

NOTES: END BEHAVIOR

DAY 5

Textbook Chapter 5.3

OBJECTIVE: Today you will learn about the end behavior of functions!

A polynomial function is in STANDARD FORM if its terms are written in *descending order of exponents* from left to right.

Standard Form Example: $f(x) = 2x^3 - 5x^2 - 4x + 7$ **Leading Coefficient** _____ **Degree** _____

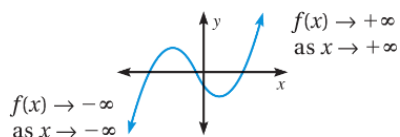
Factored Form Example: $f(x) = x(x + 2)(x - 5)^3$ **Leading Coefficient** _____ **Degree** _____

Circle all polynomial functions. For each polynomial function, state the form and the degree.

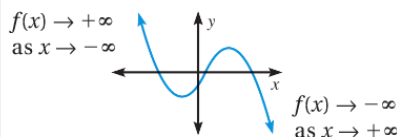
1. $f(x) = \frac{1}{2}x^4 - 3x^2 - 7$ Form: _____ Degree: _____ LC: _____	2. $f(x) = x^2(x + 3)$ Form: _____ Degree: _____ LC: _____
3. $f(x) = 6x^2 + 2x^{-1} + x$ Form: _____ Degree: _____ LC: _____	4. $f(x) = \frac{3}{5}x^4 + 2x + 9$ Form: _____ Degree: _____ LC: _____
5. $f(x) = -5x + 12$ Form: _____ Degree: _____ LC: _____	6. $f(x) = 22 - 19x + 2^x$ Form: _____ Degree: _____ LC: _____
7. $f(x) = x(x + 3)^2(x - 1)^3$ Form: _____ Degree: _____ LC: _____	8. $f(x) = 36x^4 - x^3 + x^2$ Form: _____ Degree: _____ LC: _____

End Behavior of Polynomial Functions

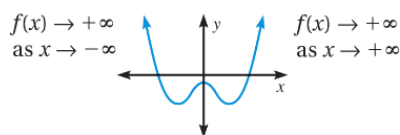
Degree: odd
Leading coefficient: positive



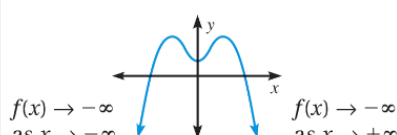
Degree: odd
Leading coefficient: negative



Degree: even
Leading coefficient: positive

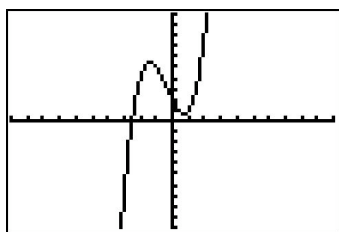


Degree: even
Leading coefficient: negative



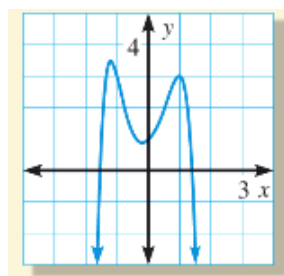
Describe the **end behavior** of the graph of the function.

1.



As $x \rightarrow +\infty$ then $f(x) \rightarrow$ _____
As $x \rightarrow -\infty$ then $f(x) \rightarrow$ _____

2.



As $x \rightarrow +\infty$ then $f(x) \rightarrow$ _____
As $x \rightarrow -\infty$ then $f(x) \rightarrow$ _____

Use your calculator the graph the following and determine the end behavior.

3. $y = -3x^5 - 6x^2 + 3x - 8$

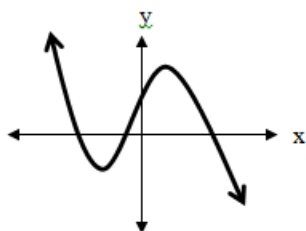
4. $h(x) = 6x^8 - 7x^5 + 4x$

As $x \rightarrow +\infty$ then $f(x) \rightarrow$ _____
As $x \rightarrow -\infty$ then $f(x) \rightarrow$ _____

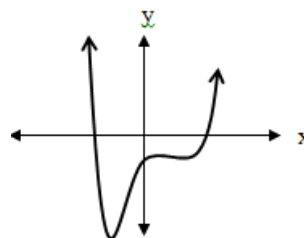
As $x \rightarrow +\infty$ then $f(x) \rightarrow$ _____
As $x \rightarrow -\infty$ then $f(x) \rightarrow$ _____

5) Describe the end behavior of the following functions:

a.



b.



Use your calculator to find the end behavior of each function.

6. $f(x) = 3x^5 + x^3 + 10x^2 + 4x + 1$

As $x \rightarrow +\infty$ then $f(x) \rightarrow$ _____

As $x \rightarrow -\infty$ then $f(x) \rightarrow$ _____

7. $f(x) = 7(x + 1)^3 (x - 5) (x + 3)^2$

As $x \rightarrow +\infty$ then $f(x) \rightarrow$ _____

As $x \rightarrow -\infty$ then $f(x) \rightarrow$ _____

8. $f(x) = -x^6 + x^4 + 10x^3 + 4x^2 + 1$

As $x \rightarrow +\infty$ then $f(x) \rightarrow$ _____

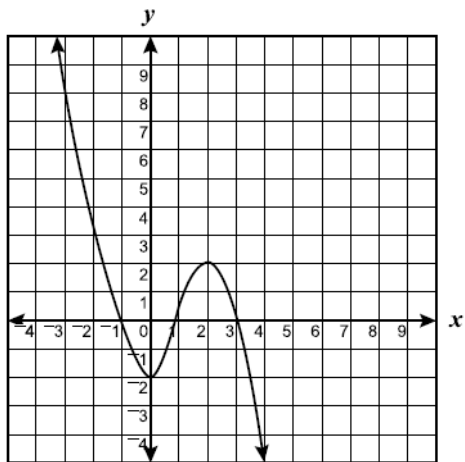
As $x \rightarrow -\infty$ then $f(x) \rightarrow$ _____

9. $f(x) = -2(x + 1)^3 (x - 5)^2 (x + 3)^2$

As $x \rightarrow +\infty$ then $f(x) \rightarrow$ _____

As $x \rightarrow -\infty$ then $f(x) \rightarrow$ _____

10. Choose the correct letter and answer the additional questions.



The polynomial function shown apparently has zeros at —

- F -1 and 2
- G -1, 0.7, and 3
- H -2
- J 1, -0.7, and -3

Describe the graph's end behavior.....

As $x \rightarrow +\infty, f(x) \rightarrow$ _____

As $x \rightarrow -\infty, f(x) \rightarrow$ _____

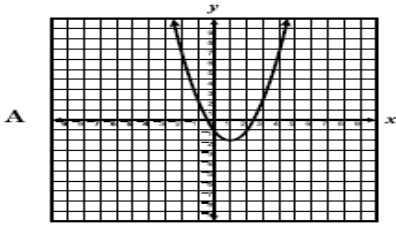
On what **x intervals** is Y (or f(x))

Increasing: _____

Decreasing: _____

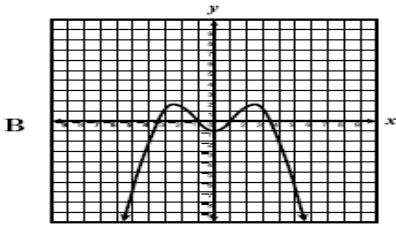
PRACTICE: END BEHAVIOR

Determine the end behavior of each of the graphs



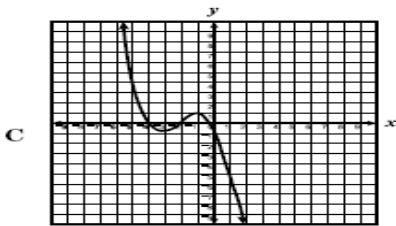
$$x \rightarrow \infty, f(x) \rightarrow \underline{\hspace{2cm}}$$

$$x \rightarrow -\infty, f(x) \rightarrow \underline{\hspace{2cm}}$$



$$x \rightarrow \infty, f(x) \rightarrow \underline{\hspace{2cm}}$$

$$x \rightarrow -\infty, f(x) \rightarrow \underline{\hspace{2cm}}$$



$$x \rightarrow \infty, f(x) \rightarrow \underline{\hspace{2cm}}$$

$$x \rightarrow -\infty, f(x) \rightarrow \underline{\hspace{2cm}}$$

2. Graph $x^3 - 9x^2 + 8x + 60$ using your calculator. Sketch its graph below.

- a. **How many zeros** of the polynomial _____
- b. **Find the real zeros** of the polynomial _____
- c. Determine the number of turning points _____
- d. Where are the relative minimums or maximums? _____
- e. Where are the absolute minimums or maximums? _____
- f. Describe the end behavior of the graph:
 As $x \rightarrow +\infty$, $f(x) \rightarrow$ _____ as $x \rightarrow -\infty$, $f(x) \rightarrow$ _____

3. Graph $3x^4 + x^3 - 10x^2 + 2x + 7$ using your calculator. Sketch its graph below.

a. How many zeros of the polynomial _____

b. Find the real zeros of the polynomial _____

c. Determine the number of turning points _____

d. Where are the relative minimums or maximums? _____

e. Where are the absolute minimums or maximums? _____

f. Describe the end behavior of the graph:

As $x \rightarrow +\infty$, $f(x) \rightarrow$ _____ as $x \rightarrow -\infty$, $f(x) \rightarrow$ _____