

Algebra 2 • Unit 2 Worksheet

Polynomial Functions

Name: _____

Date: _____

Polynomials extend linear and quadratic functions. You will work with factored, standard, and zero-product forms; reason about end behavior, multiplicity, and zeros; and learn polynomial division.

Part A • Identifying Polynomials

1. For each expression, decide if it is a polynomial. If yes, give its degree and leading coefficient. If no, explain why not.

a. $3x^4 - 5x^2 + 7$ Polynomial? ☐ Y ☐ N Degree: ____ Leading coef: ____

b. $2x^3 - \sqrt{x} + 1$ Polynomial? ☐ Y ☐ N Why or why not?

c. $(x - 2)(x + 1)(x - 5)$ Polynomial? ☐ Y ☐ N Degree: ____ Leading coef: ____

d. $x^{-2} + 4x$ Polynomial? ☐ Y ☐ N Why or why not?

Part B • Factors, Zeros, and Graphs

2. Let $p(x) = (x + 3)(x - 1)^2(x - 4)$.

a. List the zeros and their multiplicities.

b. What is the degree of p ? The leading coefficient (when expanded)? _____

c. Describe the end behavior using arrows or words.

d. Sketch a possible graph below. Mark all x-intercepts and the y-intercept.

<i>Sketch the graph of $p(x)$. Label x- and y-intercepts.</i>

Part C • Multiplicity Probe

3. At a zero of multiplicity 2, does the graph CROSS the x-axis or TOUCH and bounce back?

☐ Cross ☐ Touch and bounce ☐ Depends

Explain why — what does multiplicity 2 mean for the behavior near that zero?

What about multiplicity 3? Multiplicity 1?

Part D • Two Methods

4. Solve the polynomial equation $2x^3 - 8x = 0$ using TWO different methods.

Method 1: Factor	Method 2: Graph

Which method was faster here? When would the OTHER method be better?

Part E • Polynomial Division and the Remainder Theorem

5. Use polynomial division (long division or area model) to divide.

a. $(x^3 - 6x^2 + 11x - 6) \div (x - 1)$. Quotient: _____ Remainder: _____

b. What does the remainder tell you about whether $(x - 1)$ is a factor?

c. List ALL zeros of $p(x) = x^3 - 6x^2 + 11x - 6$.

6. If $p(2) = 0$, what can you conclude about $p(x)$? State the principle precisely.

Part F • Building Polynomials Backward

7. Write an equation for a polynomial that has zeros at $x = -2$, $x = 3$ (multiplicity 2), and passes through the point $(0, 36)$.

a. Start in factored form: $p(x) = a(x \text{ ____})(x \text{ ____})^2$

b. Use the point $(0, 36)$ to find a .

c. Final answer:

Part G • Error Analysis

8. Mai is solving $x^2 - 9 = 0$ and writes: " $x^2 = 9$ so $x = 3$." Is Mai correct?

☐ Yes ☐ No — Explain. What did she miss?

9. Diego claims that $(x + 1)(x - 2)$ and $(x - 1)(x + 2)$ are the same polynomial because they have the same factors. Is he right? Show why or why not by expanding both.

Part H • End Behavior Reflection

10. Why does the LEADING TERM of a polynomial determine its end behavior, but not its behavior in the middle? Explain with both algebra and graphs.
