Warm-Up

Algebra 2 - Unit 3 Name________________________________

Warm-Up

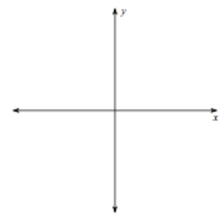
Date_______________ Period____

Divide.

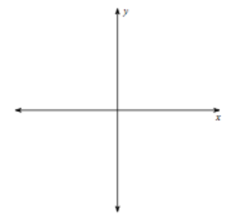
1) $(6r^3 + 21r^2 + 11r - 7) \div (r + 2)$

Sketch a general graph for each polynomial function.

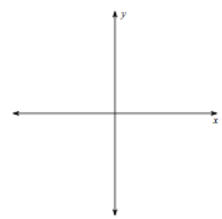
2) $y = 8x^{12} - 7x^{10} + 3x^7 - 5$



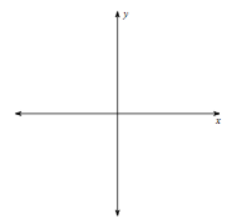
3) $y = -9x^{14} + 7x^{11} - 4x^5 + 3x$



4) $y = 5x^7 + 6x^4 - 2x^2 - 12$



5) $y = -10x^9 + 8x^4 - 3x^3 + x$



Name each polynomial by degree and number of terms.

6) 7
   A) linear monomial
   B) linear constant
   C) constant monomial
   D) 7th degree monomial

7) $5n^5 - 3n^4 - 3n^3$
   A) constant binomial
   B) constant trinomial
   C) fifth degree trinomial
   D) cubic polynomial with five terms

8) $-6x^4 + 9x^3 - x - 10$
   A) fourth degree polynomial with four terms
   B) fourth degree trinomial
   C) fourth degree binomial
   D) fifth degree binomial

9) $-2x^2 + 4x$
   A) quadratic polynomial with 4 terms
   B) quadratic trinomial
   C) quadratic binomial
   D) linear binomial

Synthetic Division & End Behavior

<u>Learning Targets</u>:

- I can divide polynomials using synthetic division
- I can describe the end behavior of the graphs of polynomial functions

Synthetic Division

- ***Synthetic Division*** is a short-cut method to dividing polynomials.

- Problem set-up: (Big polynomial) ÷ $(x - k)$

<u>Example 1</u>: $(-x^3 + 4x^2 + 9) \div (x - 3)$

$k - value = 3$

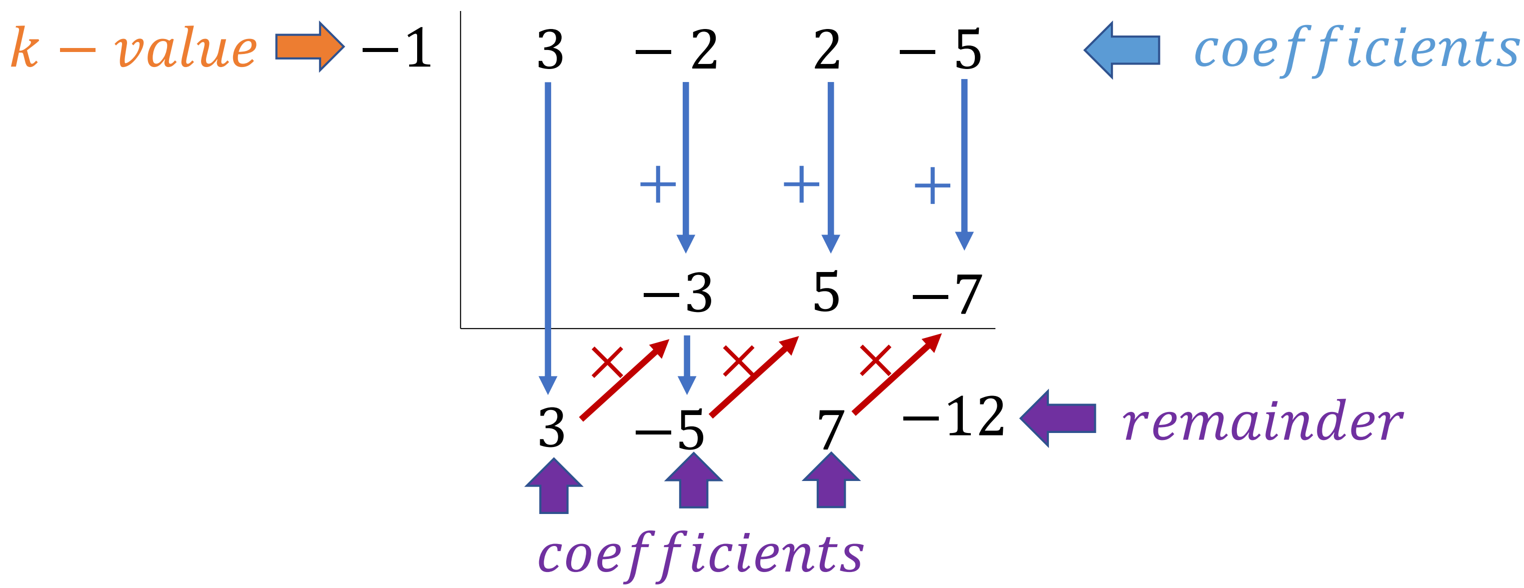
$$
\begin{array}{r|rrrr}
k - value \quad 3 & -1 & 4 & 0 & 9 \quad coefficients \\
 & & + \quad -3 & + \quad 3 & + \quad 9 \\
\hline
 & -1 & 1 & 3 & 18 \quad remainder
\end{array}
$$

$coefficients$

$$\boxed{-x^2 + x + 3 + \frac{18}{x - 3}}$$

Example 2: $(3x^3 - 2x^2 + 2x - 5) \div (x + 1)$

$k - value = -1$



$$\boxed{3x^2 - 5x + 7 + \frac{-12}{x+1}}$$

Example 3: $(x^3 - 3x^2 - 7x + 6) \div (x - 2)$

$k - value = 2$

$k - value$ → 2

$coefficients$: $1 \quad -3 \quad -7 \quad 6$

$$\begin{array}{r|rrrr} 2 & 1 & -3 & -7 & 6 \\ & & 2 & -2 & -18 \\ \hline & 1 & -1 & -9 & -12 \end{array}$$

$remainder$: -12

$coefficients$: $1 \quad -1 \quad -9$

$$\boxed{x^2 - x - 9 + \frac{-12}{x - 2}}$$

Example 4: $(2x^3 - x - 7) \div (x + 3)$

$k - value = -3$

$k - value$

$$\begin{array}{r|rrrr} -3 & 2 & 0 & -1 & -7 \\ & & -6 & 18 & -51 \\ \hline & 2 & -6 & 17 & -58 \end{array}$$

$coefficients$

$remainder$

$coefficients$

$$\boxed{2x^2 - 6x + 17 + \frac{-58}{x+3}}$$

End Behavior

The **end behavior** of a graph talks about which way y is headed as x goes towards either positive infinity ($+\infty$) or negative infinity ($-\infty$).

Basically:

as x goes to the right, is y going up or down?

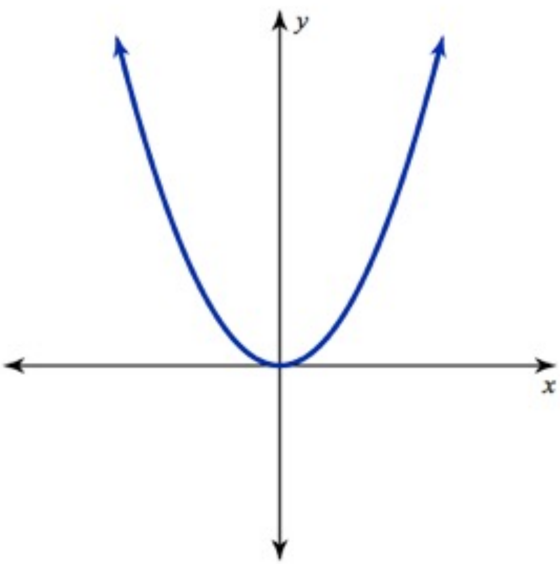
as $x \to +\infty$, is $y \to +\infty$ or is $y \to -\infty$

as x goes to the left, is y going up or down?

as $x \to -\infty$, is $y \to +\infty$ or is $y \to -\infty$

For the graph of a polynomial function, the end behavior is determined by the function's degree and the sign of its leading coefficient.

End Behavior with Parabolas:



Example: $y = x^2$

Degree: 2 (even number)

Leading Coefficient sign: +

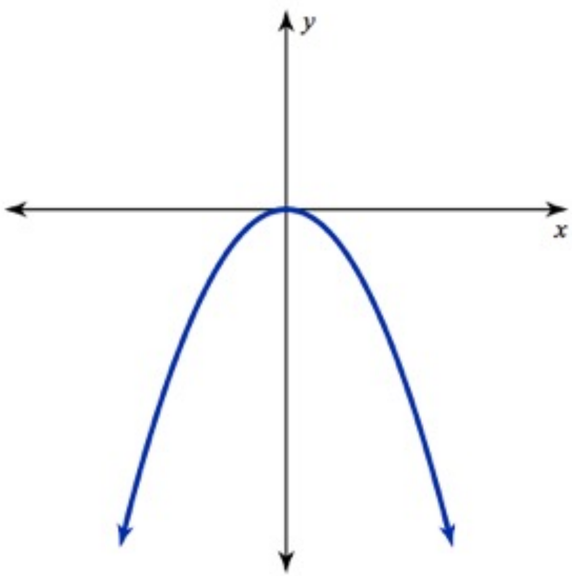
as x goes to the right, y goes up

$\boxed{\text{as } x \to +\infty,\ y \to +\infty}$

as x goes to the left, y goes up

$\boxed{\text{as } x \to -\infty,\ y \to +\infty}$

End Behavior with Parabolas:



Example: $y = -x^2$

Degree: 2 (even number)

Leading Coefficient sign: $-$

as x goes to the right, y goes down

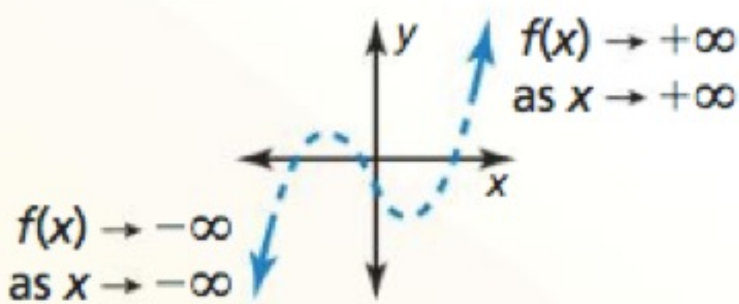
$\boxed{\text{as } x \to +\infty,\ y \to -\infty}$

as x goes to the left, y goes down

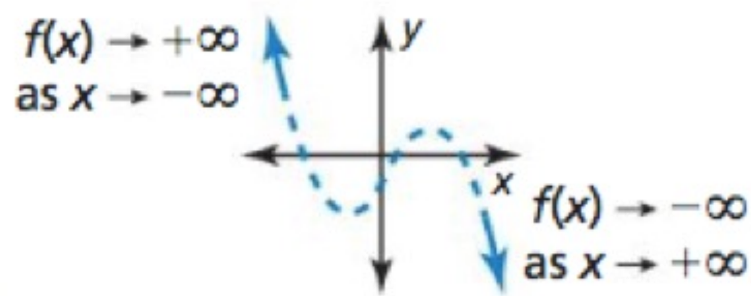
$\boxed{\text{as } x \to -\infty,\ y \to -\infty}$

End Behavior of Polynomial Functions

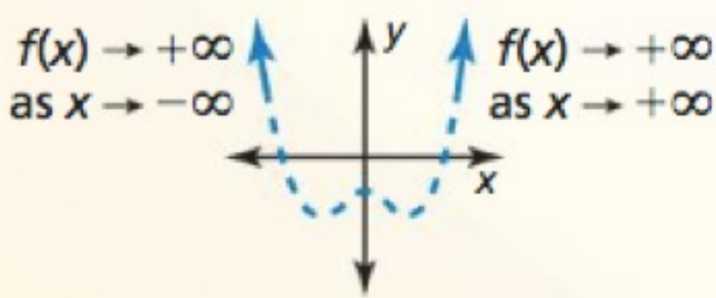
Degree: odd
Leading coefficient: positive



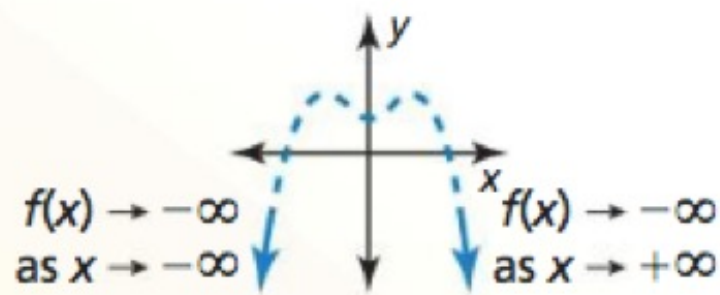
Degree: odd
Leading coefficient: negative



Degree: even
Leading coefficient: positive



Degree: even
Leading coefficient: negative



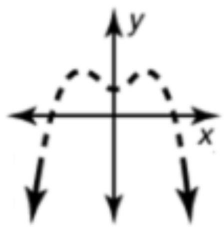
Examples:

In Exercises 7 and 8, describe the end behavior of the graph of the function.

7. $f(x) = -3x^6 + 4x^2 - 3x + 6$

Degree: 6: even

LC sign: negative



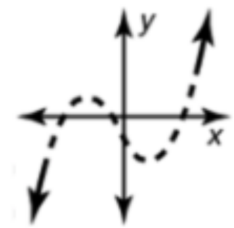
$\boxed{\begin{array}{l} \text{as } x \to +\infty,\ y \to -\infty \\ \text{as } x \to -\infty,\ y \to -\infty \end{array}}$

8. $f(x) = \frac{4}{5}x + 6x + 3x^5 - 3x^3 - 2$

$f(x) = 3x^5 - 3x^3 + 6\frac{4}{5}x - 2$

Degree: 5: odd

LC sign: positive



$\boxed{\begin{array}{l} \text{as } x \to +\infty,\ y \to +\infty \\ \text{as } x \to -\infty,\ y \to -\infty \end{array}}$