Analyzing Polynomial Functions
Factoring Review

HW:

Analyzing polynomial functions WKST

REVIEW

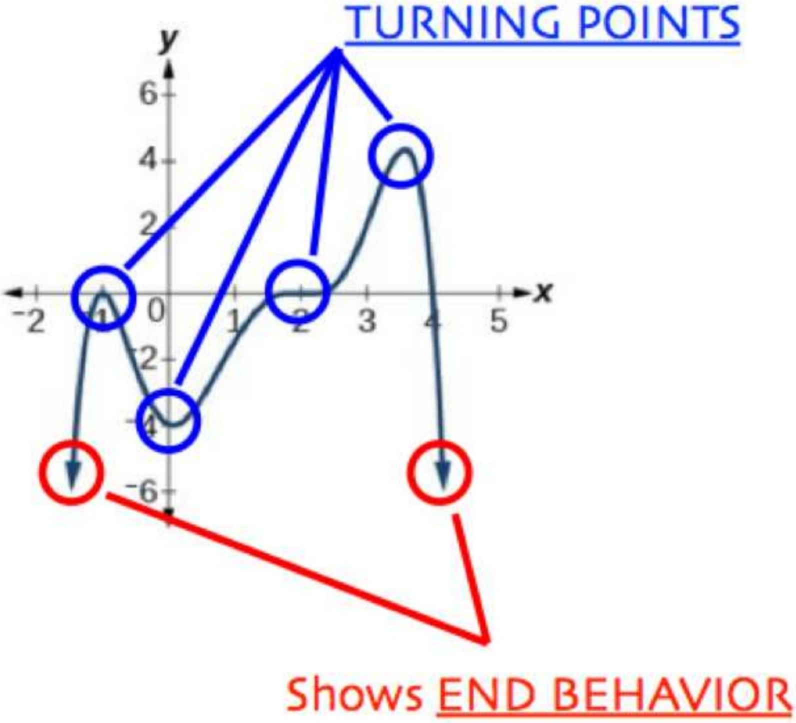
What is a polynomial function?

A polynomial function is an expression involving one or more monomials. Polynomial functions have variables with whole exponents, real coefficients and contain no division by variables. The degree of a polynomial is the largest exponent (attached to a variable). The leading coefficient is the coefficient of the term that defines the degree.

$$f\left(x\right)=2x^2-4x+\frac{1}{7} \qquad f\left(x\right)=0$$

$$f\left(x\right)=\frac{x^3}{5} \qquad f\left(x\right)=3x^5-x^4+5x-1$$

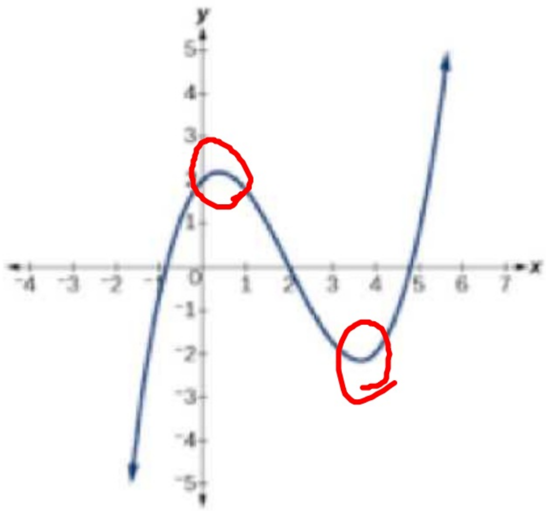
Graphs of Polynomial Functions



*A turning point can occur at a maximum, minimum or at a "flat point."

ex: Using the graph determine the number of turning points.

a)



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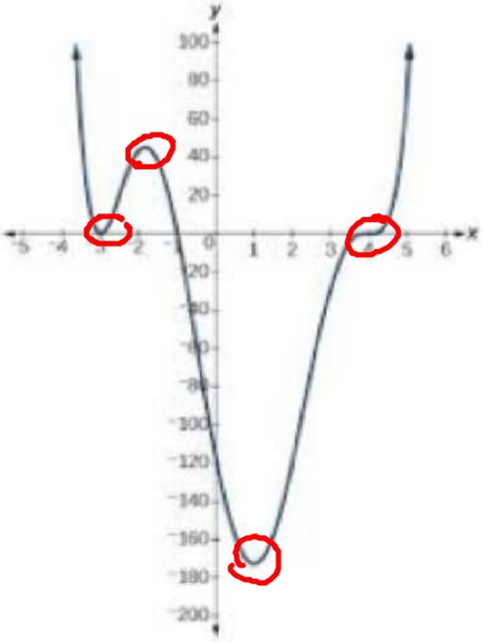
ex: Using the graph determine the number of turning points.

b)



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Polynomial Degrees and Number of Turning Points

Polynomial Type	Degree	Maximum Number of Turning Points
Constant number	0	0
Linear	1	0
Quadratic	2	1
Cubic	3	2
n^{th} Degree Polynomial	n	$n-1$

ex: Determine the degree and state the maximum number of turning points.

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

3 ; 2

b) $f(x) = 9x^4 - 6x^5$

5 ; 4

ex: Determine the degree and state the maximum number of turning points.

c) $f(x) = (3x-1)^2$ $= (3x-1)(3x-1)$

$9x^2 - 6x + 1$

$2 ; 1$

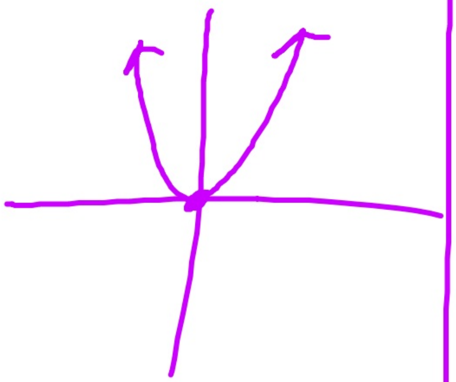
d) $f(x) = \underbrace{(x^2-5)}_{2}\underbrace{(2x+7)^3}_{3}$

$x^2 \cdot x^3$

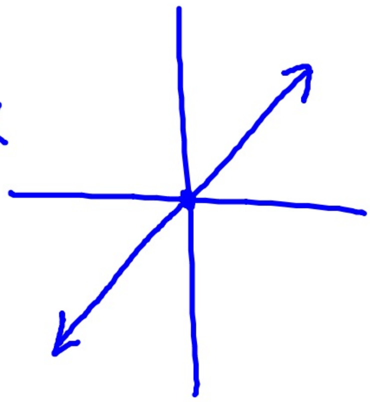
x^5

$5 ; 4$

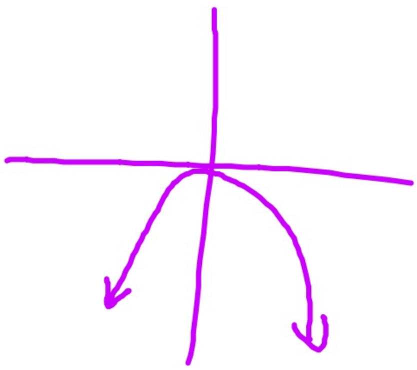
$y = x^2$



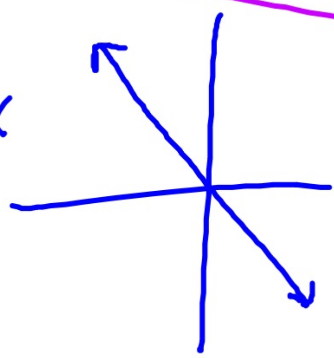
$y = x$



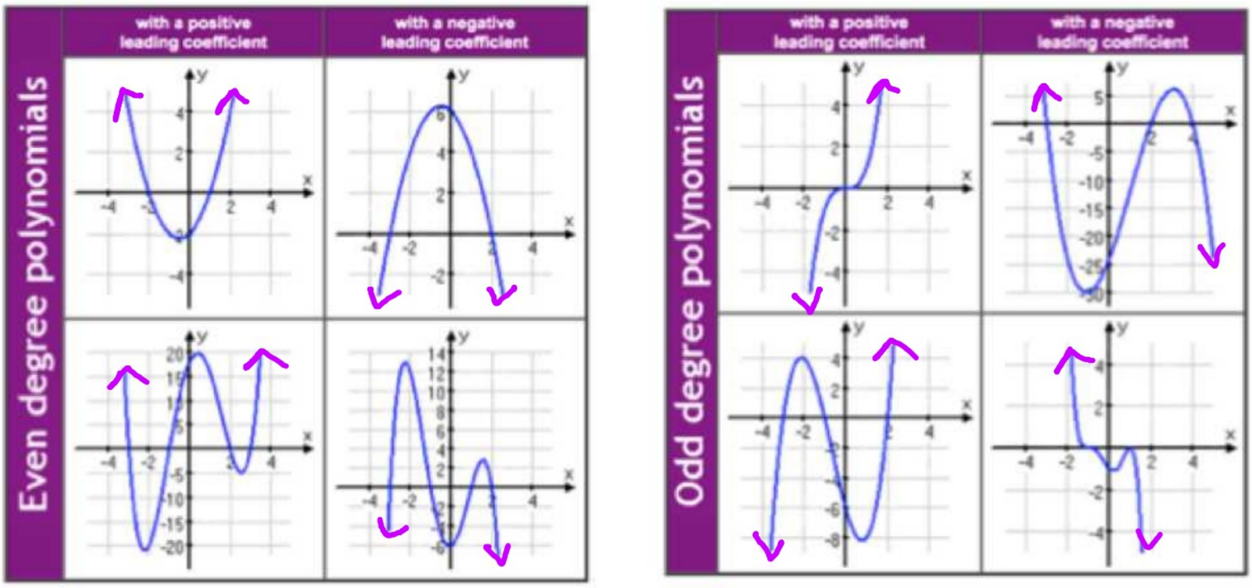
$y = -x^2$



$y = -x$



End Behavior, Degrees & Leading Coefficients



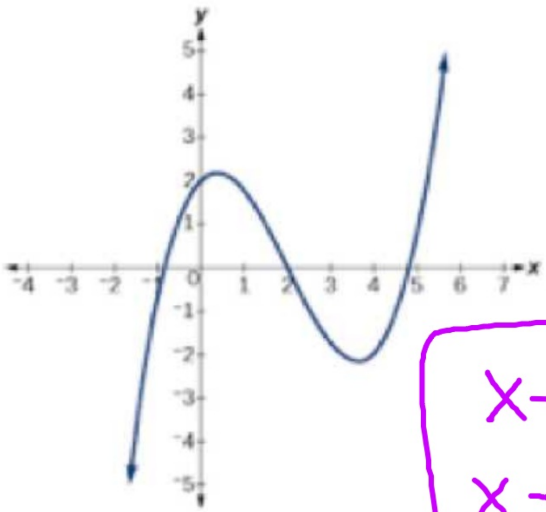
Stating End Behavior

$$x \to -\infty, \quad y \to \_\_\_\_\_\_$$

$$x \to \infty, \quad y \to \_\_\_\_\_\_$$

ex: Determine the end behavior of each polynomial.

a)



↑ ↑ ↓ ↓

↓ ↑ ↑ ↓

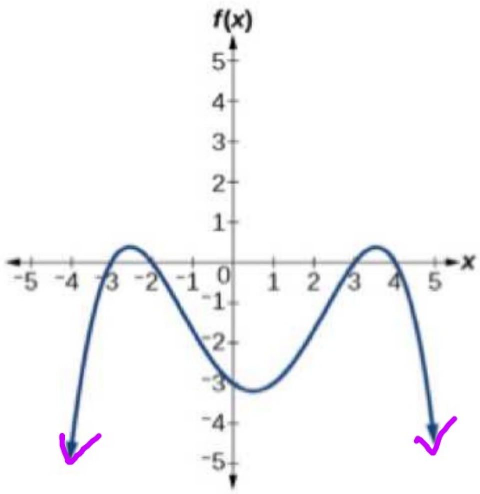
$$\boxed{\begin{array}{ll} x \to -\infty & y \to -\infty \\ x \to \infty & y \to \infty \end{array}}$$

(down)
(up)

State end behavior

ex: Determine the end behavior of each polynomial.

b)



$x \to -\infty \quad y \to -\infty$

$x \to \infty \quad y \to -\infty$

ex: Determine the end behavior of each polynomial.

c) $f(x) = \underline{2x^3} + 5x^2 - 9$

odd degree

pos. l.c.

↓↑

$x \to -\infty \quad y \to -\infty$

$x \to \infty \quad y \to \infty$

ex: Determine the end behavior of each polynomial.

d) $f(x) = 9x^4 \underline{\underline{\underline{-6x^5}}}$

odd degree

neg. l.c.

$\uparrow \downarrow$

$x \to -\infty \quad y \to \infty \quad \uparrow$

$x \to \infty \quad y \to -\infty \quad \downarrow$

ex: Determine the end behavior of each polynomial.

e) $f(x) = (3x-1)^2$

$9x^2$

even degree

pos. l.c.

$\uparrow \uparrow$

$x \to -\infty \quad y \to \infty$

$x \to \infty \quad y \to \infty$

ex: Determine the end behavior of each polynomial.

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

$x^2 \cdot x^3$

x^5

odd degree

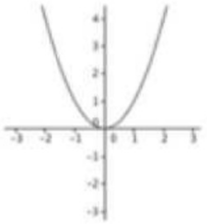
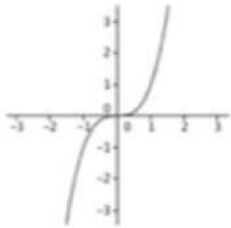
pos. l.c.

$\downarrow \uparrow$

$x \to -\infty \quad y \to -\infty$

$x \to \infty \quad y \to \infty$

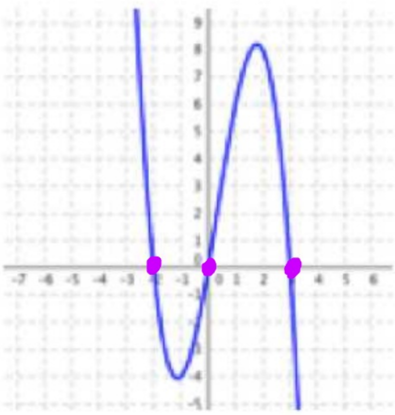
Bouncing and Crossing Zeros

In the graph below the graph "bounces" off the x-axis at x=o. 	In the graph below the graph "crosses" the x-axis at x=o. 

ex: Using the graph or the equation of the polynomial function,

1. Find the zeros. State the multiplicity if greater than 1.
2. Determine whether the graph "crosses" the x-axis or "bounces" off the x-axis at each zero.

a) $f(x) = -x(x+2)(x-3)$



$x = 0$
$x = -2$
$x = 3$

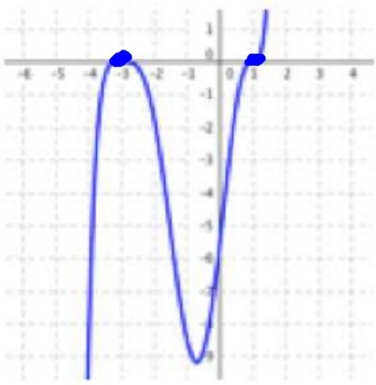
All mult. of 1

All crossing.

ex: Using the graph or the equation of the polynomial function,

1. Find the zeros. State the multiplicity if greater than 1.
2. Determine whether the graph "crosses" the x-axis or "bounces" off the x-axis at each zero.

b) $f(x) = \frac{1}{15}(x+3)^4 (x-1)^3$



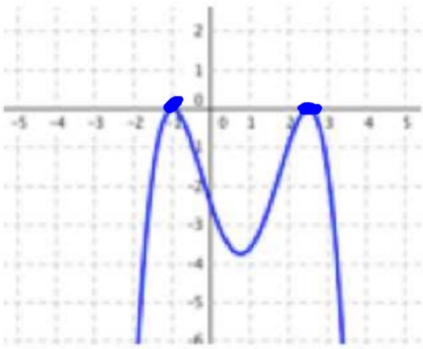
X = -3, mult. of 4 bounce

X = 1, mult. of 1 cross

ex: Using the graph or the equation of the polynomial function,

1. Find the zeros. State the multiplicity if greater than 1.
2. Determine whether the graph "crosses" the x-axis or "bounces" off the x-axis at each zero.

c) $f(x) = -\frac{1}{10}(2x-5)^2(x+1)^2$



$x = -1$ mult. of 2

$x = 2.5$ mult. of 2

both bounce

- A graph "crosses" the x-axis at a zero if the multiplicity of that zero is ___odd___.

- A graph "bounces" off the x-axis at a zero if the multiplicity of that zero is ___even___.

REVIEW

ex: Factor completely, if possible.

a) $4x^3 - 25x^2 + 25x$

$x(4x^2 - 25x + 25)$

$x(4x-5)(x-5)$

REVIEW

ex: Factor completely, if possible.

b) $x^2 + 9$

does not factor

REVIEW

ex: Factor completely, if possible.

c) $2x^3 - 3x^2 + 10x - 15$

$(x^2 + 5)(2x - 3)$

REVIEW

ex: Factor completely, if possible.

d) $8x^3 - 1$

$(2x - 1)(4x^2 + 2x + 1)$

REVIEW

ex: Factor completely, if possible.

e) $2x^2 - 32$

$2(x - 4)(x + 4)$

REVIEW

ex: Factor completely, if possible.

f) $-5x^2 + 18x - 9$

-(5x - 3)(x - 3)

REVIEW

ex: Factor completely, if possible.

g) $2x^4 + 7x^2 + 6$

$(2x^2 + 1)(x^2 + 3)$

REVIEW

ex: Factor completely, if possible.

h) $x^5 - x^3 + 64x^2 - 64$

$(x + 4)(x^2 - 4x + 16)(x - 1)(x + 1)$

REVIEW

ex: Factor completely, if possible.

i) $x^4 + 4x^2 + 5$

does not factor