

TEACHER NOTE

Achievement Indicators

Question 1 addresses AI 11.3: Explain the relationship between the linear factors of a polynomial expression and the zeros of the corresponding polynomial function.
AI 12.4: Explain the relationship between:
 • the zeros of a polynomial function
 • the roots of the corresponding polynomial equation
 • the x-intercepts of the graph of the polynomial function.
 Question 2 addresses AI 12.5: Explain how the multiplicity of a zero of a polynomial function affects the graph.

Discuss the Ideas

- Suppose $x - a$ is a factor of a polynomial. What else do you know about the corresponding polynomial equation and the graph of the corresponding polynomial function?
If $x - a$ is a factor of the polynomial, then $x = a$ is a root of the corresponding polynomial equation, a is a zero of the polynomial function, and a is an x-intercept of its graph.
- How does the multiplicity of a zero of a polynomial function affect its graph?
If a zero of a polynomial function has multiplicity 1, 3, or 5, then the graph of the polynomial function crosses the x-axis at the related x-intercept. If a zero of a polynomial function has multiplicity 2 or 4, then the graph of the polynomial function just touches the x-axis at the related x-intercept.

Exercises

A

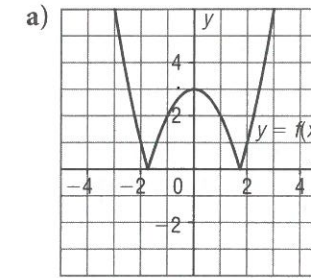
- Which functions are polynomial functions? Justify your choices.
 - $f(x) = 2\sqrt{x} - x^2$
Not a polynomial function: $\sqrt{x} = x^{\frac{1}{2}}$ and $\frac{1}{2}$ is not a whole number.
 - $g(x) = 6x^3 - x^2 + 3x - 7$
Polynomial function: the coefficients of the variables are real numbers and all exponents are whole numbers.
 - $h(x) = 7x^2 + 2x^3 - x - \frac{1}{2}$
Polynomial function: the coefficients of the variables are real numbers and all exponents are whole numbers.
 - $k(x) = 3^x + 5$
Not a polynomial function: the variable x is an exponent.
 - $p(x) = 5x^2 - 7x + \frac{2}{x}$
Not a polynomial function: $\frac{2}{x} = 2x^{-1}$ and the exponent is not a whole number.

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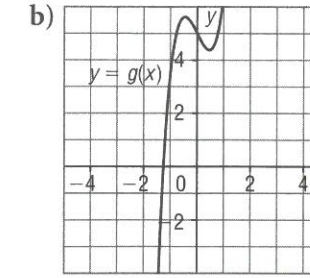
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Question 3 addresses AI 12.1: Identify the polynomial functions in a set of functions, and explain the reasoning.

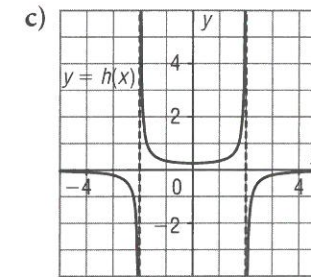
- Which graphs are graphs of polynomial functions? Justify your answers.



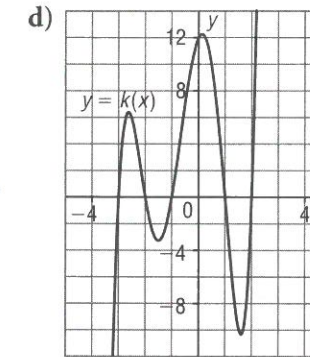
No, graph has sharp corners.



Yes, graph is smooth and continuous and has a possible shape for an odd-degree polynomial function.



No, graph is not continuous.



Yes, graph is smooth and continuous and has a possible shape for an odd-degree polynomial function.

- Complete the table below. The first row has been done for you.

	Equation	Degree	Odd or Even Degree	Type	Leading coefficient	y-intercept of its graph
	$f(x) = 3x^2 - 2x + 1$	2	even	quadratic	3	1
a)	$g(x) = 5x + x^5 - 2x^3$	5	odd	quintic	1	0
b)	$h(x) = 2x^2 - 3x^3 - 7$	3	odd	cubic	-3	-7
c)	$k(x) = 5 - x^4 - 3x$	4	even	quartic	-1	5

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Question 4 addresses AI 12.1: Identify the polynomial functions in a set of functions, and explain the reasoning.