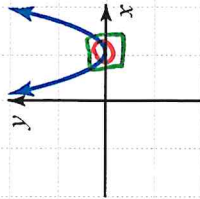
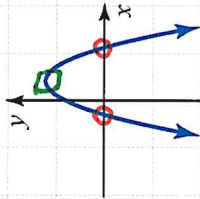
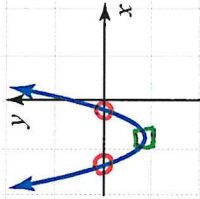


2.2 Polynomial Functions

Recall that $f(x) = ax^2 + bx + c$ is a Quadratic Function (Degree = 2)

x-intercept 

turning point 



End Behavior

$$y = x^2 + 4x + 2$$

Right: As $x \rightarrow \infty$

Right: Rises

Right: Falls

Right: Rises

Left: As $x \rightarrow -\infty$

Left: Rises

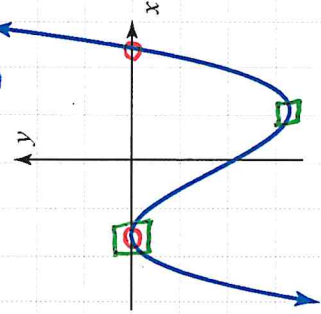
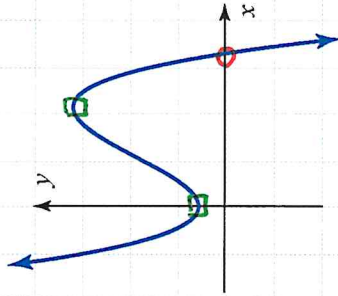
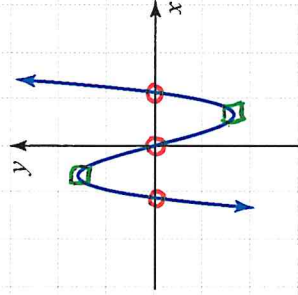
Left: Falls

Left: Rises

$$y = -x^2 + 2x + 3$$

$$y = x^2 - 6x + 4$$

The function $g(x) = ax^3 + bx^2 + cx + d$ is a Cubic Function (Degree = 3)



$$y = 3x^3 - 12x$$

$$y = -x^3 + 7x^2 + 10$$

$$y = x^3 + x^2 - 8x - 12$$

Right: Rise

Right: Fall

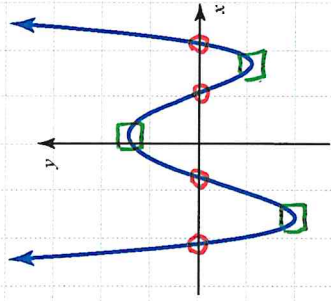
Right: Rise

Left: Fall

Left: Rise

Left: Fall

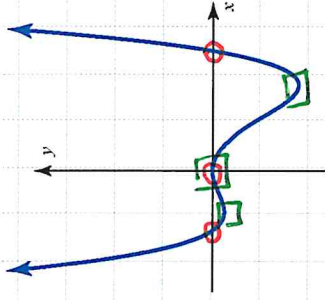
The function: $h(x) = ax^4 + bx^3 + cx^2 + dx + e$ is a Quartic Function (Degree = 4)



$$y = 3x^4 - x^3 - 14x^2 + 4x + 8$$

Right: Rise

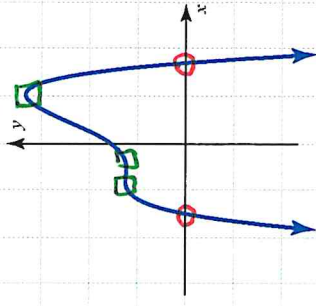
Left: Rise



$$y = \frac{1}{2}x^4 - x^3 - 4x^2$$

Right: Rise

Left: Rise



$$y = -2x^4 - x^3 + 6x^2 + 7x + 10$$

Right: Fall

Left: Fall

Definition: A general polynomial function has the form

$$P(x) = a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \dots + a_2 x^2 + a_1 x + a_0 x^0$$

where n is a positive whole number and the coefficients

$(a_n, a_{n-1}, \dots, a_1, a_0)$ are real numbers.

y -intercept
($x=0$)

Ex. $M(x) = 17x^{100} - 3.14x^{50} + \frac{22}{7}x^{15} - \pi x^7 + \sqrt{10}$

Leading term: $17x^{100}$ Leading coefficient: 17

Constant term: $\sqrt{10}$

Observations from the graphs:

(1) For an n^{th} degree polynomial function there are

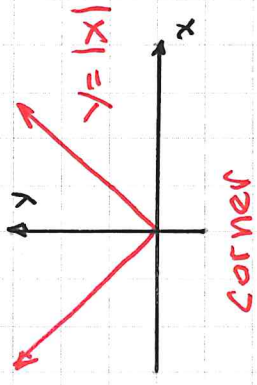
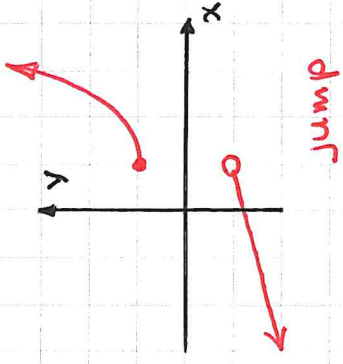
- a) a maximum of n x-intercepts
- b) a maximum of $n-1$ turning points

(2) The graph of a polynomial function is

- a) CONTINUOUS (no breaks, no jumps, no gaps)
- b) SMOOTH (no corners)

(3) The End Behavior depends on

- a) the DEGREE of the polynomial (even or odd)
- b) the SIGN of the leading coefficient (+ or -)



	Even	Odd
+		
-		

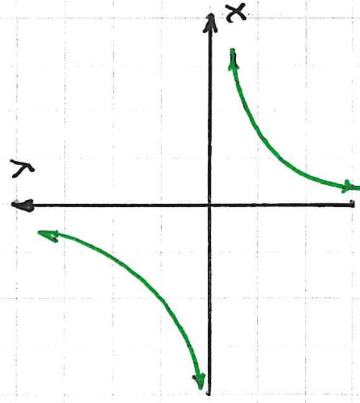
Ex. ① Determine the End Behavior of the following functions

a) $f(x) = 32x^{14} + 8x^5 - 4$ Rise Left and Rise Right

b) $g(x) = -12x^7 + 5x^4$ Rise Left and Fall Right

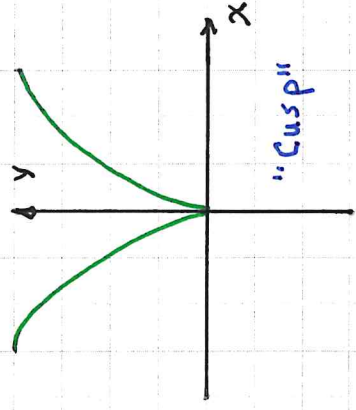
c) $h(x) = 4x^7 - 3x^{12}$ Fall Left and Fall Right

Ex. ② Which of the following could be the graph of a polynomial function?



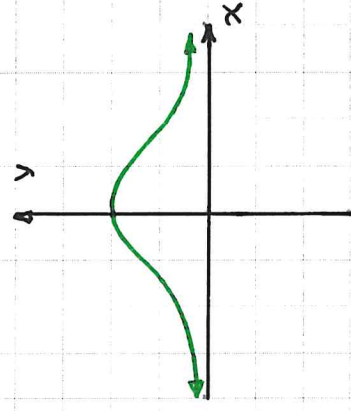
No

Break



No

Corner



No

Wrong End Behavior