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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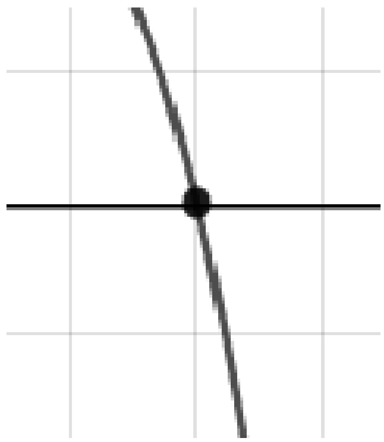
1. Describe the zero behavior of the zero $x = -2$ of the polynomial below.

$$f(x) = 6(x-5)^7(x+5)^4(x+2)^9(x-2)^6$$

The solution is the graph below.



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

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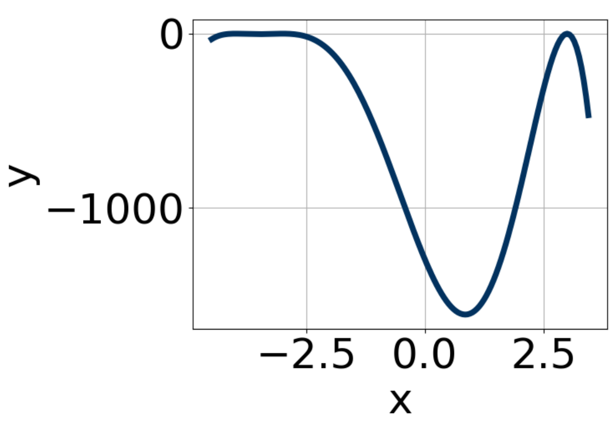
2. Write an equation that *could* represent the graph below.



The solution is $-19(x+3)^4(x+4)^{10}(x-3)^8$.

Plausible alternative answers include:* This is the correct option. The factor $(x-3)$ should have an even power and the leading coefficient should be the opposite sign. This corresponds to the leading coefficient being the opposite value than it should be. The factors $(x+4)$ and $(x-3)$ should both have even powers. The factor $(x-3)$ should have an even 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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3. Construct the lowest-degree polynomial given the zeros below.

$$\frac{-4}{3}, \frac{-5}{3}, \text{ and } -7$$

The solution is $9x^3 + 90x^2 + 209x + 140$.

> **Plausible alternative answers include:**$9x^3+66x^2+x-140$, which corresponds to multiplying out $(3x-4)(3x+5)(x+7)$. $9x^3 - 90x^2 + 209x - 140$, which corresponds to multiplying out $(3x-4)(3x-5)(x-7)$. * $9x^3+90x^2+209x+140$, which is the correct option. $9x^3+36x^2-169x+140$, which corresponds to multiplying out $(3x-4)(3x-5)(x+7)$. $9x^3 + 90x^2 + 209x - 140$, which corresponds to multiplying everything correctly except the constant term.

General Comment: To construct the lowest-degree polynomial, you want to multiply out $(3x+4)(3x+5)(x+7)$

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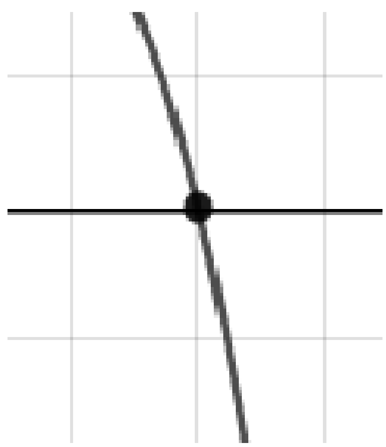
4. Describe the zero behavior of the zero $x = -8$ of the polynomial below.

$$f(x) = -6(x+2)^{11}(x-2)^7(x+8)^3(x-8)^2$$

The solution is the graph below.



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

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5. Construct the lowest-degree polynomial given the zeros below.

$$\frac{1}{2}, \frac{3}{4}, \text{ and } 4$$

The solution is $8x^3 - 42x^2 + 43x - 12$.

> **Plausible alternative answers include:**$8x^3-34x^2+5x+12$, which corresponds to multiplying out $(2x+1)(4x-3)(x-4)$. $8x^3 - 22x^2 - 37x - 12$, which corresponds to multiplying out $(2x+1)(4x+3)(x-4)$. * $8x^3-42x^2+43x-12$, which is the correct option. $8x^3-42x^2+43x+12$, which corresponds to multiplying everything correctly except the constant term. $8x^3+42x^2+43x+12$, which corresponds to multiplying out $(2x+1)(4x+3)(x+4)$.

General Comment: To construct the lowest-degree polynomial, you want to multiply out $(2x - 1)(4x-3)(x-4)$

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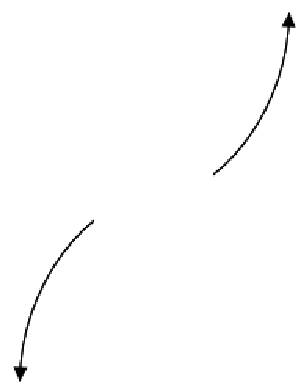
6. Describe the end behavior of the polynomial below.

$$f(x) = 2(x+7)^4(x-7)^9(x-4)^2(x+4)^2$$

The solution is the graph below.



General Comment: 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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7. Construct the lowest-degree polynomial given the zeros below.

$$-2+2i \text{ and } -2$$

The solution is $x^3 + 6x^2 + 16x + 16$.

Plausible alternative answers include:* $x^3 + 6x^2 + 16x + 16$, which is the correct option. $x^3 - 6x^2 + 16x - 16$, which corresponds to multiplying out $(x-(-2+2i))(x-(-2-2i))(x-2)$. $x^3 + x^2 + 0x - 4$, which corresponds to multiplying out $(x-2)(x+2)$. $x^3 + x^2 + 4x + 4$, which corresponds to multiplying out $(x+2)(x+2)$. 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 $(x-(-2+2i))(x-(-2-2i))(x-(-2))$.

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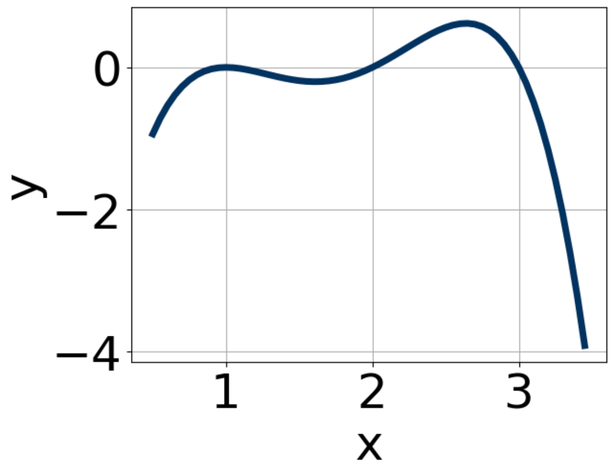
8. Write an equation that *could* represent the graph below.



The solution is $-8(x-1)^8(x-3)^7(x-2)^5$.

> **Plausible alternative answers include:*** This is the correct option. This corresponds to the leading coefficient being the opposite value than it should be. The factor 1 should have an even power and the factor 3 should have an odd power. The factor $(x-3)$ should have an odd power. The factor $(x-2)$ should have an odd power and the leading coefficient should be the opposite sign.

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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9. Construct the lowest-degree polynomial given the zeros below.

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

The solution is $x^3+x^2-4x-24$.

> **Plausible alternative answers include:**x^3+x^2-x-6, which corresponds to multiplying out $(x+2)(x-3)$. x^3+x^2-5x+6, which corresponds to multiplying out $(x-2)(x-3)$. * $x^3+x^2-4x-24$, which is the correct option. $x^3-1x^2-4x+24$, which corresponds to multiplying out $(x-(-2+2i))(x-(-2-2i))(x+3)$. 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 $(x-(-2+2i))(x-(-2-2i))(x-(3))$.

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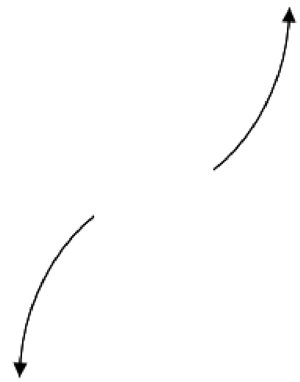
10. Describe the end behavior of the polynomial below.

$$f(x)=5(x+9)^4(x-9)^7(x-7)^4(x+7)^4$$

The solution is the graph below.



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