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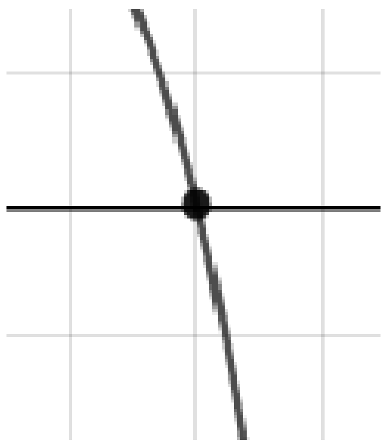
1. Describe the zero behavior of the zero $x = -9$ of the polynomial below.

$$f(x) = -2(x-4)^9(x+4)^7(x+9)^3(x-9)^2$$

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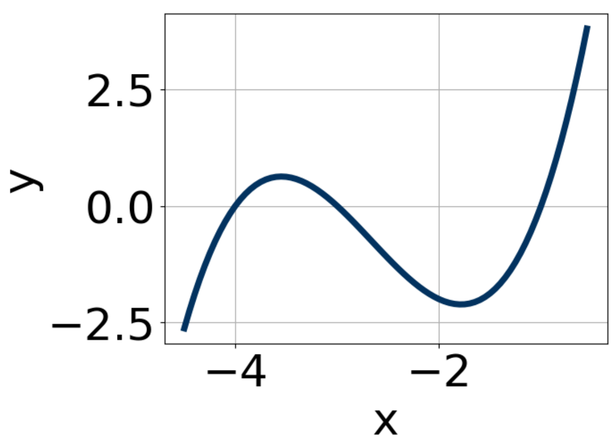
2. Write an equation that *could* represent the graph below.



The solution is $3(x+4)^7(x+3)^5(x+1)^5$.

Plausible alternative answers include: The factor $(x+4)$ should have an odd power and the leading coefficient should be the opposite sign. The factors -4 and -3 have have been odd power.

* This is the correct option. The factor -4 should have been an odd power. 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. Construct the lowest-degree polynomial given the zeros below.

$$1, \frac{7}{4}, \text{ and } \frac{5}{3}$$

The solution is $12x^3 - 53x^2 + 76x - 35$.

Plausible alternative answers include: $12x^3+53x^2+76x+35$, which corresponds to multiplying out $(x+1)(4x+7)(3x+5)$. $12x^3+13x^2-34x-35$, which corresponds to multiplying out $(x+1)(4x+7)(3x-5)$. * $12x^3 - 53x^2 + 76x - 35$, which is the correct option. $12x^3 - 53x^2 + 76x + 35$, which corresponds to multiplying everything correctly except the constant term. $12x^3 - 29x^2 - 6x + 35$, which corresponds to multiplying out $(x+1)(4x-7)(3x-5)$.

General Comment: To construct the lowest-degree polynomial, you want to multiply out $(x-1)(4x-7)(3x-5)$

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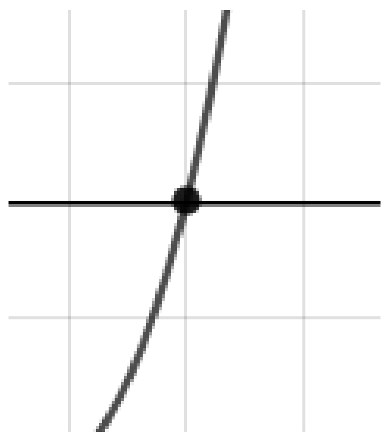
4. Describe the zero behavior of the zero $x = 9$ of the polynomial below.

$$f(x) = 2(x-7)^6(x+7)^4(x+9)^8(x-9)^7$$

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.

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

The solution is $3x^3 - 26x^2 + 7x + 196$.

Plausible alternative answers include: $3x^3+26x^2+7x-196$, which corresponds to multiplying out $(x+7)(3x-7)(x+4)$. $3x^3 - 26x^2 + 7x - 196$, which corresponds to multiplying everything correctly except the constant term. $3x^3 + 16x^2 - 63x - 196$, which corresponds to multiplying out $(x+7)(3x+7)(x-4)$. $3x^3 + 2x^2 - 105x + 196$, which corresponds to multiplying out $(x+7)(3x-7)(x-4)$. * $3x^3 - 26x^2 + 7x + 196$, which is the correct option.

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

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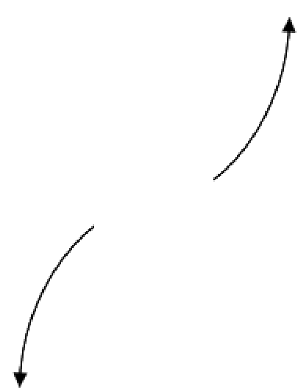
6. Describe the end behavior of the polynomial below.

$$f(x) = 7(x+6)^3(x-6)^6(x-3)^3(x+3)^3$$

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: $x^3 + x^2 - 4x + 4$, which corresponds to multiplying out $(x-2)(x-2)$. $x^3+6x^2+16x+16$, which corresponds to multiplying out $(x-(2-2i))(x-(2+2i))(x+2)$. x^3+x^2+0x-4, which corresponds to multiplying out $(x+2)(x-2)$. * $x^3-6x^2+16x-16$, which is the correct option. 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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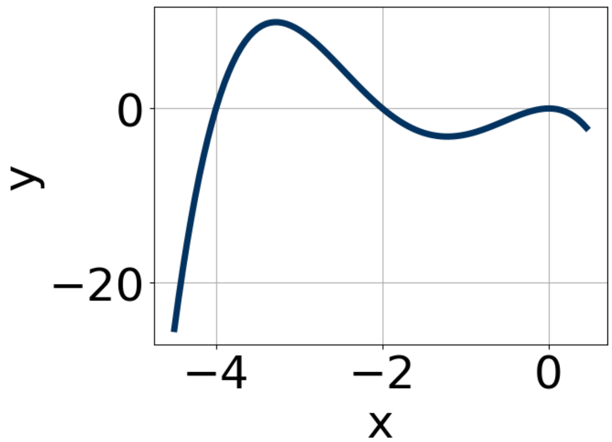
8. Write an equation that *could* represent the graph below.



The solution is $-2x^8(x+2)^7(x+4)^9$.

> **Plausible alternative answers include:** This corresponds to the leading coefficient being the opposite value than it should be. The factor 0 should have an even power and the factor -2 should have an odd power. * This is the correct option. The factor $(x+2)$ should have an odd power. The factor $(x+4)$ 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.

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

The solution is $x^3+x^2+8x-60$.

> **Plausible alternative answers include:*** $x^3+x^2+8x-60$, which is the correct option. x^3+x^2-x-6, which corresponds to multiplying out $(x+2)(x-3)$. x^3+x^2+x-12, which corresponds to multiplying out $(x+4)(x-3)$. $x^3-1x^2+8x+60$, which corresponds to multiplying out $(x-(-2-4i))(x-(-2+4i))(x+3)$. 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 $(x-(-2-4i))(x-(-2+4i))(x-(3))$.

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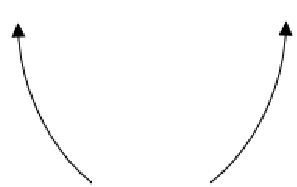
10. Describe the end behavior of the polynomial below.

$$f(x) = 7(x+5)^4(x-5)^5(x+9)^2(x-9)^3$$

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.