RLP-ALG2A · RLP Algebra 2A — Sequences, Polynomials, Rational Functions and Complex Numbers

Unit 2: Polynomials

Practice Workbook. The same problems, in the same order, as the Practice sections of the online lessons.

Name _____ Period _____

Lesson 2.1 — Polynomials as Models: The Open Box

FLUENCY

1. Multiply: $(x - 4)(x^2 - 6x + 1)$

2. Multiply: $(3x - 5)(-3x^2 + 2)$

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

4. Multiply: $(3x - 2)(x^2 + 2x - 1)$

5. Multiply: $(4x - 2)(-x^2 - 3x + 1)$

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

7. Add: $(3x^3 - 2x + 5) + (x^2 + 4x - 7)$.

8. Subtract: $(4x^2 - x + 1) - (2x^3 + x^2 - 6)$.

9. State the degree and leading coefficient of $(2x - 1)(x + 3)^2$.

APPLICATION

10. An open box is folded from a 16 cm by 24 cm sheet by cutting x cm squares from the corners. Write $V(x)$ in expanded form, state the domain, and find $V(3)$.

11. For the box above, use technology to find the cut that gives the largest volume, to the nearest hundredth.

12. A 10 m by 15 m garden in a Springfield park gets a walkway of width x m all around. Write the walkway's area as a polynomial and find the width that makes it 100 m^2.

CHALLENGE

13. If $f(x) = x^2 + 1$ and $g(x) = 2x - 3$, find $f(g(x))$. Is the result a polynomial? Argue whether polynomials are closed under composition.

REVIEW

14. An arithmetic sequence has first term -2 and common difference -3. Write an explicit formula, then find term 19 and the sum of the first 19 terms.

15. A geometric sequence has first term 1 and common ratio 2. Write an explicit formula, then find term 5 and the sum of the first 5 terms.

Lesson 2.2 — Zeros, Multiplicity and End Behavior Lab

FLUENCY

1. Solve: $x^2 + 6x + 9 = 0$
2. Solve: $x^2 - 14x + 45 = 0$
3. Solve: $x^2 + 6x + 5 = 0$
4. Factor: $x^2 - 8x + 7$
5. Factor: $x^2 + x - 20$

6. Describe the end behavior of $p(x) = -3x^5 + 2x^2 - 7$.

7. Describe the end behavior of $q(x) = -(x - 1)^2(x + 2)^2$.

8. List the zeros with multiplicities and the y-intercept of $f(x) = (x - 2)^2(x + 1)(x + 4)$.

9. Factor completely and give all zeros: $x^4 - 10x^2 + 9$.

10. Which end behavior does $y = 2x(x - 3)^3$ have, and does the graph cross or touch at $x = 3$?

APPLICATION

11. Write a polynomial with zeros -2 (multiplicity 2) and 3, whose graph passes through $(0, -24)$.

12. The 16 cm by 24 cm box has $V(x) = x(16 - 2x)(24 - 2x)$. Give its zeros and explain which interval between them is the box's domain.

13. A trail profile is modeled (illustrative) by $h(x) = -0.002x(x - 30)(x - 70)$ meters, for $0 \le x \le 70$. Where is the trail above the reference level ($h > 0$), and where below?

CHALLENGE

14. For $p(x) = x^4 - 5x^2 + 4$, find every interval where $p(x) < 0$ without graphing technology.

REVIEW

15. A geometric sequence has first term 6 and common ratio -2. Write an explicit formula, then find term 9 and the sum of the first 9 terms.

16. Evaluate $6 + 12 + 24 + \ldots + 768$.

Lesson 2.3 — Polynomial Division and the Remainder Theorem

FLUENCY

1. Divide $-2x^3 + 5x^2 + 3x + 3$ by $x + 3$. State the quotient and remainder, and use the remainder to evaluate $p(-3)$.

2. Divide $-2x^3 - x^2 - 7x + 1$ by $x - 4$. State the quotient and remainder, and use the remainder to evaluate $p(4)$.

3. Divide $-x^3 + 7x^2 - 4x + 8$ by $x - 5$. State the quotient and remainder, and use the remainder to evaluate $p(5)$.

4. Divide $3x^3 + x^2 + 2x - 8$ by $x - 5$. State the quotient and remainder, and use the remainder to evaluate $p(5)$.

5. Divide $3x^3 - 5x^2 - 8x - 8$ by $x - 1$. State the quotient and remainder, and use the remainder to evaluate $p(1)$.

6. Divide $3x^3 + 7x^2 + 5x$ by $x + 5$. State the quotient and remainder, and use the remainder to evaluate $p(-5)$.

7. Given that $x = 1$ is a zero, factor $x^3 - 6x^2 + 11x - 6$ completely.

APPLICATION

8. Find k so that $x - 2$ is a factor of $x^3 + kx^2 - 4x + 12$.

9. What is the remainder when $x^{50} - 1$ is divided by $x + 1$?

10. A box's volume is $V(x) = x^3 + 6x^2 + 11x + 6$ cubic inches and one dimension is $x + 1$. Find the other two dimensions and the volume when $x = 4$.

CHALLENGE

11. A polynomial leaves remainder 5 on division by $x - 1$ and remainder 11 on division by $x + 2$. What is its remainder on division by $(x - 1)(x + 2)$?

REVIEW

12. An arithmetic sequence has first term -8 and common difference 3. Write an explicit formula, then find term 15 and the sum of the first 15 terms.

13. An arithmetic sequence has first term -10 and common difference -3. Write an explicit formula, then find term 18 and the sum of the first 18 terms.

Lesson 2.4 — Polynomial Identities and the Binomial Theorem

FLUENCY

1. Multiply: $(x)(x^2 + 6x - 3)$

2. Multiply: $(-x - 2)(-x^2 - 2x + 6)$

3. Multiply: $(3x + 2)(x^2 - 5x + 3)$

4. Multiply: $(-x + 3)(-3x^2 + 3x - 3)$

5. Expand $(x + 2)^4$.

6. Expand $(2x - 3)^3$.

7. Find the coefficient of x^3 in $(x + 3)^7$.

8. Factor $8x^3 + 27$.

APPLICATION

9. Use $(x^2 - y^2, 2xy, x^2 + y^2)$ to generate triples from $(x, y) = (6, 1)$ and $(5, 4)$. Verify one.

10. Estimate 1.02^8 with the first three terms of the binomial expansion and compare with a calculator.

11. Use $a^2 - b^2 = (a - b)(a + b)$ to compute 97×103 mentally, and explain the identity you used.

CHALLENGE

12. Prove $(a^2 + b^2)(c^2 + d^2) = (ac - bd)^2 + (ad + bc)^2$. Use it with $13 = 2^2 + 3^2$ and $29 = 2^2 + 5^2$ to write 377 as a sum of two squares.

REVIEW

13. A geometric sequence has first term 2 and common ratio 2. Write an explicit formula, then find term 7 and the sum of the first 7 terms.

14. A loan of $6,000 at 0.5% a month for 24 months: find the monthly payment.

Unit 2 checkpoint

1. (x + 2)(x² − 3x + 5) = ?
   A. x³ − x² − x + 10
   B. x³ − 3x² + 5x + 10
   C. x³ + x² − x + 10
   D. x³ − x² + 11x + 10
2. True or false: Polynomials are closed under division.
3. End behavior of p(x) = −x⁴ + 3x?
   A. Up both ends
   B. Down both ends
   C. Up left, down right
   D. Down left, up right
4. At which zero does y = (x − 1)(x + 4)² touch without crossing?
   A. x = 1
   B. x = −4
   C. x = 4
   D. both
5. The y-intercept of y = (x − 2)²(x + 1)(x + 4) is _____.
6. The remainder when x³ − 2x + 7 is divided by x + 3 is _____.
7. If p(5) = 0, then…
   A. x + 5 is a factor
   B. x − 5 is a factor
   C. p has no zeros
   D. p(0) = 5
8. True or false: A polynomial of degree 4 can have 5 different zeros.
9. The coefficient of x² in (x + 2)⁵ is _____.

10. Which triple does the identity give for x = 4, y = 1?
    A. 15, 8, 17
    B. 16, 4, 17
    C. 15, 4, 17
    D. 3, 4, 5
11. True or false: Checking an equation at five values of x proves it is an identity.
12. A quartic fit has R² = 0.99 on a year of reservoir data. Using it to predict two years ahead is…
    A. reliable because R² is high
    B. unreliable: end behavior of the leading term takes over outside the data
    C. reliable if the quartic is positive
    D. only wrong for cubics

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