

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* _____

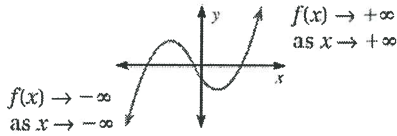
Factored Form Example: $f(x) = x(x + 2)(x - 5)^3$ *Leading Coefficient* _____ *Degree* _____

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

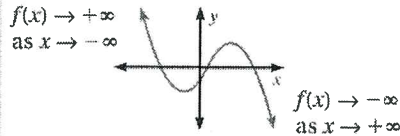
1. $f(x) = \frac{1}{2}x^4 - 3x^2 - 7$ Form: <u>Standard</u> Degree: <u>4</u> LC: <u>$\frac{1}{2}$</u>	2. $f(x) = x^2(x + 3)$ Form: <u>Factored</u> Degree: <u>3</u> LC: <u>1</u>
3. $f(x) = 6x^2 + 2x^{-1} + x$ Form: _____ Degree: _____ LC: _____	4. $f(x) = \frac{3}{5}x^4 + 2x + 9$ Form: <u>Standard</u>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

End Behavior of Polynomial Functions

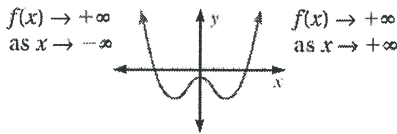
Degree: odd
Leading coefficient: positive



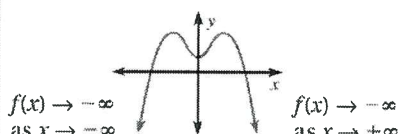
Degree: odd
Leading coefficient: negative



Degree: even
Leading coefficient: positive

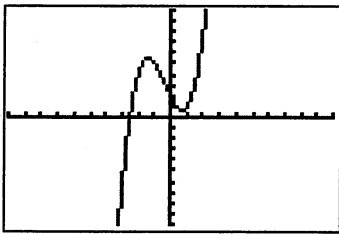


Degree: even
Leading coefficient: negative



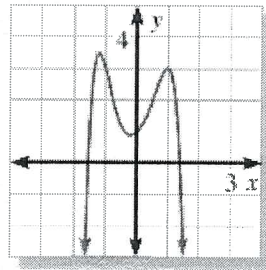
Describe the **end behavior** of the graph of the function.

1.



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

2.



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

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

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

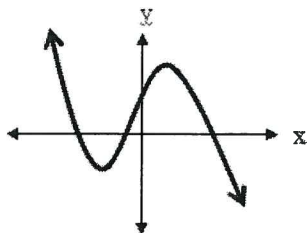
As $x \rightarrow +\infty$ then $f(x) \rightarrow -\infty$
As $x \rightarrow -\infty$ then $f(x) \rightarrow \infty$

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

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

5) Describe the end behavior of the following functions:

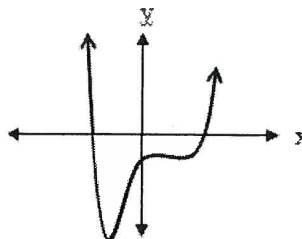
a.



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

 $x \rightarrow -\infty$
 $f(x) \rightarrow \infty$

b.



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

 $x \rightarrow \infty,$
 $f(x) \rightarrow \infty$

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 $f(x) \rightarrow \underline{\infty}$
 As $x \rightarrow -\infty$ then $f(x) \rightarrow \underline{-\infty}$



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

As $x \rightarrow +\infty$ then $f(x) \rightarrow \underline{\infty}$
 As $x \rightarrow -\infty$ then $f(x) \rightarrow \underline{\infty}$



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

As $x \rightarrow +\infty$ then $f(x) \rightarrow \underline{-\infty}$
 As $x \rightarrow -\infty$ then $f(x) \rightarrow \underline{-\infty}$

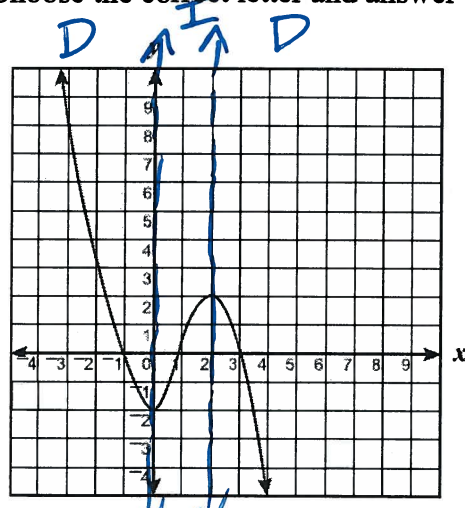


9. $f(x) = -2(x + 1)^3 (x - 5)^2 (x + 3)^2$

As $x \rightarrow +\infty$ then $f(x) \rightarrow \underline{-\infty}$
 As $x \rightarrow -\infty$ then $f(x) \rightarrow \underline{\infty}$



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 $x \rightarrow +\infty, f(x) \rightarrow \underline{-\infty}$
 As $x \rightarrow -\infty, f(x) \rightarrow \underline{\infty}$

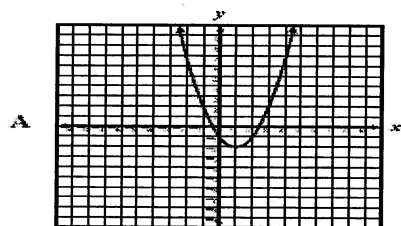
On what x intervals is Y (or f(x))

Increasing: (0, 2)

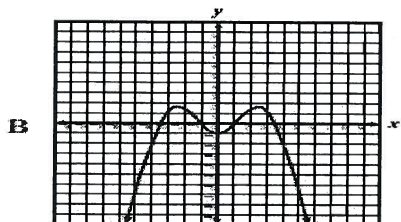
Decreasing: (-\infty, 0) \cup (2, \infty)

PRACTICE: END BEHAVIOR

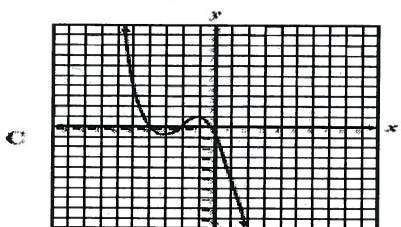
Determine the end behavior of each of the graphs



End Behavior: $x \rightarrow \infty, f(x) \rightarrow \infty$
 $x \rightarrow -\infty, f(x) \rightarrow \infty$

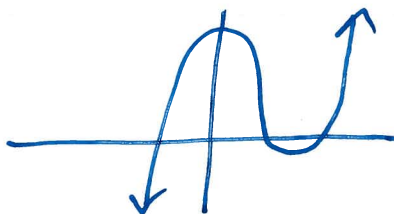


$x \rightarrow \infty, f(x) \rightarrow -\infty$
 $x \rightarrow -\infty, f(x) \rightarrow -\infty$



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

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



a. How many zeros: 3

b. Find the **real zeros** of the polynomial $x = -2, 5, 6$

c. Determine the number of turning points 2

d. Does the graph have relative minimums or maximums? Max: 61.877, Min: -1.877

e. Does the graph have absolute minimums or maximums? None

f. Describe the end behavior of the graph:

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

