Section 4.2

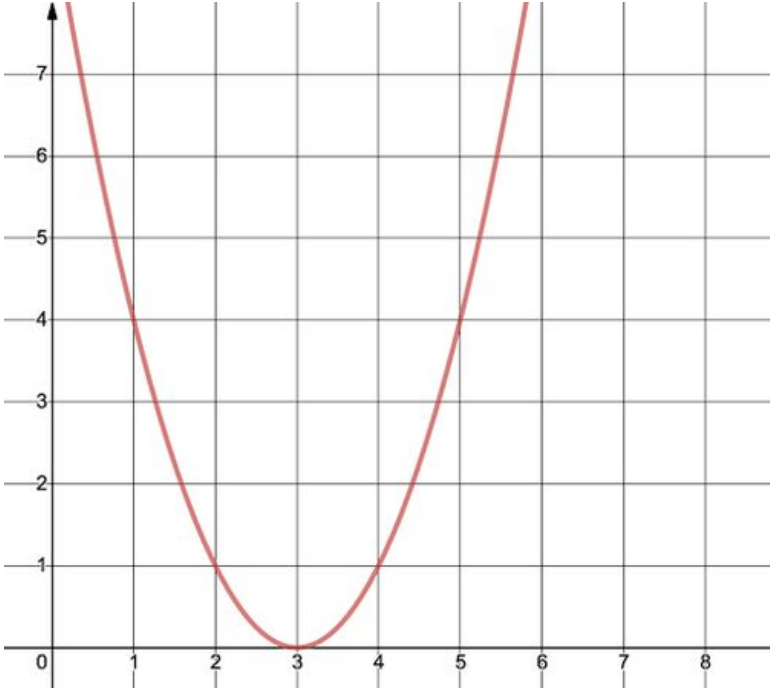
Polynomial Functions and Models

End behavior of a graph

As the x value increases (goes right)...	the y value increases (goes up).
$x \to \infty$	$y \to \infty$
	the y value decreases (goes down).
	$y \to -\infty$
As the x value decreases (goes left)...	the y value increases (goes up).
$x \to -\infty$	$y \to \infty$
	the y value decreases (goes down).
	$y \to -\infty$

	Even Degree	Odd Degree
Positive Leading Coefficient	As $x \to \infty$, $y \to \infty$ As $x \to -\infty$, $y \to \infty$	As $x \to \infty$, $y \to \infty$ As $x \to -\infty$, $y \to -\infty$
Negative Leading Coefficient	As $x \to \infty$, $y \to -\infty$ As $x \to -\infty$, $y \to -\infty$	As $x \to \infty$, $y \to -\infty$ As $x \to -\infty$, $y \to \infty$

For the following graph, identify if the leading coefficient is positive or negative and if the degree is even or odd



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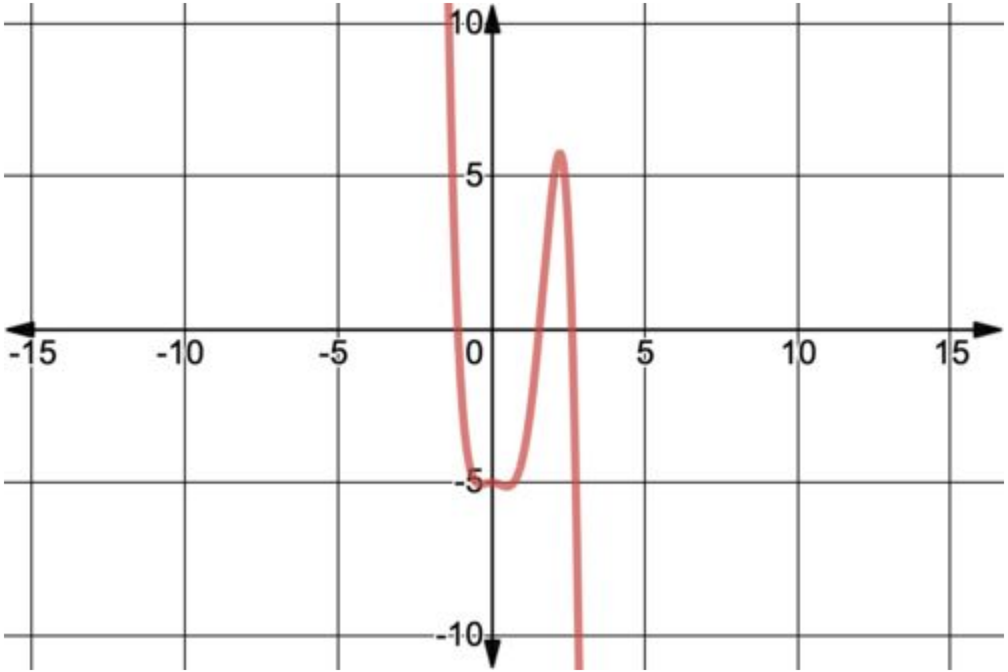

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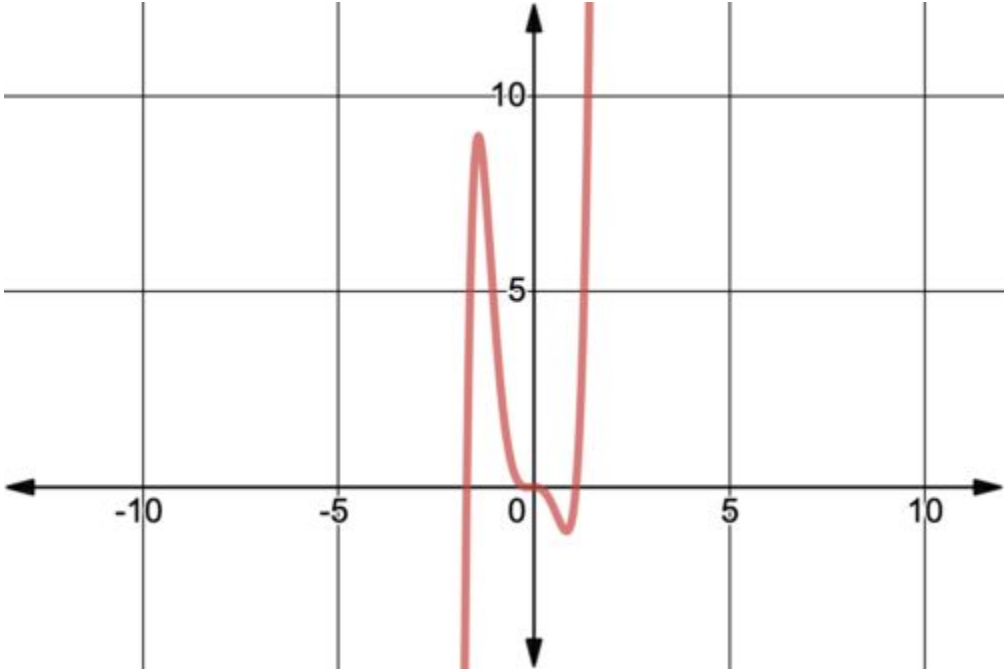
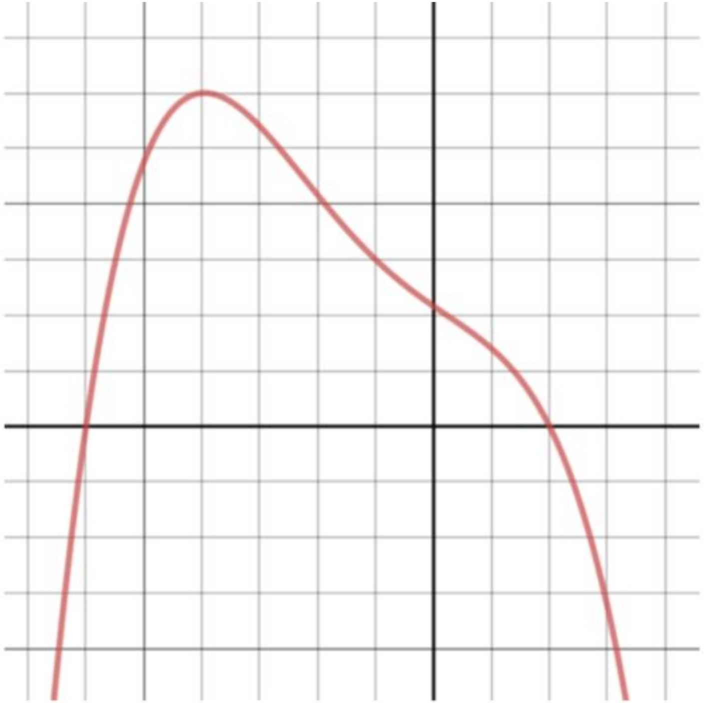
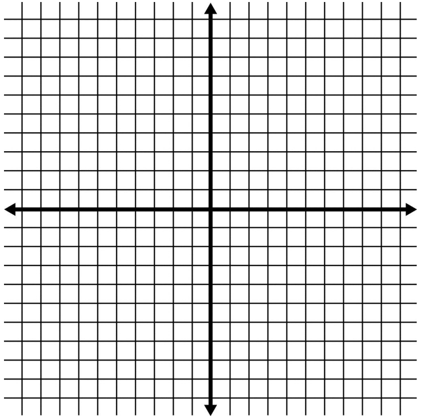
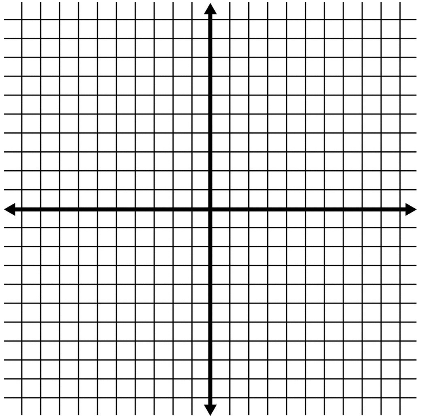
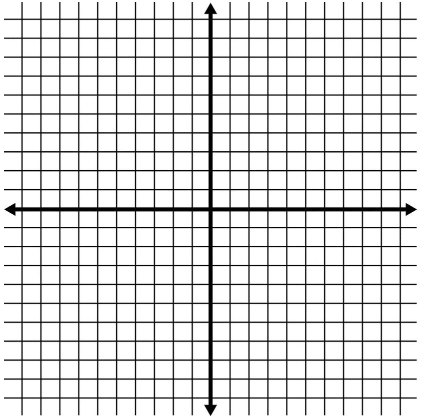
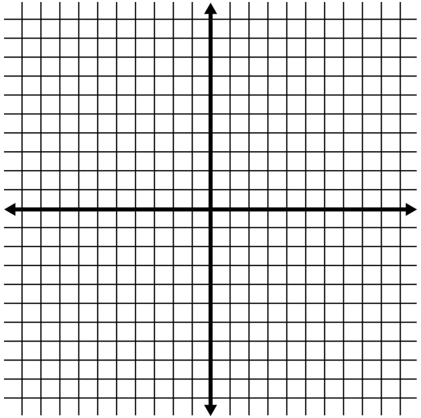


Describe the end behavior of the polynomial using arrow notation and using words



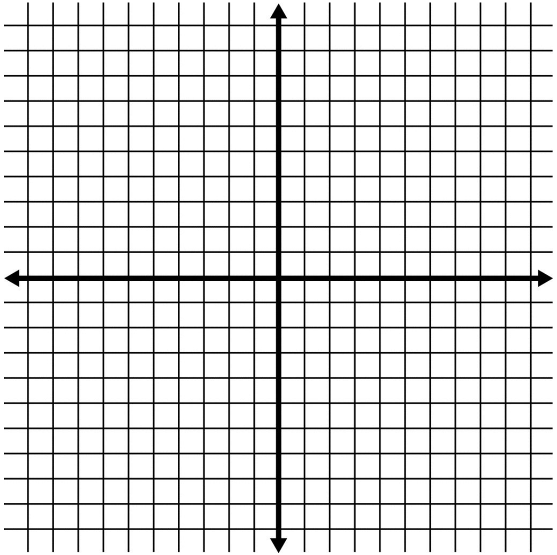
Multiplicities (degrees of zeroes)

- When a zero has a multiplicity of 1, the function normally passes through the x-intercept.
- When a zero has a multiplicity of 2, the function bounces off the x-intercept forming a parabola-like shape.
- When a zero has a multiplicity of 3, the function passes through x-intercept, forming a shape that the function $y=x^3$ has.

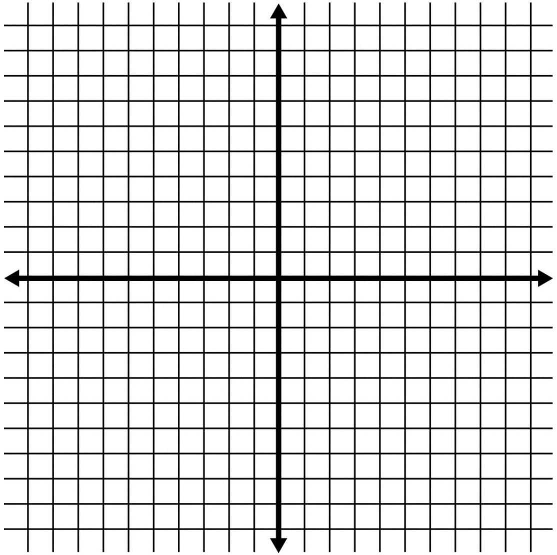
Example: $f(x)=(x-3)(x-1)(x+5)$

- Identify the degree, the leading coefficient, the zeros, and each zeros multiplicity
- Determine the intervals where the polynomial is positive and where it is negative.
- Use the above information to sketch a graph of $f(x)$



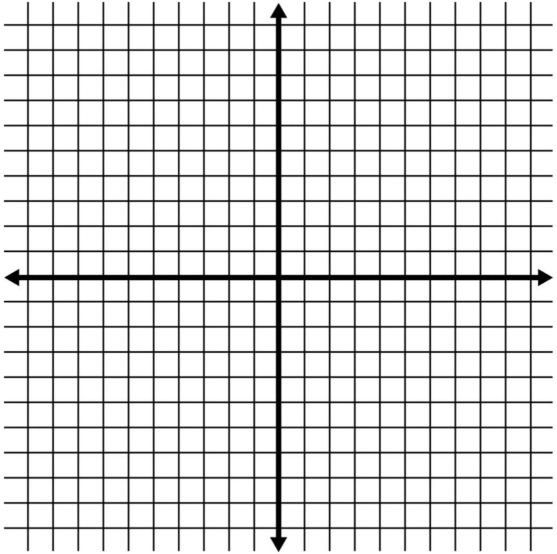
Example: $f(x)=(x+3)(x-2)^2(x-4)$

- Identify the degree, the leading coefficient, the zeros, and each zeros multiplicity
- Determine the intervals where the polynomial is positive and where it is negative.
- Use the above information to sketch a graph of f(x)



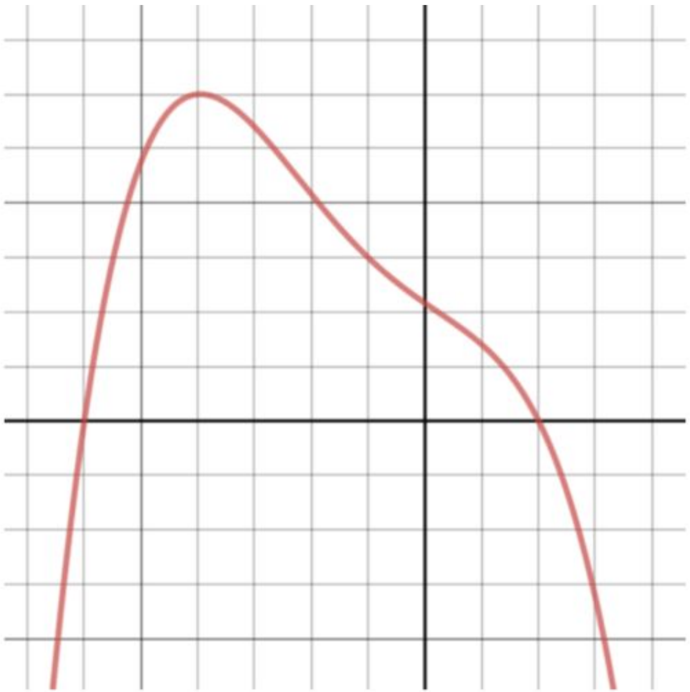
Example: $f(x)=(x+4)(x+1)^2(2x-1)(x-5)$

- Identify the degree, the leading coefficient, the zeros, and each zeros multiplicity
- Determine the intervals where the polynomial is positive and where it is negative.
- Use the above information to sketch a graph of f(x)



Recall: Increasing vs. Decreasing

- On what interval(s) is the following function increasing? On what interval(s) is it decreasing?



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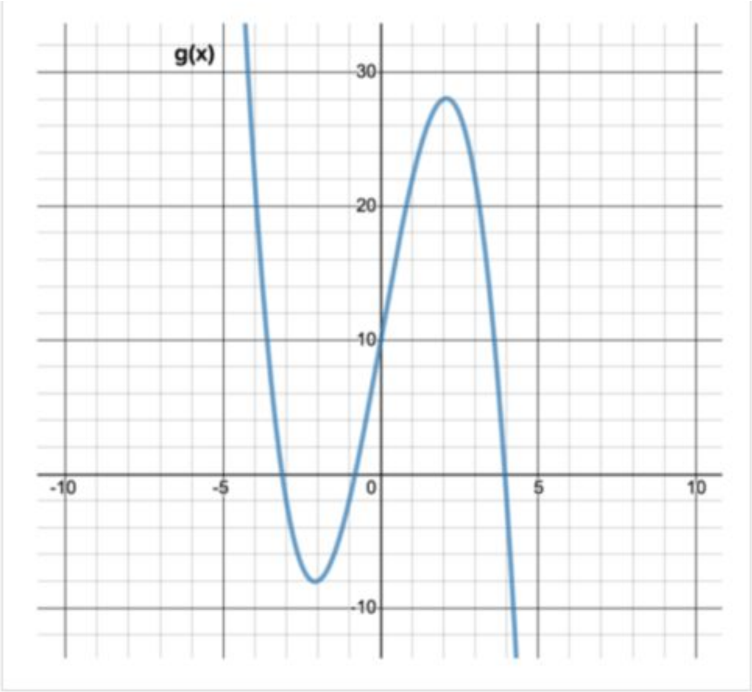
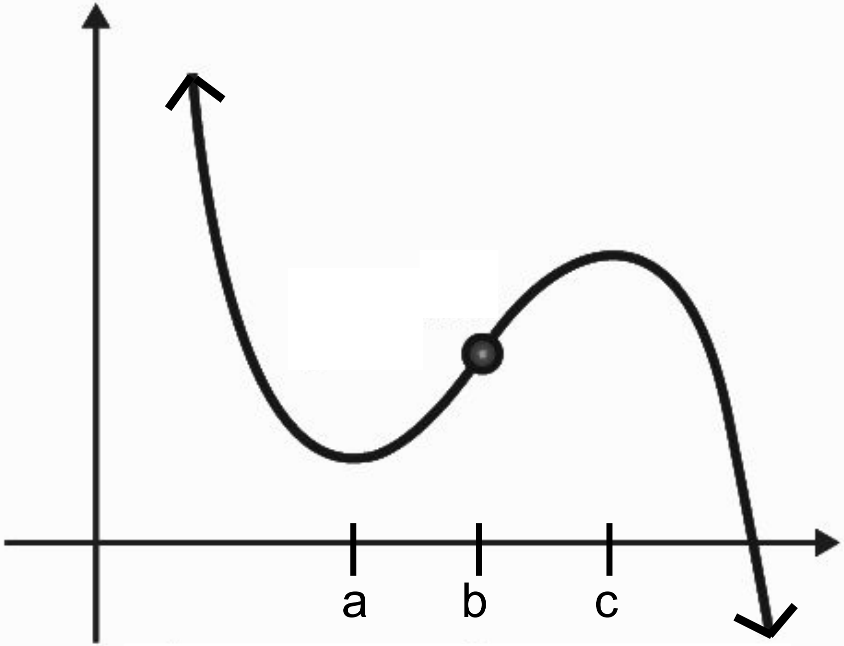


Concavity

- The shape of a function on an interval can be described as concave up or concave down. A point at which a function switches concavity, is called an inflection point.



Describe this graph using as many terms as you can