for Examples 3, 4, and 5

Simplify the expression. Tell which properties of exponents you used.

5. $x^{-6}x^5x^3$ 6. $(7y^2z^5)(y^{-4}z^{-1})$ 7. $\left(\frac{s^3}{t^{-4}}\right)^2$ 8. $\left(\frac{x^4y^{-2}}{x^3y^6}\right)^3$

5.1 EXERCISES

HOMEWORK KEY

○ = **WORKED-OUT SOLUTIONS** on p. WS1 for Exs. 17, 31, and 51

= **TAKS PRACTICE AND REASONING** Exs. 36, 46, 51, 53, 55, and 56

SKILL PRACTICE

1. **VOCABULARY** State the name of the property illustrated.

   a. $a^m \cdot a^n = a^{m+n}$ b. $a^{-m} = \frac{1}{a^m}, a \neq 0$ c. $(ab)^m = a^m b^m$

2. **WRITING** Is the number 25.2×10^{-3} in scientific notation? *Explain.*

EXAMPLE 1 on p. 330 for Exs. 3–14

EVALUATING NUMERICAL EXPRESSIONS **Evaluate the expression. Tell which properties of exponents you used.**

3. $3^3 \cdot 3^2$ 4. $(4^{-2})^3$ 5. $(-5)(-5)^4$ 6. $(2^4)^2$

7. $\frac{5^2}{5^5}$ 8. $\left(\frac{3}{5}\right)^4$ 9. $\left(\frac{2}{7}\right)^{-3}$ 10. $9^3 \cdot 9^{-1}$

11. $\frac{3^4}{3^{-2}}$ 12. $\left(\frac{2}{3}\right)^{-5}\left(\frac{2}{3}\right)^4$ 13. $6^3 \cdot 6^0 \cdot 6^{-5}$ 14. $\left(\left(\frac{1}{2}\right)^{-5}\right)^2$

EXAMPLE 2 on p. 331 for Exs. 15–23

SCIENTIFIC NOTATION **Write the answer in scientific notation.**

15. $(4.2 \times 10^3)(1.5 \times 10^6)$ 16. $(1.2 \times 10^{-3})(6.7 \times 10^{-7})$ 17. $(6.3 \times 10^5)(8.9 \times 10^{-12})$

18. $(7.2 \times 10^9)(9.4 \times 10^8)$ 19. $(2.1 \times 10^{-4})^3$ 20. $(4.0 \times 10^3)^4$

21. $\frac{8.1 \times 10^{12}}{5.4 \times 10^9}$ 22. $\frac{1.1 \times 10^{-3}}{5.5 \times 10^{-8}}$ 23. $\frac{(7.5 \times 10^8)(4.5 \times 10^{-4})}{1.5 \times 10^7}$

EXAMPLES 3 and 4 on pp. 331–332 for Exs. 24–39

SIMPLIFYING ALGEBRAIC EXPRESSIONS **Simplify the expression. Tell which properties of exponents you used.**

24. $\frac{w^{-2}}{w^5}$ 25. $(2^2y^3)^5$ 26. $(p^3q^2)^{-1}$ 27. $(w^3x^{-2})(w^6x^{-1})$

28. $(5s^{-2}t^4)^{-3}$ 29. $(3a^3b^5)^{-3}$ 30. $\frac{x^{-1}y^2}{x^2y^{-1}}$ 31. $\frac{3c^3d}{9cd^{-1}}$

32. $\frac{4r^4s^5}{24r^4s^{-5}}$ 33. $\frac{2a^3b^{-4}}{3a^5b^{-2}}$ 34. $\frac{y^{11}}{4z^3} \cdot \frac{8z^7}{y^7}$ 35. $\frac{x^2y^{-3}}{3y^2} \cdot \frac{y^2}{x^{-4}}$

36. **TAKS REASONING** What is the simplified form of $\frac{2x^2y}{6xy^{-1}}$?

Ⓐ $\frac{y^2}{3}$ Ⓑ $\frac{xy^2}{3}$ Ⓒ $\frac{x}{3}$ Ⓓ $\frac{1}{3}$

ERROR ANALYSIS *Describe* and correct the error in simplifying the expression.

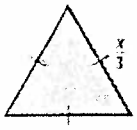
37. $\frac{x^{10}}{x^2} = x^5$ ✗

38. $x^5 \cdot x^3 = x^{15}$ ✗

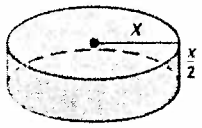
39. $(-3)^2(-3)^4 = 9^6$ ✗

GEOMETRY **Write an expression for the figure's area or volume in terms of x.**

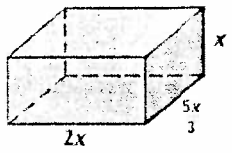
40. $A = \frac{\sqrt{3}}{4}s^2$



41. $V = \pi r^2 h$



42. $V = \ell wh$



REASONING **Write an expression that makes the statement true.**

43. $x^{15}y^{12}z^8 = x^4y^7z^{11} \cdot ?$

44. $3x^3y^2 = \frac{12x^2y^5}{?}$

45. $(a^5b^4)^2 = a^{14}b^{-1} \cdot ?$

46. **TAKS REASONING** Find three different ways to complete the following statement so that it is true: $x^{12}y^{16} = (x^?y^?)(x^?y^?)$.

CHALLENGE **Refer to the properties of exponents on page 330.**

47. Show how the negative exponent property can be derived from the quotient of powers property and the zero exponent property.

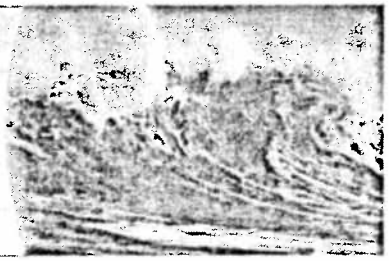
48. Show how the quotient of powers property can be derived from the product of powers property and the negative exponent property.

PROBLEM SOLVING

EXAMPLE 2 on p. 331 for Exs. 49–50

49. **OCEAN VOLUME** The table shows the surface areas and average depths of four oceans. Calculate the volume of each ocean by multiplying the surface area of each ocean by its average depth. Write your answers in scientific notation.

Ocean	Surface area (square meters)	Average depth (meters)
Pacific	1.56×10^{14}	4.03×10^3
Atlantic	7.68×10^{13}	3.93×10^3
Indian	6.86×10^{13}	3.96×10^3
Arctic	1.41×10^{13}	1.21×10^3



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50. **EARTH SCIENCE** The continents of Earth move at a very slow rate. The South American continent has been moving about 0.000022 mile per year for the past 125,000,000 years. How far has the continent moved in that time? Write your answer in scientific notation.

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○ = WORKED-OUT SOLUTIONS on p. WS1

= TAKS PRACTICE AND REASONING

EXAMPLE 5 on p. 332 for Exs. 51–52

51. **TAKS REASONING** A typical cultured black pearl is made by placing a bead with a diameter of 6 millimeters inside an oyster. The resulting pearl has a diameter of about 9 millimeters. *Compare* the volume of the resulting pearl with the volume of the bead.

52. **MULTI-STEP PROBLEM** A can of tennis balls consists of three spheres of radius r stacked vertically inside a cylinder of radius r and height h.

a. Write an expression for the total volume of the three tennis balls in terms of r.

b. Write an expression for the volume of the cylinder in terms of r and h.

c. Write an expression for h in terms of r using the fact that the height of the cylinder is the sum of the diameters of the three tennis balls.

d. What fraction of the can's volume is taken up by the tennis balls?

53. **TAKS REASONING** You can think of a penny as a cylinder with a radius of about 9.53 millimeters and a height of about 1.55 millimeters.

a. **Calculate** Approximate the volume of a penny. Give your answer in cubic meters.

b. **Estimate** Approximate the volume of your classroom in cubic meters. *Explain* how you obtained your answer.

c. **Interpret** Use your results from parts (a) and (b) to estimate how many pennies it would take to fill your classroom. Do you think your answer is an overestimate or an underestimate? *Explain.*

54. **CHALLENGE** Earth's core is approximately spherical in shape and is divided into a solid inner core (the yellow region in the diagram shown) and a liquid outer core (the dark orange region in the diagram).

a. Earth's radius is about 5 times as great as the radius of Earth's inner core. Find the ratio of Earth's total volume to the volume of Earth's inner core.

b. Find the ratio of the volume of Earth's outer core to the volume of Earth's inner core.

MIXED REVIEW FOR TAKS

TAKS PRACTICE at classzone.com

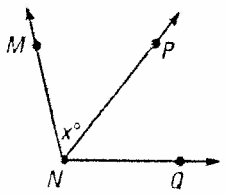
REVIEW Lesson 4.4; TAKS Workbook

55. **TAKS PRACTICE** What are the zeros of the function $y = 2x^2 + 5x - 12$?
TAKS Obj. 5

Ⓐ $-\frac{3}{2}, -4$ Ⓑ $-\frac{3}{2}, 4$ Ⓒ $\frac{3}{2}, -4$ Ⓓ $\frac{3}{2}, 4$

REVIEW Skills Review Handbook p. 994; TAKS Workbook

56. **TAKS PRACTICE** In the diagram, $\overrightarrow{NP}$ bisects $\angle MNQ$ and $m\angle MNP$ is $x°$. Which equation can be used to find y, which represents $m\angle MNQ$?
TAKS Obj. 6



Ⓕ $y = \frac{x}{2}$ Ⓖ $y = x$

Ⓗ $y = 2x$ Ⓙ $y = 180 - x$

GUIDED PRACTICE for Examples 5 and 6

Graph the polynomial function.

9. $f(x) = x^4 + 6x^2 - 3$ 10. $f(x) = -x^3 + x^2 + x - 1$ 11. $f(x) = 4 - 2x^3$

12. **WHAT IF?** If wind speed is measured in miles per hour, the model in Example 6 becomes $E = 0.0051s^4$. Graph this model. What wind speed is needed to generate a wave with 2000 foot-pounds of energy per square foot?

5.2 EXERCISES

HOMEWORK KEY

- ○ = **WORKED-OUT SOLUTIONS** on p. WS1 for Exs. 21, 27, and 57
- = **TAKS PRACTICE AND REASONING** Exs. 24, 37, 50, 52, 59, 61, and 62
- = **MULTIPLE REPRESENTATIONS** Ex. 56

SKILL PRACTICE

1. **VOCABULARY** Identify the degree, type, leading coefficient, and constant term of the polynomial function $f(x) = 6 + 2x^2 - 5x^4$.

2. **WRITING** *Explain* what is meant by the end behavior of a polynomial function.

EXAMPLE 1 on p. 337 for Exs. 3–8

POLYNOMIAL FUNCTIONS **Decide whether the function is a polynomial function. If so, write it in standard form and state its degree, type, and leading coefficient.**

3. $f(x) = 8 - x^2$ 4. $f(x) = 6x + 8x^4 - 3$ 5. $g(x) = \pi x^4 + \sqrt{6}$

6. $h(x) = x^3\sqrt{10} + 5x^{-2} + 1$ 7. $h(x) = -\frac{5}{2}x^3 + 3x - 10$ 8. $g(x) = 8x^3 - 4x^2 + \frac{2}{x}$

EXAMPLE 2 on p. 338 for Exs. 9–14

DIRECT SUBSTITUTION **Use direct substitution to evaluate the polynomial function for the given value of x.**

9. $f(x) = 5x^3 - 2x^2 + 10x - 15; x = -1$ 10. $f(x) = 8x + 5x^4 - 3x^2 - x^3; x = 2$

11. $g(x) = 4x^3 - 2x^5; x = -3$ 12. $h(x) = 6x^3 - 25x + 20; x = 5$

13. $h(x) = x + \frac{1}{2}x^4 - \frac{3}{4}x^3 + 10; x = -4$ 14. $g(x) = 4x^5 + 6x^3 + x^2 - 10x + 5; x = -2$

EXAMPLE 3 on p. 338 for Exs. 15–23

SYNTHETIC SUBSTITUTION **Use synthetic substitution to evaluate the polynomial function for the given value of x.**

15. $f(x) = 5x^3 - 2x^2 - 8x + 16; x = 3$ 16. $f(x) = 8x^4 + 12x^3 + 6x^2 - 5x + 9; x = -2$

17. $g(x) = x^3 + 8x^2 - 7x + 35; x = -6$ 18. $h(x) = -8x^3 + 14x - 35; x = 4$

19. $f(x) = -2x^4 + 3x^3 - 8x + 13; x = 2$ 20. $g(x) = 6x^5 + 10x^3 - 27; x = -3$

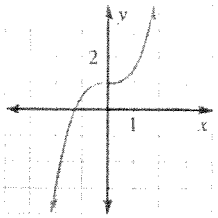
21. $h(x) = -7x^3 + 11x^2 + 4x; x = 3$ 22. $f(x) = x^4 + 3x - 20; x = 4$

23. **ERROR ANALYSIS** *Describe* and correct the error in evaluating the polynomial function $f(x) = -4x^4 + 9x^2 - 21x + 7$ when $x = -2$.

−2	−4	9	−21	7
		8	−34	110
	−4	17	−55	117

EXAMPLE 4
on p. 339
for Exs. 24–27

24. **MULTIPLE CHOICE** The graph of a polynomial function is shown. What is true about the function's degree and leading coefficient?



(A) The degree is odd and the leading coefficient is positive.

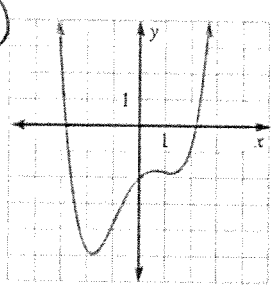
(B) The degree is odd and the leading coefficient is negative.

(C) The degree is even and the leading coefficient is positive.

(D) The degree is even and the leading coefficient is negative.

USING END BEHAVIOR ***Describe*** **the degree and leading coefficient of the polynomial function whose graph is shown.**

25.



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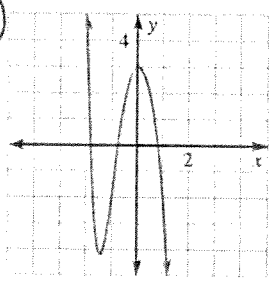

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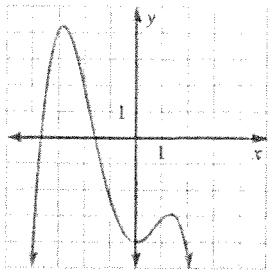


DESCRIBING END BEHAVIOR ***Describe*** **the end behavior of the graph of the polynomial function by completing these statements:** $f(x) \to$ ___?___ **as** $x \to -\infty$ **and** $f(x) \to$ ___?___ **as** $x \to +\infty$.

28. $f(x) = 10x^4$

29. $f(x) = -x^6 + 4x^3 - 3x$

30. $f(x) = -2x^3 + 7x - 4$

31. $f(x) = x^7 + 3x^4 - x^2$

32. $f(x) = 3x^{10} - 16x$

33. $f(x) = -6x^5 + 14x^2 + 20$

34. $f(x) = 0.2x^3 - x + 45$

35. $f(x) = 5x^8 + 8x^7$

36. $f(x) = -x^{273} + 500x^{271}$

37. **TAKS REASONING** Write a polynomial function f of degree 5 such that the end behavior of the graph of f is given by $f(x) \to +\infty$ as $x \to -\infty$ and $f(x) \to -\infty$ as $x \to +\infty$. Then graph the function to verify your answer.

EXAMPLE 5
on p. 340
for Exs. 38–50

GRAPHING POLYNOMIALS **Graph the polynomial function.**

38. $f(x) = x^3$

39. $f(x) = -x^4$

40. $f(x) = x^5 + 3$

41. $f(x) = x^4 - 2$

42. $f(x) = -x^3 + 5$

43. $f(x) = x^3 - 5x$

44. $f(x) = -x^4 + 8x$

45. $f(x) = x^5 + x$

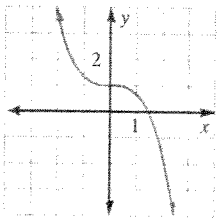
46. $f(x) = -x^3 + 3x^2 - 2x + 5$

47. $f(x) = x^5 + x^2 - 4$

48. $f(x) = x^4 - 5x^2 + 6$

49. $f(x) = -x^4 + 3x^3 - x + 1$

50. **MULTIPLE CHOICE** Which function is represented by the graph shown?



(A) $f(x) = \frac{1}{3}x^3 + 1$ (B) $f(x) = -\frac{1}{3}x^3 + 1$

(C) $f(x) = \frac{1}{3}x^3 - 1$ (D) $f(x) = -\frac{1}{3}x^3 - 1$

51. **VISUAL THINKING** Suppose $f(x) \to +\infty$ as $x \to -\infty$ and $f(x) \to -\infty$ as $x \to +\infty$. *Describe* the end behavior of $g(x) = -f(x)$.

52. **TAKS REASONING** A cubic polynomial function f has leading coefficient 2 and constant term -5. If $f(1) = 0$ and $f(2) = 3$, what is $f(-5)$? *Explain* how you found your answer.

○ = WORKED-OUT SOLUTIONS on p. WS1

= TAKS PRACTICE AND REASONING

= MULTIPLE REPRESENTATIONS

5.3 EXERCISES

HOMEWORK KEY

○ = WORKED-OUT SOLUTIONS on p. WS1 for Exs. 11, 21, and 61

= TAKS PRACTICE AND REASONING Exs. 15, 47, 56, 63, 65, and 66

SKILL PRACTICE

1. **VOCABULARY** When you add or subtract polynomials, you add or subtract the coefficients of ___?___.

2. **WRITING** *Explain* how a polynomial subtraction problem is equivalent to a polynomial addition problem.

EXAMPLES 1 and 2 on p. 346 for Exs. 3–15

ADDING AND SUBTRACTING POLYNOMIALS **Find the sum or difference.**

3. $(3x^2 - 5) + (7x^2 - 3)$
4. $(x^2 - 3x + 5) - (-4x^2 + 8x + 9)$
5. $(4y^2 + 9y - 5) - (4y^2 - 5y + 3)$
6. $(z^2 + 5z - 7) + (5z^2 - 11z - 6)$
7. $(3s^3 + s) + (4s^3 - 2s^2 + 7s + 10)$
8. $(2a^2 - 8) - (a^3 + 4a^2 - 12a + 4)$
9. $(5c^2 + 7c + 1) + (2c^3 - 6c + 8)$
10. $(4t^3 - 11t^2 + 4t) - (-7t^2 - 5t + 8)$
11. $(5b - 6b^3 + 2b^4) - (9b^3 + 4b^4 - 7)$
12. $(3y^2 - 6y^4 + 5 - 6y) + (5y^4 - 6y^3 + 4y)$
13. $(x^4 - x^3 + x^2 - x + 1) + (x + x^4 - 1 - x^2)$
14. $(8v^4 - 2v^2 + v - 4) - (3v^3 - 12v^2 + 8v)$

15. **TAKS REASONING** What is the result when $2x^4 - 8x^2 - x + 10$ is subtracted from $8x^4 - 4x^3 - x + 2$?

   (A) $-6x^4 + 4x^3 - 8x^2 + 8$
   (B) $6x^4 - 4x^3 + 8x^2 - 8$
   (C) $10x^4 - 8x^3 - 4x^2 + 12$
   (D) $6x^4 + 4x^3 - 2x - 8$

EXAMPLE 3 on p. 347 for Exs. 16–25

MULTIPLYING POLYNOMIALS **Find the product of the polynomials.**

16. $x(2x^2 - 5x + 7)$
17. $5x^2(6x + 2)$
18. $(y - 7)(y + 6)$
19. $(3z + 1)(z - 3)$
20. $(w + 4)(w^2 + 6w - 11)$
21. $(2a - 3)(a^2 - 10a - 2)$
22. $(5c^2 - 4)(2c^2 + c - 3)$
23. $(-x^2 + 4x + 1)(x^2 - 8x + 3)$
24. $(-d^2 + 4d + 3)(3d^2 - 7d + 6)$
25. $(3y^2 + 6y - 1)(4y^2 - 11y - 5)$

ERROR ANALYSIS ***Describe*** **and correct the error in simplifying the expression.**

26.
$$(x^2 - 3x + 4) - (x^3 + 7x - 2)$$
$$= x^2 - 3x + 4 - x^3 + 7x - 2$$
$$= -x^3 + x^2 + 4x + 2$$

27.
$$(2x - 7)^3 = (2x)^3 - 7^3$$
$$= 8x^3 - 343$$

EXAMPLE 4 on p. 347 for Exs. 28–37

MULTIPLYING THREE BINOMIALS **Find the product of the binomials.**

28. $(x + 4)(x - 6)(x - 5)$
29. $(x + 1)(x - 7)(x + 3)$
30. $(z - 4)(-z + 2)(z + 8)$
31. $(a - 6)(2a + 5)(a + 1)$
32. $(3p + 1)(p + 3)(p + 1)$
33. $(b - 2)(2b - 1)(-b + 1)$
34. $(2s + 1)(3s - 2)(4s - 3)$
35. $(w - 6)(4w - 1)(-3w + 5)$
36. $(4x - 1)(-2x - 7)(-5x - 4)$
37. $(3q - 8)(-9q + 2)(q - 2)$