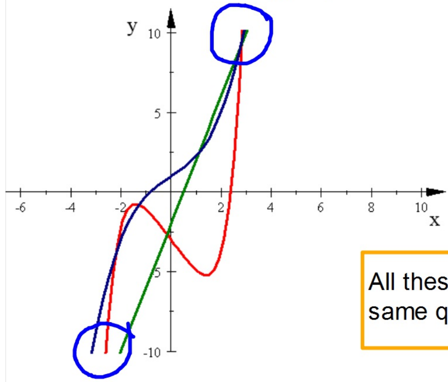
End Behavior
of polynomial graphs.

What do the graphs have in common?



$$Y_1 = 4x - 2$$
$$Y_2 = 0.25x^3 + x + 1$$
$$Y_3 = 0.1x^5 - 2x - 3$$

All these functions start and end in the same quadrant.

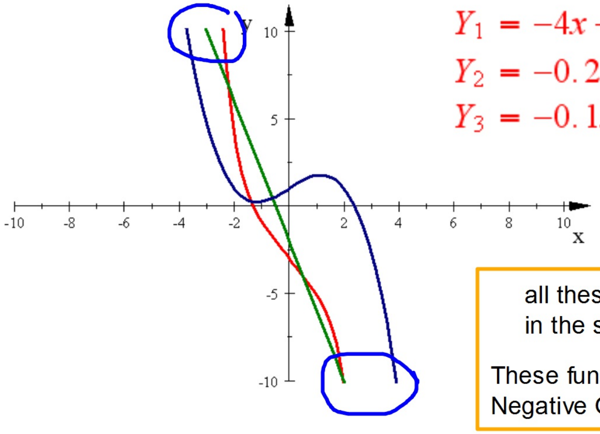
What do the equations have in common?

	Degree	Lead Coeff
$Y_1 = 4x - 2$	1	4
$Y_2 = 0.25x^3 + x + 1$	3	0.25
$Y_3 = 0.1x^5 - 2x - 3$	5	0.1
	ODD	pos

all these functions are considered Positive Odd functions

$$Y_1 = -4x - 2$$
$$Y_2 = -0.25x^3 + x + 1$$
$$Y_3 = -0.1x^5 - 2x - 3$$

What would happen if they all had a negative leading coefficient?



$Y_1 = -4x - 2$

$Y_2 = -0.25x^3 + x + 1$

$Y_3 = -0.1x^5 - 2x - 3$

all these functions begin and end in the same quadrant.

These functions would be considered Negative Odd functions.

Odd Functions

Positive Leading Coefficient:

Moves from the third quadrant to the first quadrant.

Like a line with a Positive slope

Negative Leading Coefficient:

Moves from the second quadrant to the fourth quadrant.

Like a line with a Negative slope

This is called the END BEHAVIOR of an ODD function

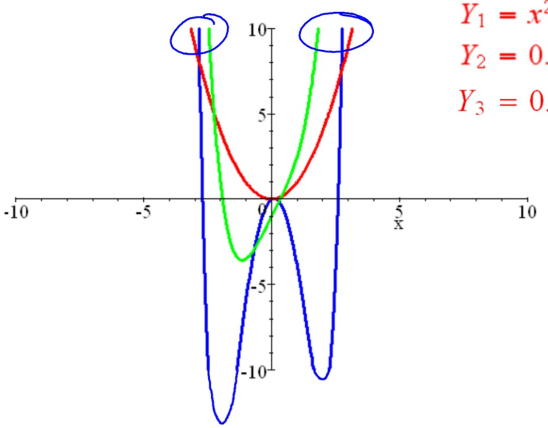
Graph all three of these in a Standard Window:

$$Y_1 = x^2$$

$$Y_2 = 0.5x^4 + 3x - 1$$

$$Y_3 = 0.1x^6 - 5x^2 + x$$

What do the graphs have in common?



$Y_1 = x^2$

$Y_2 = 0.5x^4 + 3x - 1$

$Y_3 = 0.1x^6 - 5x^2 + x$

All these graphs begin in the 2nd Quadrant and end in the 1st Quadrant.

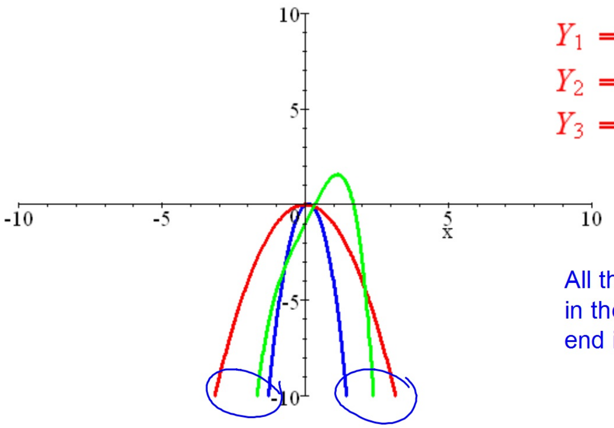
What do the equations have in common?

	Degree	Lead Coeff
$Y_1 = x^2$	2	+
$Y_2 = 0.5x^4 + 3x - 1$	4	+
$Y_3 = 0.1x^6 - 5x^2 + x$	6	+
	Even	pos

All these functions would be called
Positive Even functions.

$Y_1 = -x^2$
$Y_2 = -0.5x^4 + 3x - 1$
$Y_3 = -0.1x^6 - 5x^2 + x$

What would happen if they all had a negative leading coefficient?



$Y_1 = -x^2$
$Y_2 = -0.5x^4 + 3x - 1$
$Y_3 = -0.1x^6 - 5x^2 + x$

All these graphs begin
in the 3rd Quadrant and
end in the 4th Quadrant.

Even Functions: Largest exponent is EVEN when expanded

This is called the degree of
the function.

Positive Leading Coefficient:

Moves from the second quadrant
to the first quadrant.
Like a parabola with a>0

Negative Leading Coefficient:

Moves from the third quadrant
to the fourth quadrant.
Like a parabola with a<0

Even Functions

Positive Leading Coefficient:

Moves from the second quadrant to the first quadrant.

Like a parabola with a>0

Negative Leading Coefficient:

Moves from the third quadrant to the fourth quadrant.

Like a parabola with a<0

This is called the END BEHAVIOR of an EVEN function

End-Behavior:

The behavior of the graph on the far left and the far right.

How the value of the function (y) changes as x becomes larger negative LEFT END $x \to -\infty$ and larger positive RIGHT END. $x \to \infty$

END BEHAVIOR

EVEN Functions:

Positive Leading Coefficient:	Negative Leading Coefficient:
(↖ , ↗)	(↙ , ↘)
as $x \to -\infty, y \to \infty$	as $x \to -\infty, y \to -\infty$
as $x \to \infty, y \to \infty$	as $x \to \infty, y \to -\infty$

as $x \to \pm\infty, y \to \infty$

as $x \to \pm\infty$, $y \to -\infty$

END BEHAVIOR

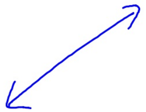
ODD Functions:

Positive Leading Coefficient:	Negative Leading Coefficient:
(↙ , ↗)	(↖ , ↘)
as $x \to -\infty, y \to -\infty$	as $x \to -\infty, y \to \infty$
as $x \to \infty, y \to \infty$	as $x \to \infty, y \to -\infty$

Odd Function
End Behavior:

think of a LINE

Pos ODD:

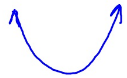


Neg ODD:

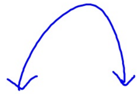
Even Function
End Behavior:

think of a PARABOLA

Pos EVEN:



Neg EVEN:



State the end behavior of each polynomial.

1. $y = 4x^3 - 6x^2 + 11x - 93$ $(\swarrow, \nearrow)$
   POS ODD
2. $y = 5x(x+2)(x-7)^2$ $(\nwarrow, \nearrow)$
   POS EVEN
3. $f(x) = 9x + 6x^2 - x^3 + 13$ $(\nwarrow, \searrow)$
   NEG ODD
4. $y = (9x-7)(4-x)$ $(\swarrow, \searrow)$
   NEG EVEN

You can now finish Hwk #26:

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Problems 1-10