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

$$4 - 5i \text{ and } 4$$

The solution is $x^3 - 12x^2 + 73x - 164$

A. $b \in [-17, -8], c \in [72, 75],$ and $d \in [-165, -158]$

* $x^3 - 12x^2 + 73x - 164$, which is the correct option.

B. $b \in [0, 3], c \in [-7, 4],$ and $d \in [-27, -16]$

$x^3 + x^2 + x - 20$, which corresponds to multiplying out $(x + 5)(x - 4)$.

C. $b \in [9, 17], c \in [72, 75],$ and $d \in [162, 169]$

$x^3 + 12x^2 + 73x + 164$, which corresponds to multiplying out $(x - (4 - 5i))(x - (4 + 5i))(x + 4)$.

D. $b \in [0, 3], c \in [-9, -4],$ and $d \in [10, 22]$

$x^3 + x^2 - 8x + 16$, which corresponds to multiplying out $(x - 4)(x - 4)$.

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 Comments: Remember that the conjugate of $a + bi$ is $a - bi$. Since these zeros always come in pairs, we need to multiply out $(x - (4 - 5i))(x - (4 + 5i))(x - (4))$.

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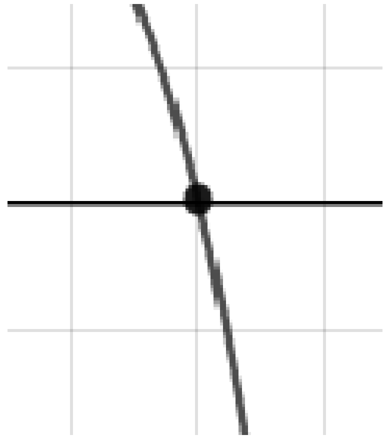
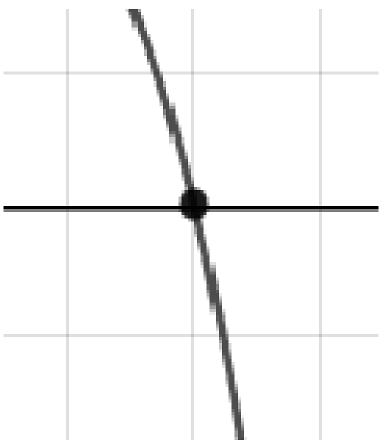
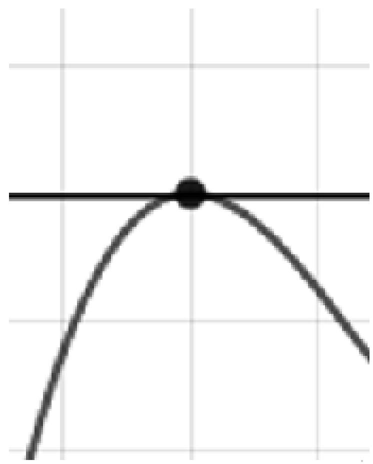
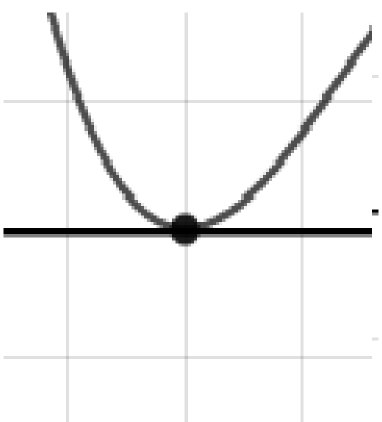
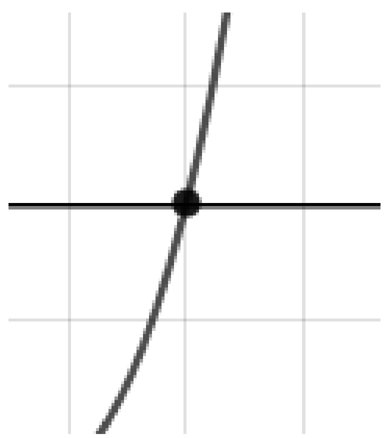
27. Describe the zero behavior of the zero $x = 9$ of the polynomial below.

$$f(x) = -7(x - 3)^{10}(x + 3)^8(x - 9)^5(x + 9)^2$$

The solution is



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

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

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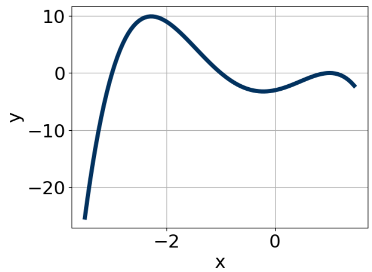
28. Which of the following equations *could* be of the graph presented below?



The solution is $-6(x-1)^6(x+3)^7(x+1)^7$

A. $-6(x-1)^{10}(x+3)^8(x+1)^9$

The factor $(x+3)$ should have an odd power.

B. $19(x-1)^{10}(x+3)^{11}(x+1)^7$

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

C. $-6(x-1)^6(x+3)^7(x+1)^7$

* This is the correct option.

D. $-2(x-1)^9(x+3)^{10}(x+1)^{11}$

The factor 1 should have an even power and the factor -3 should have an odd power.

E. $4(x-1)^{10}(x+3)^9(x+1)^6$

The factor $(x+1)$ should have an odd power and the leading coefficient should be the opposite sign.

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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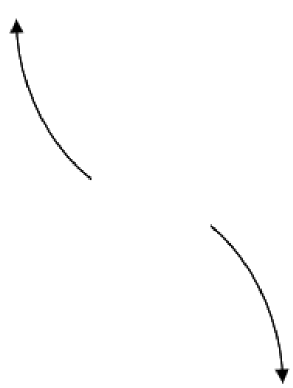
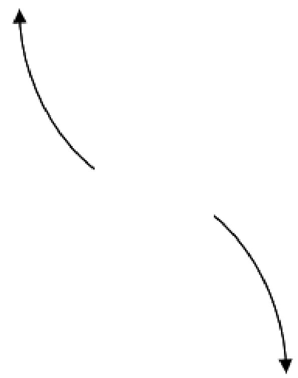
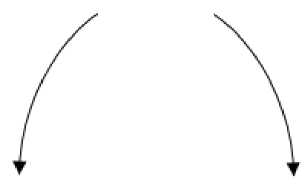
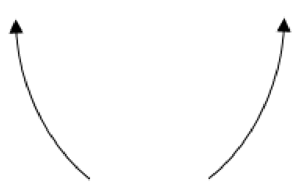
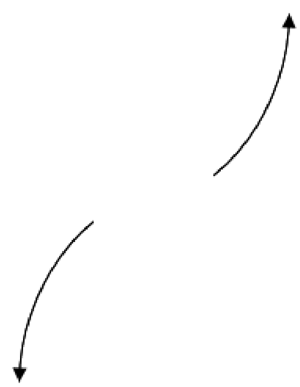
29. Describe the end behavior of the polynomial below.

$$f(x) = -3(x-7)^5(x+7)^{10}(x+4)^2(x-4)^4$$

The solution is



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

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

$$\frac{1}{2}, \frac{6}{5}, \text{ and } \frac{5}{3}$$

The solution is $30x^3 - 101x^2 + 103x - 30$

A. $a \in [29, 35], b \in [-102, -98], c \in [102, 106],$ and $d \in [-36, -28]$

   * $30x^3 - 101x^2 + 103x - 30$, which is the correct option.

B. $a \in [29, 35], b \in [100, 103], c \in [102, 106],$ and $d \in [25, 33]$

   $30x^3 + 101x^2 + 103x + 30$, which corresponds to multiplying out $(2x + 1)(5x + 6)(3x + 5)$.

C. $a \in [29, 35], b \in [-102, -98], c \in [102, 106],$ and $d \in [25, 33]$

   $30x^3 - 101x^2 + 103x + 30$, which corresponds to multiplying everything correctly except the constant term.

D. $a \in [29, 35], b \in [-82, -69], c \in [15, 19],$ and $d \in [25, 33]$

   $30x^3 - 71x^2 + 17x + 30$, which corresponds to multiplying out $(2x + 2)(5x - 5)(3x - 3)$.

E. $a \in [29, 35], b \in [-3, 2], c \in [-71, -61],$ and $d \in [-36, -28]$

$30x^3 + x^2 - 67x - 30$, which corresponds to multiplying out $(2x + 2)(5x + 5)(3x - 3)$.

General Comments: To construct the lowest-degree polynomial, you want to multiply out $(2x - 1)(5x - 6)(3x - 5)$