

PART 1: END BEHAVIOR

1. What is the degree of the polynomial $f(x) = 5(x - 2)^2(x + 4)(x - 5)^3$? Explain how you know.

degree = 6

$$(x-2)^2 \rightarrow x^2 \quad (x-5)^3 \rightarrow x^3$$

$$x+4 \rightarrow x \quad x^2 \cdot x \cdot x^3 = x^6$$

2. What is the leading coefficient of $f(x) = 5(x - 2)^2(x + 4)(x - 5)^3$

5

3. a. Explain why $5x^6 \rightarrow \infty$ as $x \rightarrow \pm\infty$.

Because $(-\#)^6 = (\#)^6$. Negatives & positives both give big positive answers when raised to the 6th power.

b. Hence, describe the END BEHAVIOR of $f(x) = 5(x - 2)^2(x + 4)(x - 5)^3$.

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

4. What is the degree and leading coefficient of $g(x) = -10x(x - 3)^4$?

Degree = 5 $(1+4)$ | L.C. = -10
 $x(x-3)^4$

5. a. Explain why $-10x^5 \rightarrow \infty$ as $x \rightarrow -\infty$ and $-10x^5 \rightarrow -\infty$ as $x \rightarrow \infty$.

Because $(-\#)^5 = -\#$, so $-10(-\#)^5 = +\#$
 And $(+\#)^5 = +\#$, so $-10(+\#)^5 = -\#$.

b. Hence, describe the END BEHAVIOR of $g(x) = -10x(x - 3)^4$.

As $x \rightarrow \infty, g(x) \rightarrow -\infty$
 As $x \rightarrow -\infty, g(x) \rightarrow \infty$

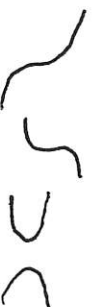
6. GENERALIZATION:

END BEHAVIOR of polynomial depends on the DEGREE (odd or even) and LEADING COEFFICIENT (positive or negative). Complete the table:

Example Functions

- $5x^5$
- $-7x^3$
- $12x^4$
- $-3x^6$

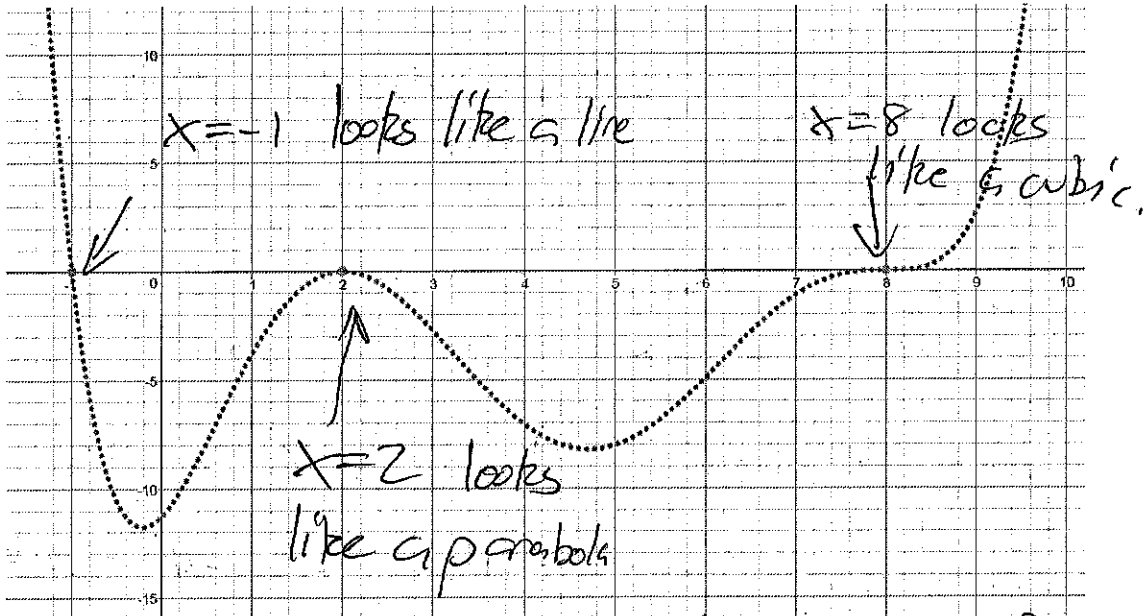
Degree	Leading Coefficient	END BEHAVIOR
ODD	Positive	$x \rightarrow \infty, f(x) \rightarrow \infty$ $x \rightarrow -\infty, f(x) \rightarrow -\infty$
ODD	Negative	$x \rightarrow \infty, f(x) \rightarrow -\infty$ $x \rightarrow -\infty, f(x) \rightarrow \infty$
EVEN	Positive	$x \rightarrow \pm\infty, f(x) \rightarrow \infty$
EVEN	Negative	$x \rightarrow \pm\infty, f(x) \rightarrow -\infty$



Visualize the graphs!

PART 2: MULTIPLICITY

7. What are the roots of $f(x) = 0.0055(x-2)^2(x+1)(x-8)^3$?
 $x=2, x=-1, x=8$
8. What is the MULTIPLICITY of each root from #7?
 2 has mult. 2 , -1 has mult. 1 , 8 has mult. 3
9. The graph of $f(x) = 0.0055(x-2)^2(x+1)(x-8)^3$ is shown below. The BEHAVIOR AT A ROOT depends on the MULTIPLICITY. Describe what the function looks like AT THE ROOT for each x-intercept. Use the MULTIPLICITY as a reference for your description.



Each root looks like the parent function of that factor with multiplicity.
 E.g. $(x-2)^2$ looks like x^2 .

10. Which function best fits the graph shown?
 Explain your choice.

- a. $f(x) = x(x+5)^2(x+2)^3$
- b. $f(x) = x^2(x+5)^3(x+2)$
- c. $f(x) = x^3(x+5)(x+2)^2$
- d. $f(x) = x(x+5)^3(x+2)^2$

