Factored Polynomial Graphs

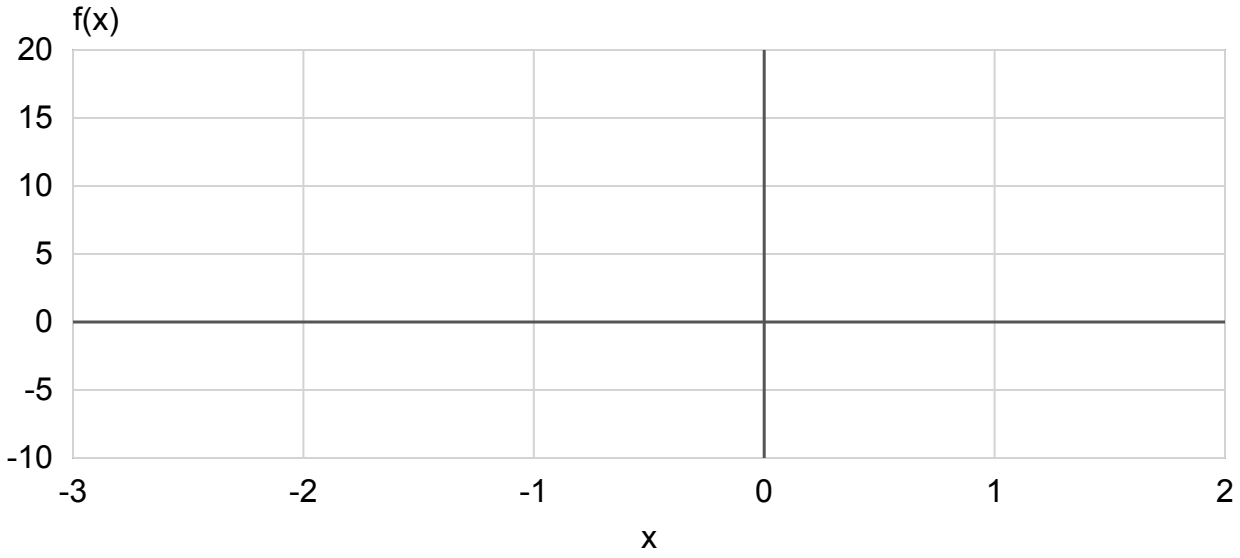
Use factors to graph zeros, intercepts, multiplicity behavior, and end behavior

Name: _____ Date: _____

Part 1 - A positive-leading cubic

Listen: Your teacher will read a short launch. Then complete the table and graph **$f(x) = (x + 2)^2(x - 1)$**. Plot your table points, sketch one smooth curve, and add arrows to show the curve continues.

x	-3	-2.5	-2	-1	0	1	1.5	2
f(x)								



Reasoning box: State the zeros and x-intercepts. Tell which zero touches and which crosses, using multiplicity. Give the y-intercept and both end behaviors.

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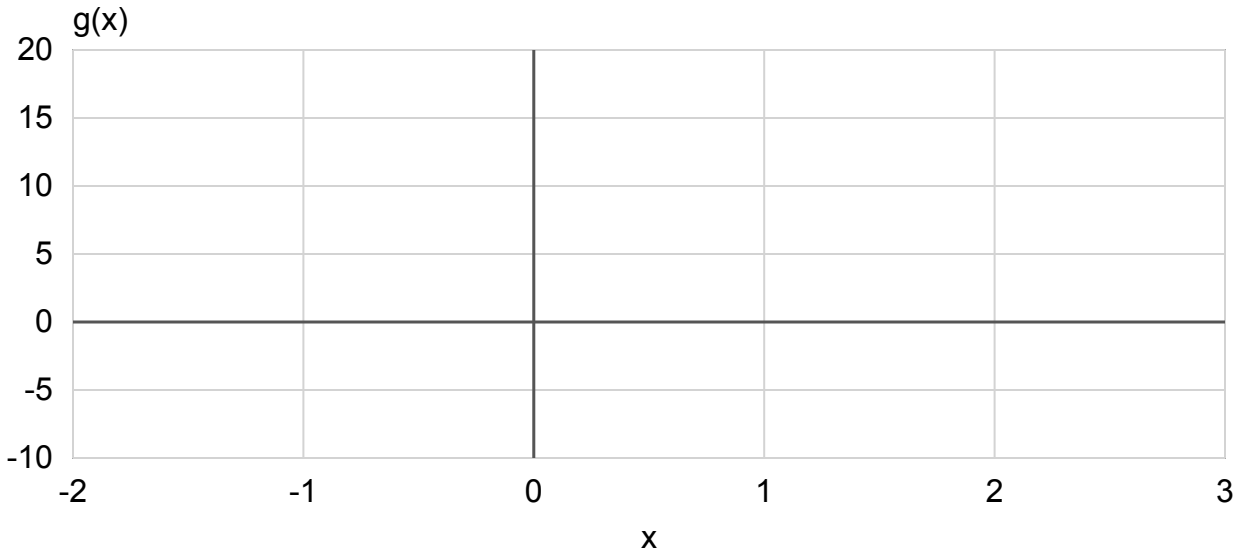
Use factors to graph zeros, intercepts, multiplicity behavior, and end behavior

Name: _____ Date: _____

Part 2 - A negative-leading cubic

Complete the table and graph **$g(x) = -(x + 1)(x - 2)^2$**. Plot your table points, sketch one smooth curve, and add arrows to show the curve continues.

x	-2	-1.5	-1	0	1	2	2.5	3
g(x)								



Reasoning box: State the zeros and x-intercepts. Tell which zero crosses and which touches, using multiplicity. Give the y-intercept and both end behaviors.

Factored Polynomial Graphs

Use factors to graph zeros, intercepts, multiplicity behavior, and end behavior

Answer key and teaching notes - Part 1

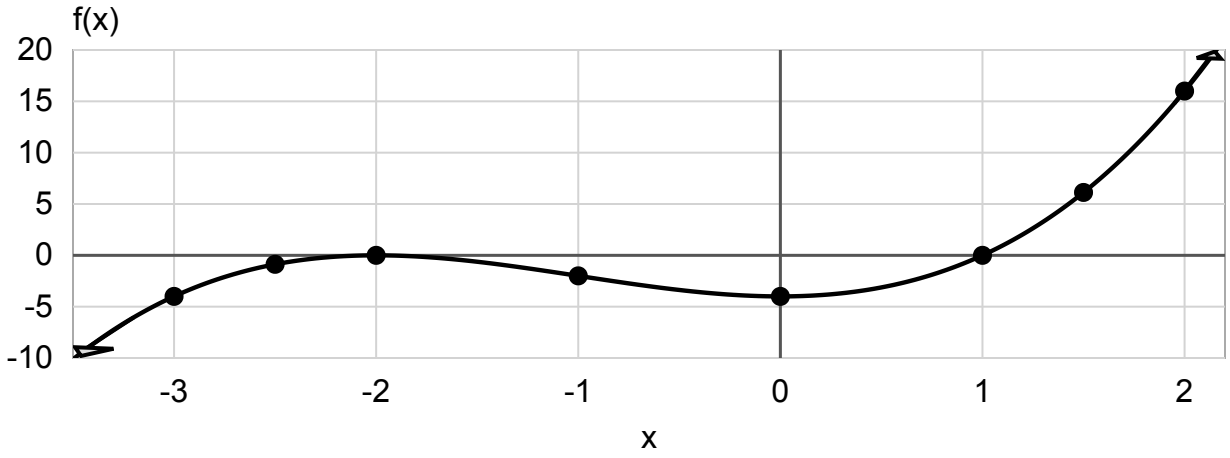
Materials: Student pages, pencils, and rulers or straightedges. Optional: graphing technology for a check after hand graphing. **Setup:** Print and supply all student pages, keeping teacher-key pages separate. Students work on Part 1 before turning to Part 2. Require a plotted table point at every listed x-value and arrows on both ends of each curve.

Teacher-read launch: “A factor tells where a polynomial is zero. Its exponent tells whether the curve usually crosses the x-axis or turns around there. Today, use factors, a table, and end behavior together. Your sketch should be a smooth curve, not connected line segments.”

Observation method: While students work, use this checklist: (1) substitutes accurately in the table; (2) marks both x-intercepts; (3) identifies the squared factor as a touch; (4) gives end behavior from the leading term; (5) draws a smooth curve consistent with points and behavior. Ask a student who connects points with straight segments: “What must the curve do at the squared zero?”

1. Table: f(-3) = -4; f(-2.5) = -0.875; f(-2) = 0; f(-1) = -2; f(0) = -4; f(1) = 0; f(1.5) = 6.125; f(2) = 16.

1. Reasoning/graph rubric: Zeros are x = -2 (multiplicity 2) and x = 1 (multiplicity 1). X-intercepts: (-2, 0) and (1, 0). The graph touches and turns at x = -2 and crosses at x = 1. The y-intercept is (0, -4). Since $f(x) = x^3 + 3x^2 - 4$ has positive leading coefficient, f(x) approaches negative infinity as x approaches negative infinity and positive infinity as x approaches positive infinity. Award full credit for a smooth graph through the table points with these intercept and end behaviors. The continuation arrows on the model curve point down-left and up-right.



Source credit: New York State Next Generation Mathematics, AII-F.IF.7.c task wording supplied in the assignment contract: https://lessonmakerpro.com/standards/ny-nextgen-math/aii-f-if-7-c

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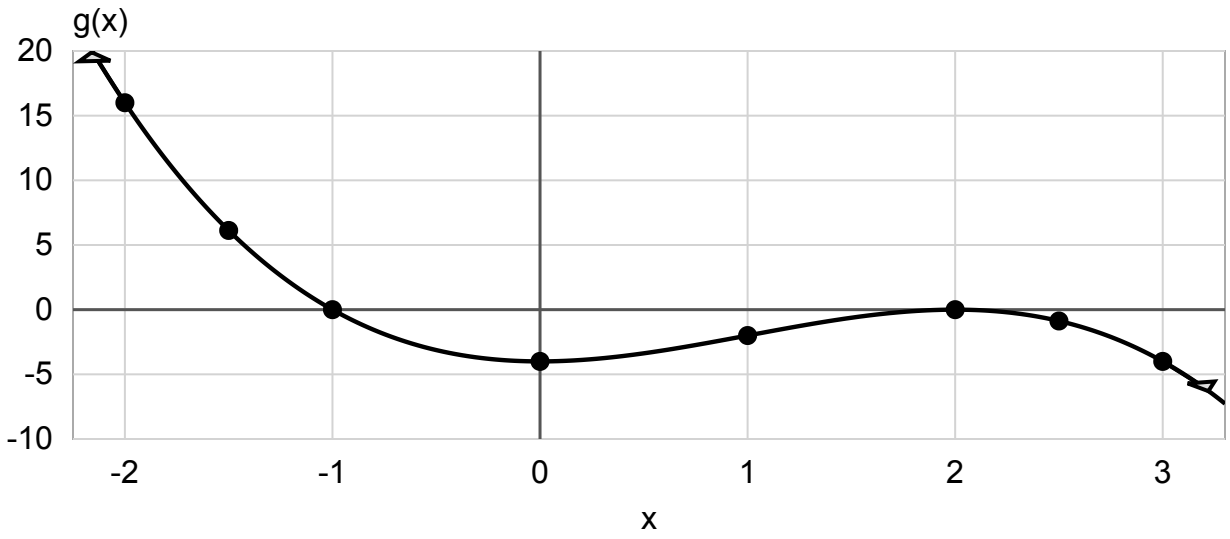
Use factors to graph zeros, intercepts, multiplicity behavior, and end behavior

Answer key - Part 2

2. Table: g(-2) = 16; g(-1.5) = 6.125; g(-1) = 0; g(0) = -4; g(1) = -2; g(2) = 0; g(2.5) = -0.875; g(3) = -4.

2. Reasoning/graph rubric: Zeros are x = -1 (multiplicity 1) and x = 2 (multiplicity 2). X-intercepts: (-1, 0) and (2, 0). The graph crosses at x = -1 and touches and turns at x = 2. The y-intercept is (0, -4). Since $g(x) = -x^3 + 3x^2 - 4$ has negative leading coefficient, g(x) approaches positive infinity as x approaches negative infinity and negative infinity as x approaches positive infinity. Award full credit for a smooth graph through the table points with these intercept and end behaviors. The continuation arrows on the model curve point up-left and down-right.

Teaching follow-up: If a student says the graph crosses at x = 2, direct attention to the even exponent in $(x - 2)^2$ and ask for the sign of g(x) at x = 1 and x = 2.5. Both are negative, so the curve stays below the x-axis on both sides and only touches at (2, 0).



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