# GUIDED NOTES – 5.3 GRAPHS OF POLYNOMIAL FUNCTIONS

## LEARNING OBJECTIVES

In this section, you will:

- Recognize characteristics of graphs of polynomial functions.
- Use factoring to find zeros of polynomial functions.
- Identify zeros and their multiplicities.
- Determine end behavior.
- Understand the relationship between degree and turning points.
- Graph polynomial functions.
- Use the Intermediate Value Theorem.

## USING FACTORING TO FIND ZEROS OF POLYNOMIAL FUNCTIONS

- Write out the 3 step process for finding the $x$-intercepts by factoring, given a polynomial function $f$.

    1.

    2.

        a.

        b.

    3.

***Try It:*** Read Examples 2 and 3 in the text, then answer the following.

Find the $x$- and $y$-intercepts of the function $f(x) = x^3 - 17x^2 + 30x$.

***Try It:*** Read Example 4 in the text, then answer the following.

Find the $x$- and $y$-intercepts of the function $f(x) = (x + 3)^2(x - 2)$.

**IDENTIFYING ZEROS AND THEIR MULTIPLICITIES**

Graphs behave differently at various $x$-intercepts. They sometimes cross over the horizontal axis and other times they will touch the horizontal axis and "bounce off".

*Study the box in your textbook section titled "graphical behavior of polynomials at x-intercepts.*

- If a polynomial contains a factor of the form $(x-h)^p$, the behavior near the $x$-intercept $h$ is determined by the power $p$. We say that $x=h$ is a zero of _____ $p$.

  What will the graph of a polynomial do at zeros with even multiplicities?

  What will the graph of a polynomial do at zeros with odd multiplicities?

- The sum of the multiplicities is the _____ of the polynomial function.

- Write out the 4 step process for identifying the zeros and their multiplicities, given a graph of a polynomial function of degree $n$.

  1.

  2.

  3.

  4.

***Try It:*** Read Example 6 in the text, then answer the following.

Use the graph of the function of degree 9 in **Figure 10** to identify the zeros and their multiplicities.

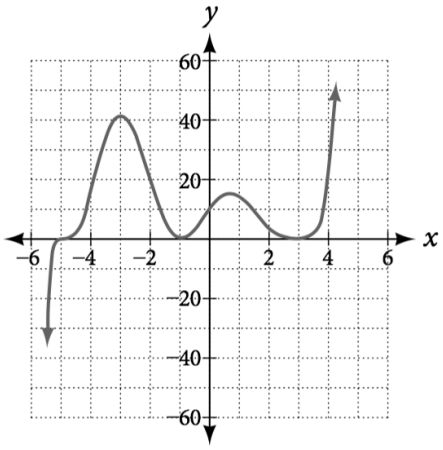
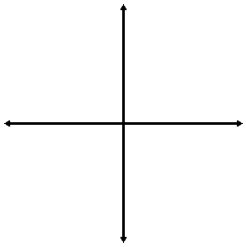
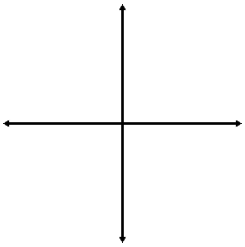
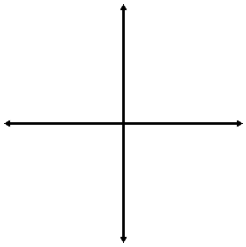
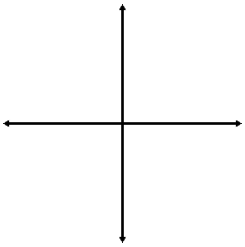



**Figure 10**

**Homework:** *You should now be ready to attempt problems 1-5 in "Homework – Section 5.3" on WeBWorK.*

## DETERMINING END BEHAVIOR

*Use the **Figure 11** in your textbook section to fill out the table below.*

| Even Degree | Odd Degree |
|---|---|
| Positive Leading Coefficient: $a_n$____0<br>  <br>$x \to -\infty, f(x) \to$ _____<br>and $x \to \infty, f(x) \to$ _____ | Positive Leading Coefficient: $a_n$____0<br>  <br>$x \to -\infty, f(x) \to$ _____<br>and $x \to \infty, f(x) \to$ _____ |
| Negative Leading Coefficient: $a_n$____0<br>  <br>$x \to -\infty, f(x) \to$ _____<br>and $x \to \infty, f(x) \to$ _____ | Negative Leading Coefficient: $a_n$____0<br>  <br>$x \to -\infty, f(x) \to$ _____<br>and $x \to \infty, f(x) \to$ _____ |

## UNDERSTANDING THE RELATIONSHIP BETWEEN DEGREE AND TURNING POINTS

*Study the box in your textbook section titled "interpreting turning points."*

- What is a turning point in your own words?

- A polynomial of degree $n$ will have at most _____ turning points.

## GRAPHING POLYNOMIAL FUNCTIONS

- Write out the 7 step process for sketching the graph, given a polynomial function.

1.

2.

3.

4.

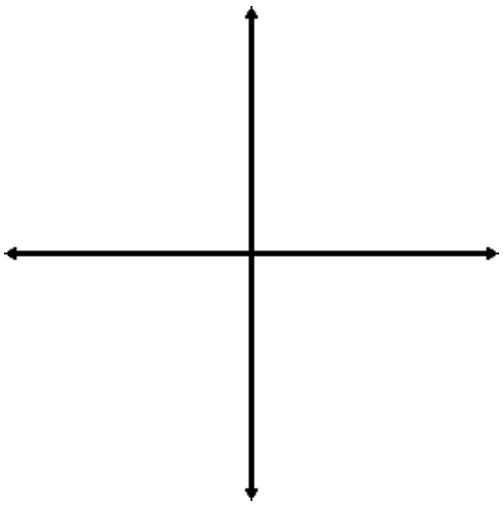
5.

6.

7.

***Try It:*** Read Example 8 in the text, then answer the following.

Sketch the graph of $f(x) = \frac{1}{4}x(x-1)^4(x+3)^3$.



- Write out the 4 step process for writing a formula for a function, given a graph of a polynomial function.

    1.

    2.

    3.

    4.

***Try It:*** Read Example 10 in the text, then answer the following.

Given the graph shown in **Figure 20**, write a formula for the function pictured.

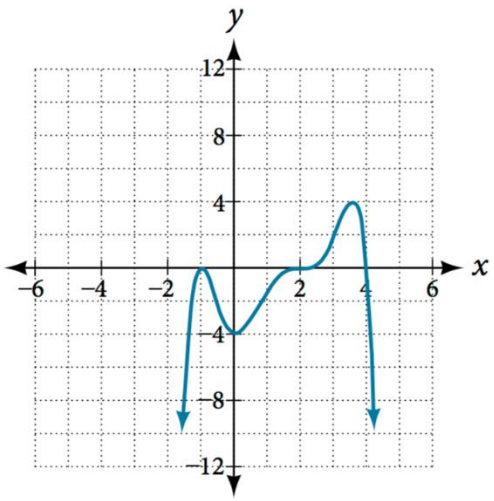



**Figure 20**

**Homework:** *You should now be ready to attempt problems 6-7 in "Homework – Section 5.3" on WeBWorK.*

- Each turning point represents a local _____ or _____. When a turning point is the highest or lowest point on the graph, we say that the turning point is a _____ minimum or maximum. These can also be referred as the absolute minimum or maximum values of a function.