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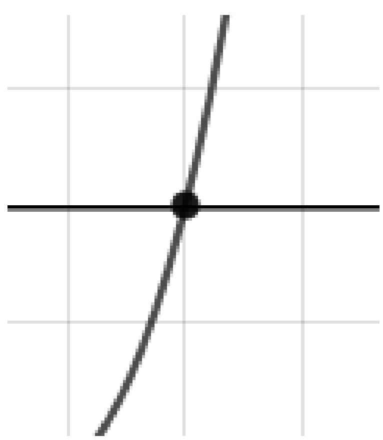
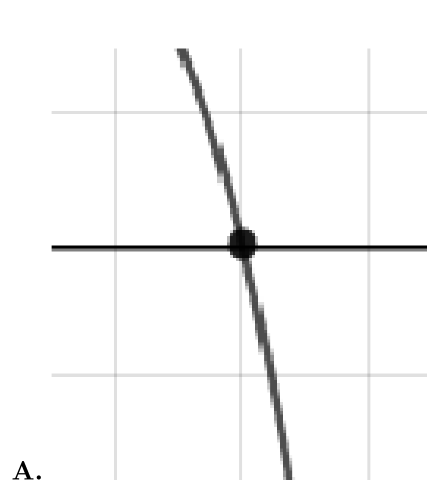
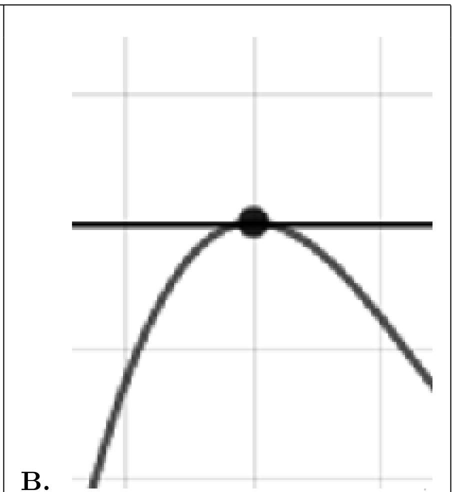
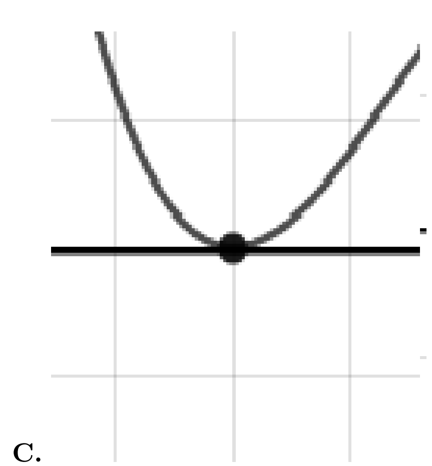
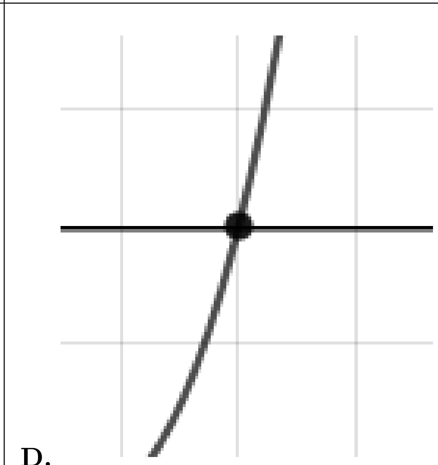
1. Describe the zero behavior of the zero $x = 9$ of the polynomial below.

$$f(x) = 9(x+5)^8(x-5)^4(x-9)^{11}(x+9)^6$$

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.

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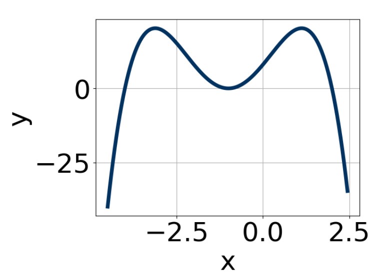
2. Which of the following equations *could* be of the graph presented below?



The solution is $-13(x+1)^8(x+4)^5(x-2)^9$

A. $-2(x+1)^9(x+4)^8(x-2)^7$

The factor -1 should have an even power and the factor -4 should have an odd power.

B. $-10(x+1)^8(x+4)^8(x-2)^5$

The factor $(x+4)$ should have an odd power.

C. $-13(x+1)^8(x+4)^5(x-2)^9$

* This is the correct option.

D. $14(x+1)^4(x+4)^9(x-2)^4$

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

E. $13(x+1)^6(x+4)^9(x-2)^7$

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

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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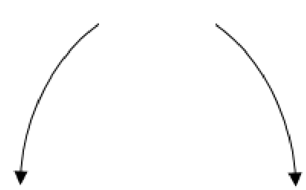
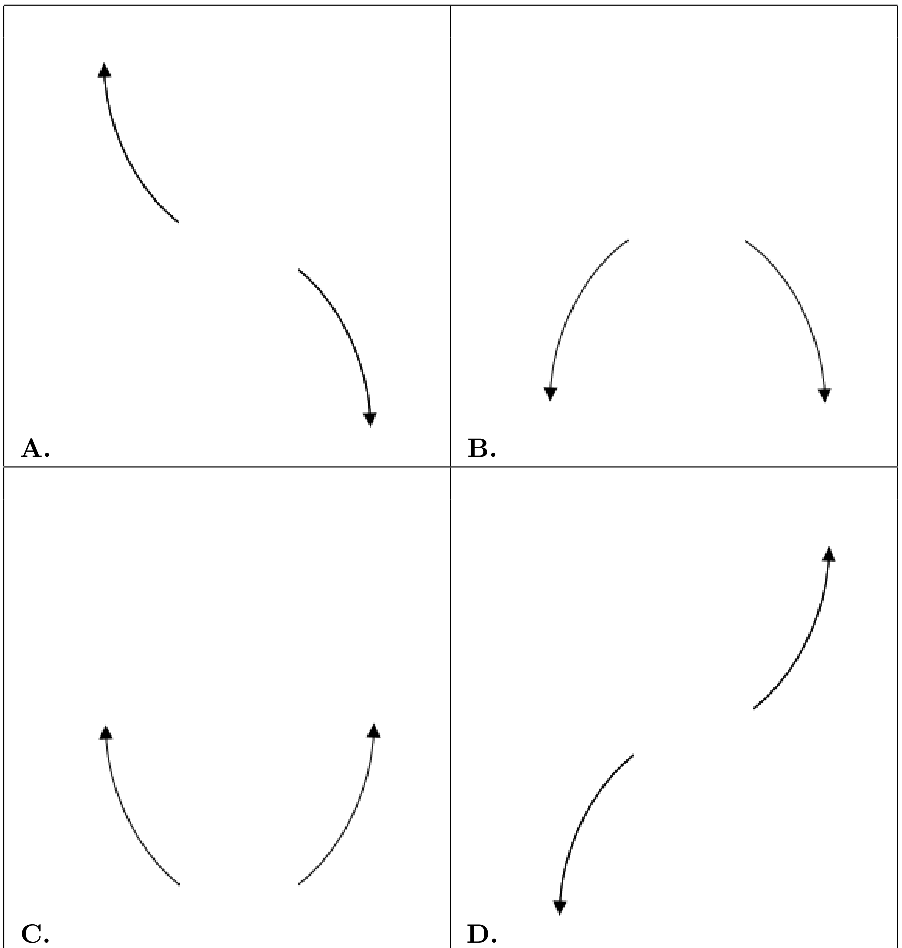
3. Describe the end behavior of the polynomial below.

$$f(x) = -4(x+3)^4(x-3)^5(x+8)^4(x-8)^5$$

The solution is





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

$$\frac{-7}{5}, \frac{7}{3}, \text{ and } \frac{-2}{3}$$

The solution is $45x^3 - 12x^2 - 175x - 98$

A. $a \in [35, 48], b \in [6, 14], c \in [-180, -167], \text{ and } d \in [93, 104]$

   $45x^3 + 12x^2 - 175x + 98$, which corresponds to multiplying out $(5x - 7)(3x + 7)(3x - 2)$.

B. $a \in [35, 48], b \in [-14, -6], c \in [-180, -167], \text{ and } d \in [-100, -90]$

   * $45x^3 - 12x^2 - 175x - 98$, which is the correct option.

C. $a \in [35, 48], b \in [-141, -136], c \in [30, 43],$ and $d \in [93, 104]$

$45x^3 - 138x^2 + 35x + 98$, which corresponds to multiplying out $(5x + 5)(3x - 3)(3x - 3)$.

D. $a \in [35, 48], b \in [71, 76], c \in [-126, -112],$ and $d \in [-100, -90]$

$45x^3 + 72x^2 - 119x - 98$, which corresponds to multiplying out $(5x + 5)(3x + 3)(3x - 3)$.

E. $a \in [35, 48], b \in [-14, -6], c \in [-180, -167],$ and $d \in [93, 104]$

$45x^3 - 12x^2 - 175x + 98$, which corresponds to multiplying everything correctly except the constant term.

General Comment: General Comments: To construct the lowest-degree polynomial, you want to multiply out $(5x + 7)(3x - 7)(3x + 2)$

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

$$4 + 2i \text{ and } x - 3$$

The solution is $x^3 - 5x^2 - 4x + 60$

A. $b \in [-6.9, -3.4], c \in [-9.6, -2.8],$ and $d \in [57, 63]$

* $x^3 - 5x^2 - 4x + 60$, which is the correct option.

B. $b \in [0.7, 1.6], c \in [-2.7, -0.1],$ and $d \in [-17, -7]$

$x^3 + x^2 - x - 12$, which corresponds to multiplying out $(x - 4)(x + 3)$.

C. $b \in [0.7, 1.6], c \in [0.2, 2.5],$ and $d \in [-7, -2]$

$x^3 + x^2 + x - 6$, which corresponds to multiplying out $(x - 2)(x + 3)$.

D. $b \in [3.6, 7.9], c \in [-9.6, -2.8],$ and $d \in [-67, -52]$

$x^3 + 5x^2 - 4x - 60$, which corresponds to multiplying out $(x - (4 + 2i))(x - (4 - 2i))(x - 3)$.

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 $(x - (4 + 2i))(x - (4 - 2i))(x - (x - 3))$.
