3.1 Polynomial Functions

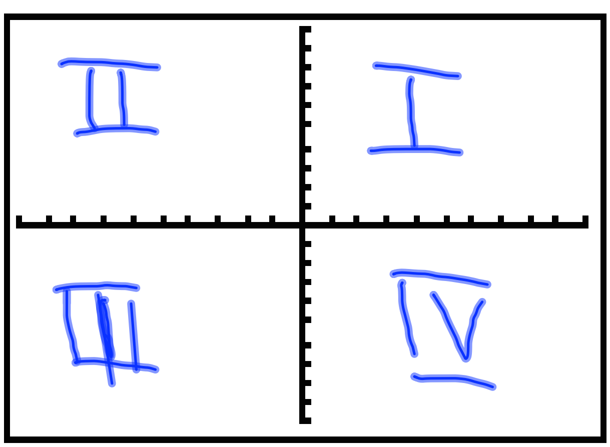
You need a little information before you begin.

- *The **degree** of the function is the **exponent of the highest power** on x in the equation.*
- *The **leading coefficient** is the coefficient on the term with the highest exponent.*
- *The following are examples;*

	Degree	Leading coefficient
Linear function $f(x) = 3x + 4.5$	1	3
Quadratic function $f(x) = -2x^2 + 5x + 2$	2	-2
Cubic function $f(x) = x^3 - 2x^2 + 3x + 4$	3	1
Quartic function $f(x) = x^4 - 5x^2 + 7$	4	1

Polynomials in standard form are written from largest exponent to smallest exponent.

Quadrants:



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Degree	Sign of leading coefficient	Extends from quadrant…	To quadrant…	Greatest number of hills and valleys
1	+	3	1	0
1	-	2	4	0
2	+	2	1	1
2	-	3	4	1
3	+	3	1	2
3	−	2	4	2
4	+	2	1	3
4	−	3	4	3
5	+	3	1	4
5	−	2	4	4

Use the chart to answer the following questions.

1. Describe the quadrant a graph extends from for each of the following situations

a) Odd degree with a positive leading coefficient

Starts in 3 and ends in 1

b) Odd degree with a negative leading coefficient

2 → 4

c) Even degree with a positive leading coefficient

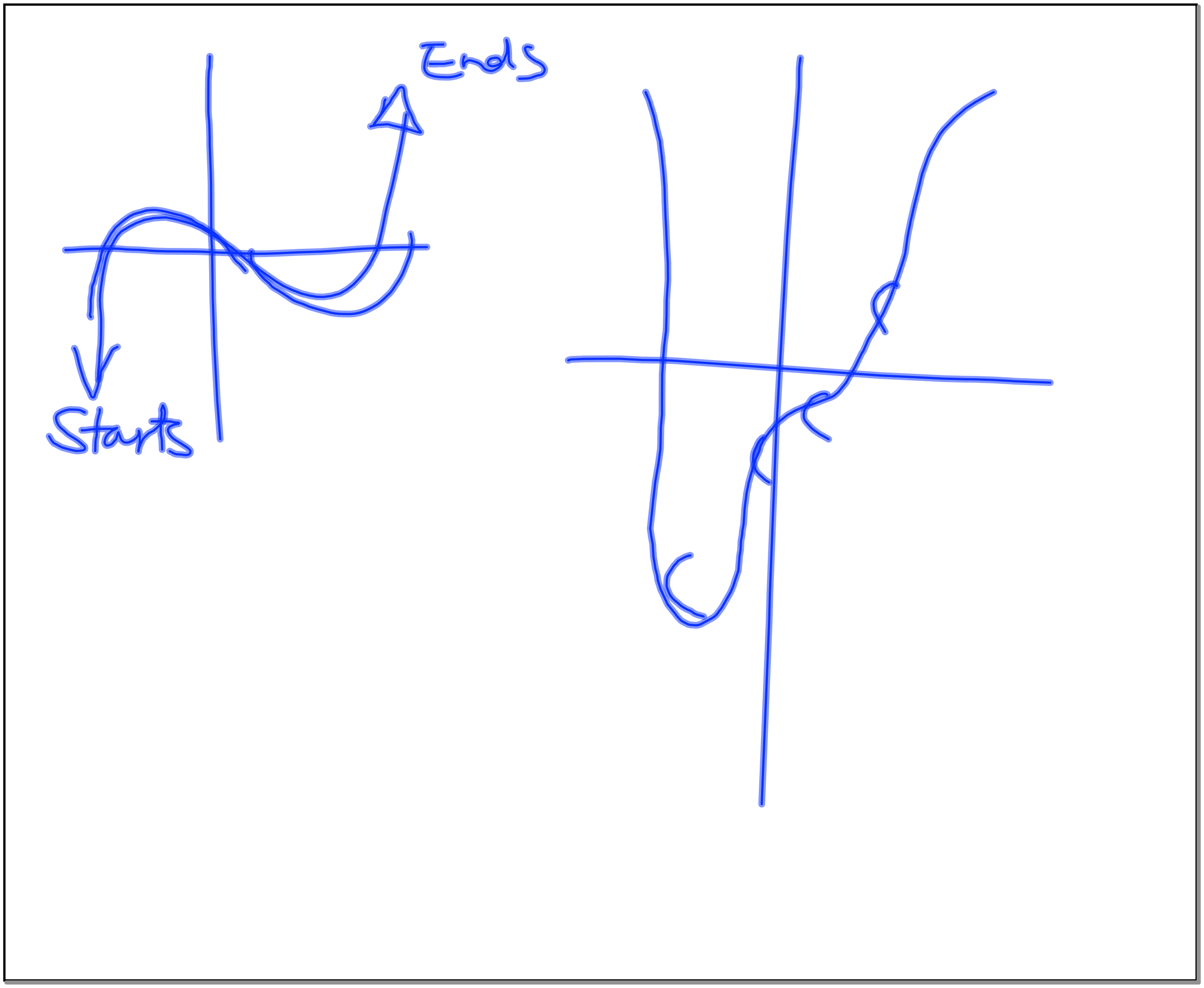
2 → 1

d) Even degree with a negative leading coefficient

3 → 4

2. Describe how the number of hills and valleys relates to the degree of the polynomial function.

1 # of hills & valleys is less than the degree.


Ends
Starts

A polynomial function of degree "n" is a function whose equation can be written in the form

$$f(x) = a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \ldots + a_1 x + a_0$$

where "n" (the exponents) must be whole numbers and

$a_n, a_{n-1}, a_{n-2}, a_1, a_0$ (the coefficients) are real numbers

Are the following polynomials???

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

Not a poly because of the exponent $\frac{3}{4}$

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

No Negative exponent

$$f(x) = 4x + \sqrt{8x}$$

$4x + 8^{\frac{1}{2}} x^{\frac{1}{2}}$

No

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

$3x^{-2}$ No

$$f(x) = \sqrt{7}x^3 - 2x$$

Yes

$$f(x) = x^2 - 4x^3 + \sqrt{-3}$$

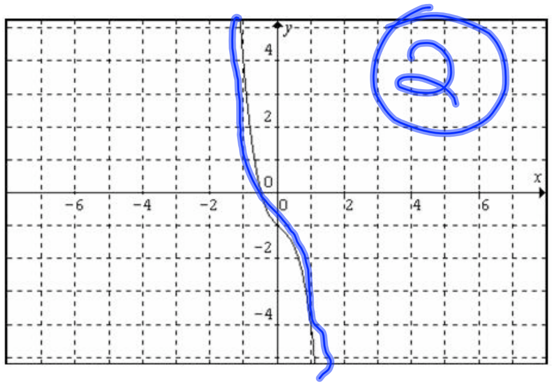
Identify the function that corresponds to each graph

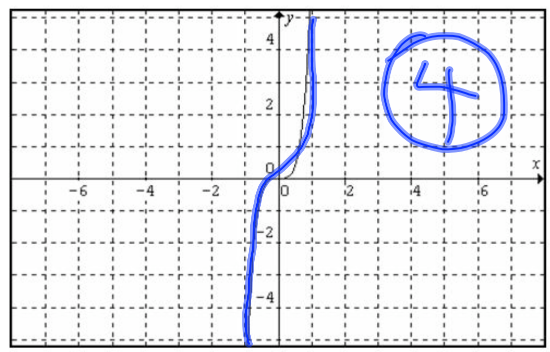
1 $h(x) = x^4 - 3x^2 - 2$

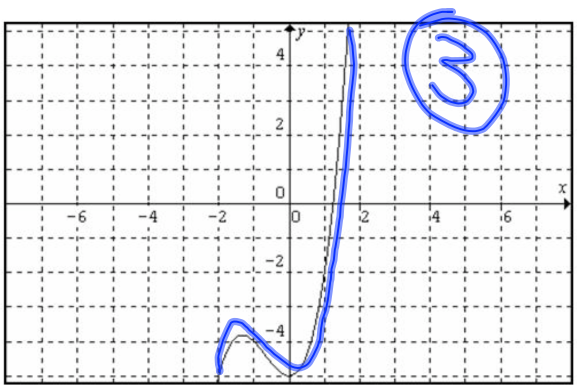
2 $f(x) = -3x^3 + x^2 - x - 1$

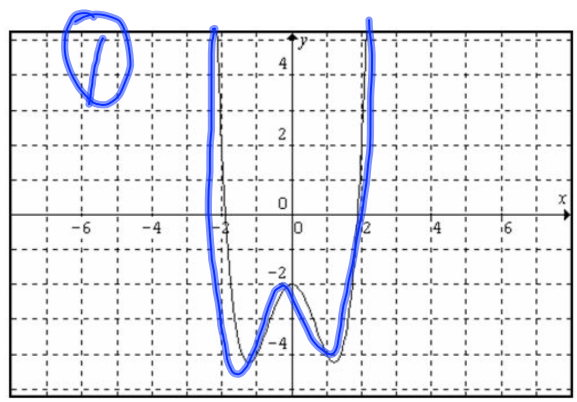
3 $g(x) = 5x^5 + 2x^3$

4 $f(x) = x^3 + 2x^2 - 5$









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