

Polynomial Functions: Zeros, Ends, and Graphs

Grade 11 – Algebra 2 math · Worksheet · Standards: F-IF.C.7c, A-APR.B.3, F-IF.B.4

Name: _____ Date: _____ Class: _____

These problems cover the structure and graphs of polynomial functions: degree, leading coefficient, zeros, multiplicity, turning points, and modeling. They align with Common Core standards F-IF.C.7c, A-APR.B.3, and F-IF.B.4.

Early problems read information from factored forms and graphs; later ones build polynomials from conditions and use cubic models for volume and track height. Use the sign of the leading coefficient and the parity of the degree to check every sketch.

Standards: F-IF.C.7c, A-APR.B.3, F-IF.B.4 · **Level:** Grade 11 Algebra 2

Problem 1 Degree and leading coefficient (easy)

For each polynomial, state the degree, the leading coefficient, and its name by degree.

- a. $5x^4 - 2x^2 + 7$
- b. $-3x^3 + x$
- c. $8 - x + 6x^5$
- d. $-x^2 + 4x^6 - 10$

Problem 2 End behavior (easy)

Describe the end behavior of each function using the degree and leading coefficient.

- a. $-2x^4 + 7x - 1$
- b. $x^3 - 5x$
- c. $-x^5 + 3x^2$
- d. $6x^2 + 4x$

Problem 3 Zeros from factored form (easy)

Find all zeros of each function.

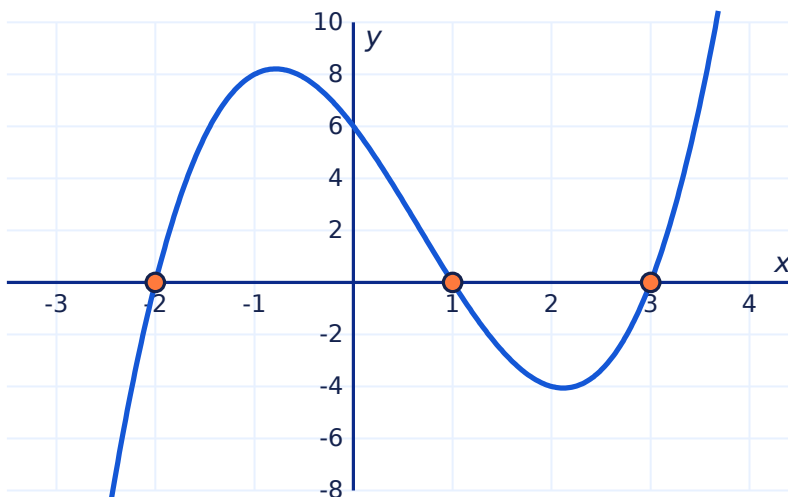
- a. $f(x) = (x - 4)(x + 7)(2x - 5)$
- b. $g(x) = x^2(x + 3)$

Problem 4 Multiplicity (easy)

For $f(x) = (x + 7)^3(x - 3)^2(x - 8)$, list each zero with its multiplicity, state the degree, and tell whether the graph crosses or touches the axis at each zero.

Problem 5 Reading a polynomial graph (easy)

The graph of a polynomial is shown. State its zeros, the number of turning points, and the least possible degree.



A polynomial graph.

Problem 6 Factoring out a common factor (medium)

Find the zeros of each function.

a. $f(x) = x^3 - 9x$

b. $g(x) = x^3 + 4x^2 - 21x$

Problem 7 Quadratic form (medium)

Find all zeros of $f(x) = x^4 - 17x^2 + 16$.

Problem 8 Factoring by grouping (medium)

Find the zeros of $f(x) = x^3 + 2x^2 - 25x - 50$.

Problem 9 Writing a polynomial from its zeros (medium)

Write a polynomial with leading coefficient 1 and zeros -3 , 2 , and 6 . Give the answer in

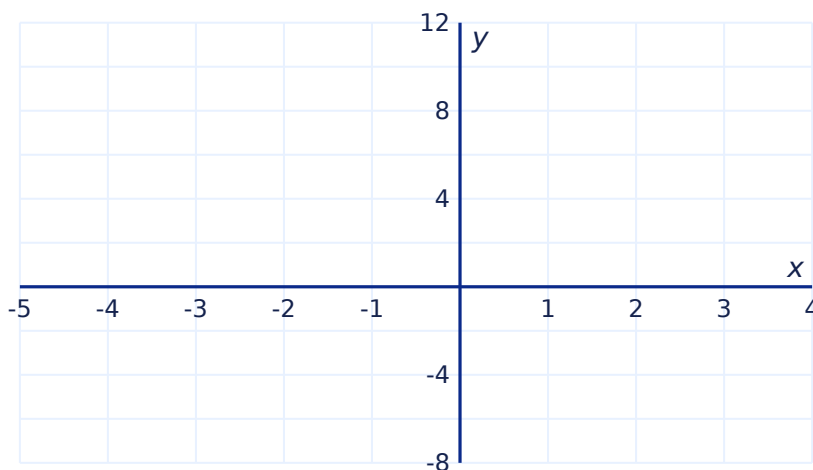
standard form.

Problem 10 Using a point to find the leading coefficient (medium)

A polynomial has a zero of multiplicity 2 at $x = -1$, a zero of multiplicity 1 at $x = 4$, and $f(0) = -12$. Write the function in factored form.

Problem 11 Sketching from factored form (medium)

Sketch the graph of $f(x) = (x + 3)(x - 1)^2$. Mark the zeros, the y-intercept, and the end behavior.



Grid for the sketch.

Problem 12 Sign of a polynomial (medium)

For $f(x) = (x + 4)(x - 1)(x - 5)$, decide whether f is positive or negative on each interval: $x < -4$, $-4 < x < 1$, $1 < x < 5$, and $x > 5$.

Problem 13 Turning points and zeros (medium)

A polynomial function has degree 6. What is the greatest number of turning points it can have? What is the greatest number of real zeros? Can it have no real zeros? Give an example.

Problem 14 Where is the function positive? (hard)

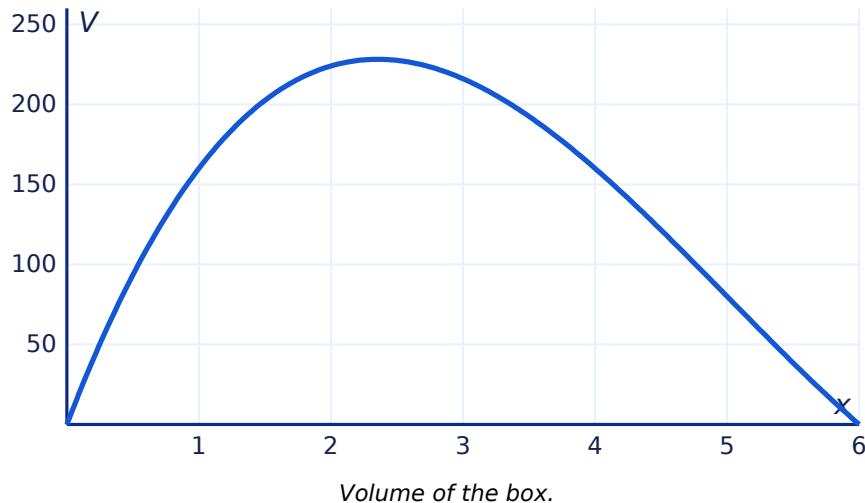
For $f(x) = -x^2(x - 3)(x + 6)$, find the zeros with multiplicities, describe the end behavior, and state where $f(x) > 0$.

Problem 15 Finding all zeros of a cubic (hard)

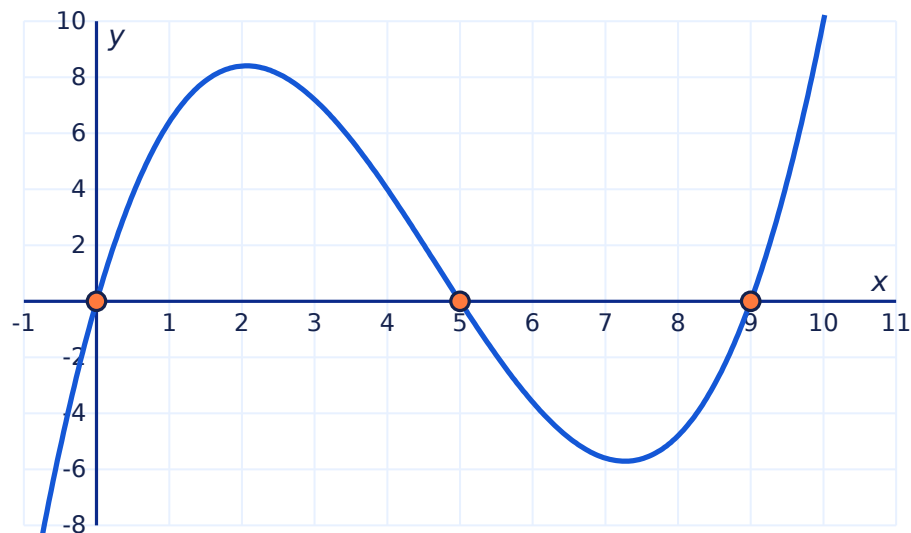
Show that -2 is a zero of $f(x) = 2x^3 - 3x^2 - 11x + 6$, and then find the other zeros.

Problem 16 An open box from a sheet (hard)

A sheet of cardboard 12 inches by 18 inches has a square of side x inches cut from each corner, and the sides are folded up to make an open box. Write the volume $V(x)$ in standard form, state the domain, and use the graph to estimate the greatest volume.

**Problem 17 A tunnel in a roller coaster** (hard)

A roller coaster track has height $h(x) = 0.2x(x - 5)(x - 9)$ feet relative to ground level, where x is the horizontal distance in tens of feet. The track enters a tunnel below ground level. Find the zeros, the interval where the track is below ground, and the height when $x = 7$.



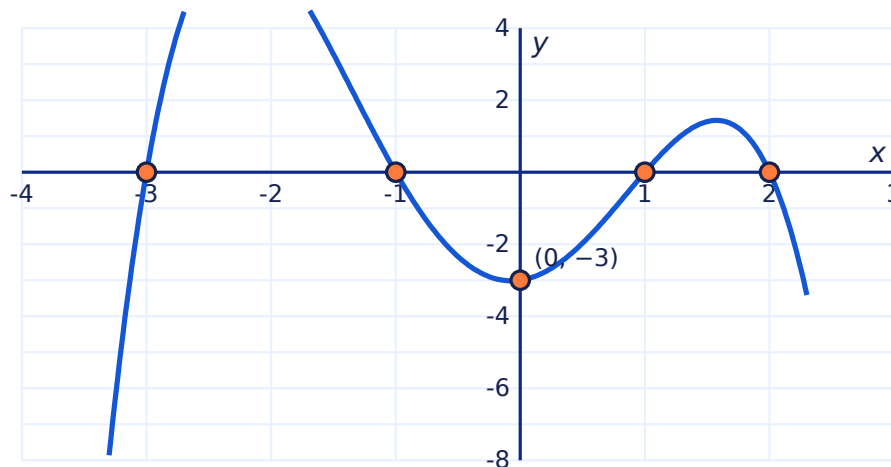
Track height.

Problem 18 A cubic through a point (hard)

A cubic polynomial has zeros -2 , 1 , and 4 and passes through the point $(2, -16)$. Write its equation in factored form and in standard form.

Problem 19 Identifying a function from its graph (hard)

The graph shows a polynomial with all of its zeros. Give the least possible degree, the sign of the leading coefficient, and a factored equation that fits the graph.



Polynomial graph.

Problem 20 Analyzing a polynomial without graphing (hard)

For $g(x) = 2(x - 1)(x + 2)^2(x - 5)^3$, find the degree, the leading coefficient, the end behavior, the behavior at each zero, and the y-intercept.