This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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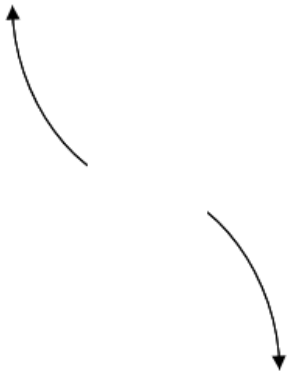
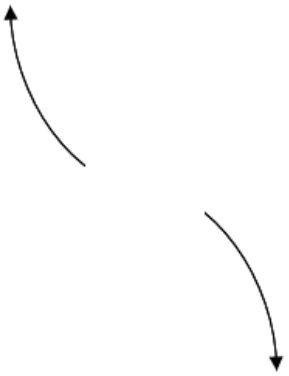
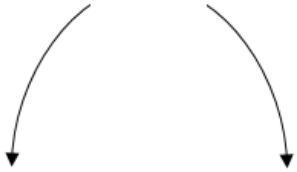
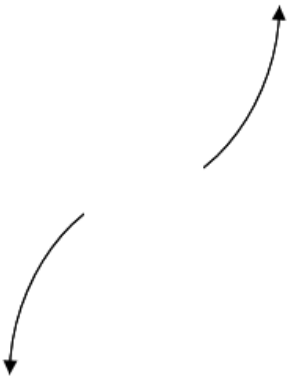
1. Describe the end behavior of the polynomial below.

$$f(x) = -4(x-9)^2(x+9)^5(x-6)^2(x+6)^4$$

The solution is



A. 	**B.** 
C. 	**D.** 
E. None of the figures above.	

A. The function is above the x-axis, then passes through.

B. The function is below the x-axis, then touches.

C. The function is above the x-axis, then touches.

D. The function is below the x-axis, then passes through.

General Comment: General Comments: Remember that end behavior is determined by the leading coefficient AND whether the **sum** of the multiplicities is positive or negative.

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2. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $x^3 + bx^2 + cx + d$.

$$-2 + 3i \text{ and } x + 1$$

The solution is $x^3 + 3x^2 + 9x - 13$

A. $b \in [-1.4, 2.7], c \in [-5.4, -1.8],$ and $d \in [-1, 11]$

$x^3 + x^2 - 4x + 3$, which corresponds to multiplying out $(x - 3)(x - 1)$.

B. $b \in [-1.4, 2.7], c \in [-3.3, 4],$ and $d \in [-6, -1]$

$x^3 + x^2 + x - 2$, which corresponds to multiplying out $(x + 2)(x - 1)$.

C. $b \in [-3.9, -0.8], c \in [8.2, 12.3],$ and $d \in [9, 21]$

$x^3 - 3x^2 + 9x + 13$, which corresponds to multiplying out $(x - (-2 + 3i))(x - (-2 - 3i))(x + 1)$.

D. $b \in [2, 6.8], c \in [8.2, 12.3],$ and $d \in [-15, -10]$

* $x^3 + 3x^2 + 9x - 13$, which is the correct option.

E. None of the above.

This corresponds to making an unanticipated error or not understanding how to use nonreal complex numbers to create the lowest-degree polynomial. If you chose this and are not sure what you did wrong, please contact the coordinator for help.

General Comment: Remember that the conjugate of $a + bi$ is $a - bi$. Since these zeros always come in pairs, we need to multiply out $(x - (-2 + 3i))(x - (-2 - 3i))(x - (x + 1))$.

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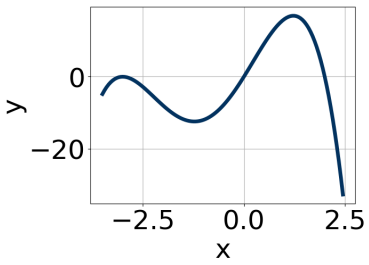
3. Which of the following equations *could* be of the graph presented below?



The solution is $-18x^9(x + 3)^4(x - 2)^{11}$

A. $11x^{11}(x + 3)^8(x - 2)^7$

This corresponds to the leading coefficient being the opposite value than it should be.

B. $-18x^9(x + 3)^4(x - 2)^{11}$

* This is the correct option.

C. $-18x^{10}(x + 3)^{10}(x - 2)^{11}$

The factor x should have an odd power.

D. $15x^7(x + 3)^6(x - 2)^{10}$

The factor $(x - 2)$ should have an odd power and the leading coefficient should be the opposite sign.

E. $-11x^6(x + 3)^9(x - 2)^5$

The factor -3 should have an even power and the factor 0 should have an odd power.

General Comment: General Comments: Draw the x-axis to determine which zeros are touching (and so have even multiplicity) or cross (and have odd multiplicity).

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4. Construct the lowest-degree polynomial given the zeros below. Then, choose the intervals that contain the coefficients of the polynomial in the form $ax^3 + bx^2 + cx + d$.

$$\frac{4}{5}, \frac{3}{4}, \text{ and } \frac{3}{2}$$

The solution is $40x^3 - 122x^2 + 117x - 36$

A. $a \in [37, 42], b \in [-131, -109], c \in [116, 124],$ and $d \in [-40, -34]$

* $40x^3 - 122x^2 + 117x - 36$, which is the correct option.

B. $a \in [37, 42], b \in [116, 124], c \in [116, 124],$ and $d \in [32, 40]$

$40x^3 + 122x^2 + 117x + 36$, which corresponds to multiplying out $(5x + 4)(4x + 3)(2x + 3)$.

C. $a \in [37, 42], b \in [-131, -109], c \in [116, 124],$ and $d \in [32, 40]$

$40x^3 - 122x^2 + 117x + 36$, which corresponds to multiplying everything correctly except the constant term.

D. $a \in [37, 42], b \in [-62, -57], c \in [-28, -24],$ and $d \in [32, 40]$

$40x^3 - 58x^2 - 27x + 36$, which corresponds to multiplying out $(5x + 5)(4x - 4)(2x - 2)$.

E. $a \in [37, 42], b \in [-2, 6], c \in [-72, -67],$ and $d \in [-40, -34]$

$40x^3 + 2x^2 - 69x - 36$, which corresponds to multiplying out $(5x + 5)(4x + 4)(2x - 2)$.

General Comment: General Comments: To construct the lowest-degree polynomial, you want to multiply out $(5x - 4)(4x - 3)(2x - 3)$

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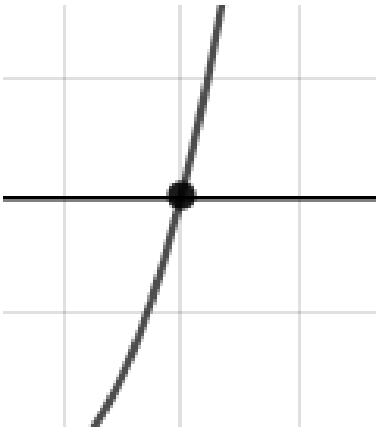
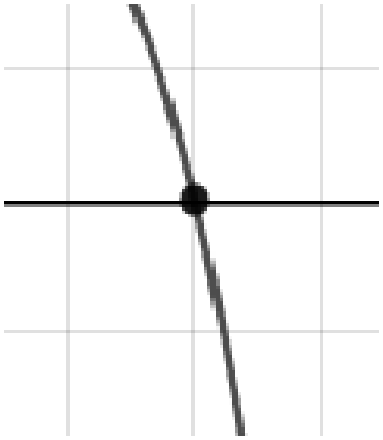
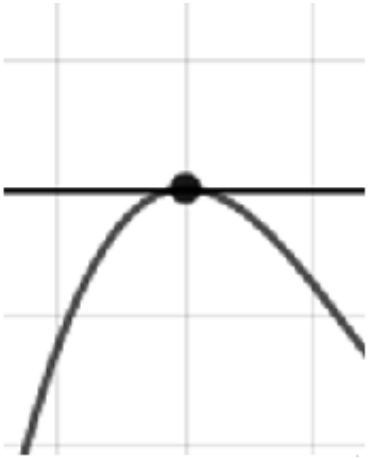
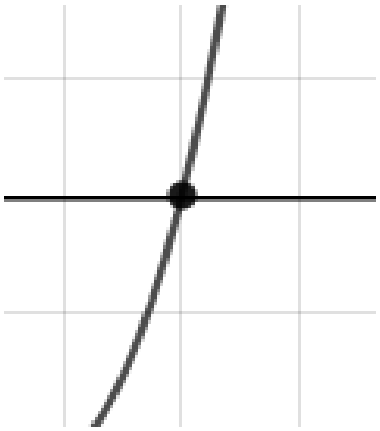
0. Describe the zero behavior of the zero $x = 9$ of the polynomial below.

$$f(x) = 7(x + 9)^4(x - 9)^7(x + 6)^7(x - 6)^8$$

The solution is



A. 	**B.** 
C. 	**D.** 
E. None of the figures above.	

A.

B.

C.

D.

General Comment: General Comments: You will need to sketch the entire graph, then zoom in on the zero the question asks about.