

Polynomial Functions

Obj: Determine the leading coefficient and degree of a polynomial.

Polynomial Functions

degree : 3

$$7x^3 + 8x^2 - 3x + 1$$

Expression

$$f(x) = \underline{7}x^3 + 8x^2 - 3x + 1$$

Function

LC : 7

The degree of a polynomial in one variable is the highest exponent on the variable.

The leading coefficient is the coefficient on the term with the highest exponent.
in front x

→ Same term

Polynomial Functions

Obj: Determine the leading coefficient and degree of a polynomial.

Example 1: State the degree and leading coefficient (LC) of each polynomial in one variable.

a. $7z^3 - 4z^2 + z$

Degree: 3

LC: 7

b. $10a - 4a^2 + 6a^3$

Degree: 3

LC: 6

c. $3c^2 + 4c - 2$

Degree: 2

LC: 3

d. $9y - 3y^2 + y^4$

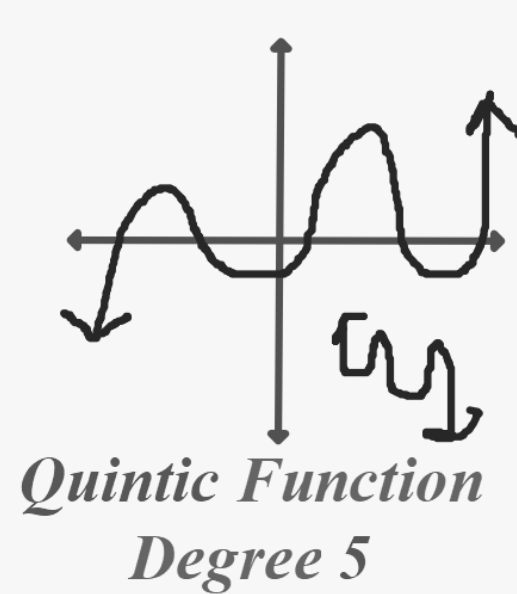
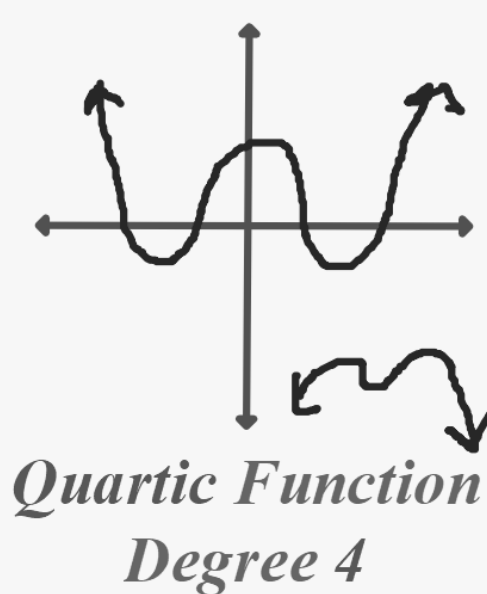
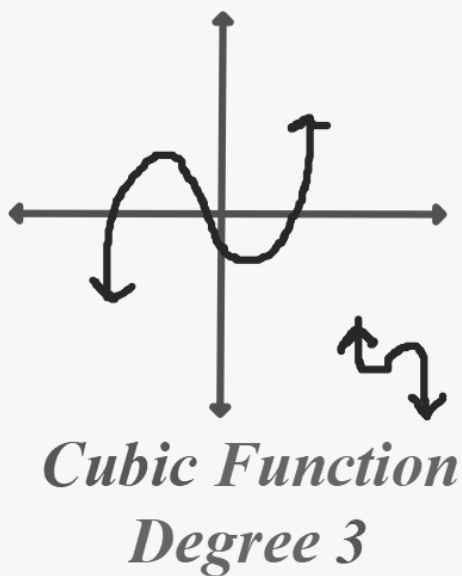
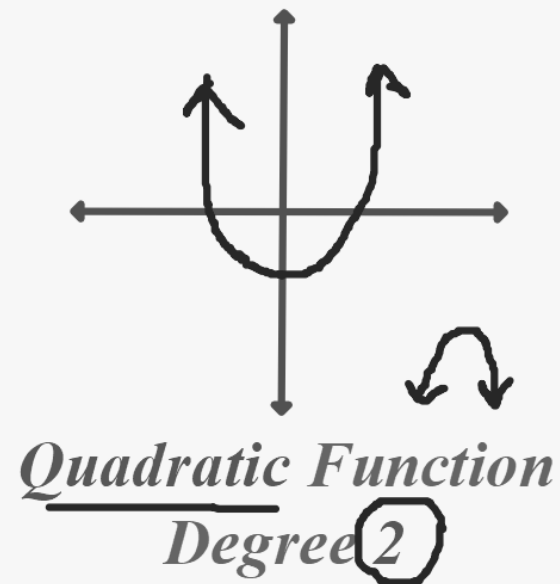
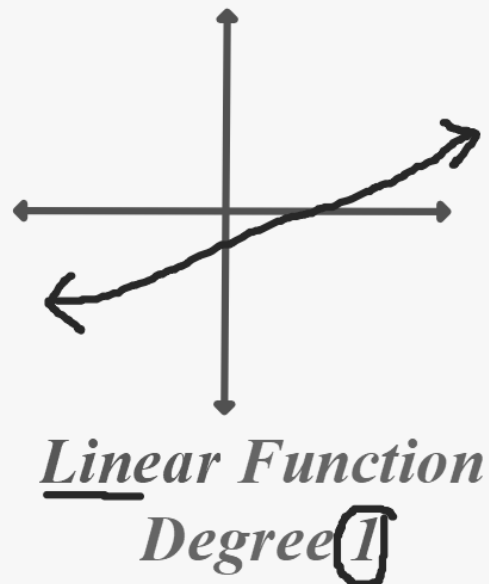
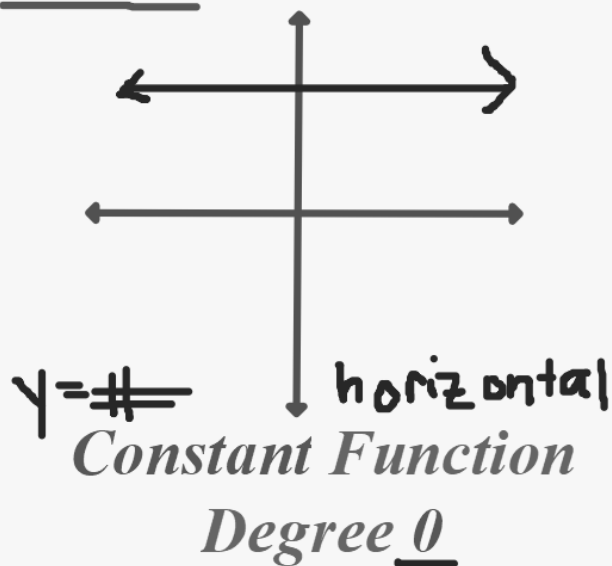
Degree: 4

LC: 1

🐾 Polynomial Functions 🐾

Obj: Identify general shapes of graphs of polynomial functions.

General Graphs of Polynomial Functions



Polynomial Functions

Obj: State the end behavior of graphs of polynomial functions.

Real zeros \longrightarrow where the graph crosses the x-axis

End behavior \longrightarrow what graph is doing as "x" approaches positive infinity ($+\infty$) or negative infinity ($-\infty$).

$x \longrightarrow +\infty$ (x approaches positive infinity)

$x \longrightarrow -\infty$ (x approaches negative infinity)

$f(x) \longrightarrow +\infty$ function (ends) goes up $+\infty$

$f(x) \longrightarrow -\infty$ function (ends) goes down $-\infty$

🐾 Polynomial Functions 🐾

Obj: Identify general shapes of graphs of polynomial functions.

Obj: State the end behavior of polynomial functions.

EVEN

DEGREE

ends go same way

*Positive
Leading
Coefficient*

① *both ends up*

$\text{as } x \rightarrow -\infty, f(x) \rightarrow +\infty$ right end up

$\text{as } x \rightarrow +\infty, f(x) \rightarrow +\infty$ end up

ODD

DEGREE

ends go different ways

③ $\text{as } x \rightarrow -\infty, f(x) \rightarrow -\infty$

$\text{as } x \rightarrow +\infty, f(x) \rightarrow +\infty$

*Negative
Leading
Coefficient*

② *both ends down*

② $\text{as } x \rightarrow -\infty, f(x) \rightarrow -\infty$ right end down

$\text{as } x \rightarrow +\infty, f(x) \rightarrow -\infty$

④ $\text{as } x \rightarrow -\infty, f(x) \rightarrow +\infty$

$\text{as } x \rightarrow +\infty, f(x) \rightarrow -\infty$

Polynomial Functions



Obj: Identify general shapes of graphs of polynomial functions.

Obj: State the end behavior of polynomial functions.

Obj: Determine the leading coefficient and degree of a polynomial function.

Obj: Determine the number of real zeros from the graph of a polynomial function.



Example 2: For each graph

a.) describe end behavior

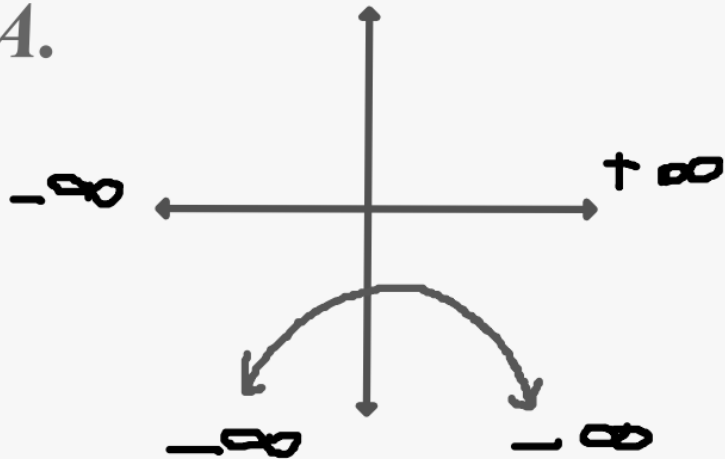
b.) odd or even degree

c.) # of real zeros

d.) positive or negative leading coefficient

e.) the least degree

A.



a.) as $x \rightarrow -\infty, f(x) \rightarrow -\infty$
as $x \rightarrow +\infty, f(x) \rightarrow -\infty$

b.) even (end both same)

c.) none

d.) neg. LC

e.) 2

Polynomial Functions



Obj: Identify general shapes of graphs of polynomial functions.

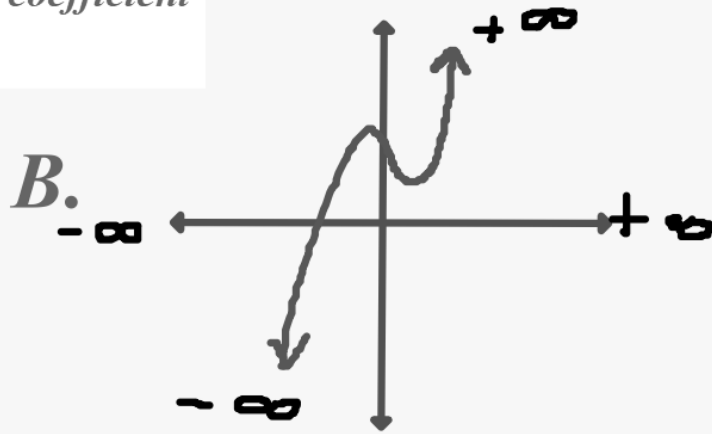
Obj: State the end behavior of polynomial functions.

Obj: Determine the leading coefficient and degree of a polynomial function.

Obj: Determine the number of real zeros from the graph of a polynomial function.



ng coefficient



a.) as $x \rightarrow -\infty$, $f(x) \rightarrow -\infty$
 as $x \rightarrow +\infty$, $f(x) \rightarrow +\infty$

b.) odd (1 up 1 down)

c.) one

d.) pos LC

e.) 3

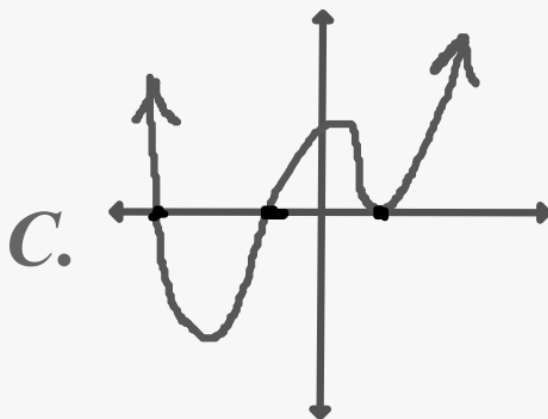
a.) as $x \rightarrow -\infty$, $f(x) \rightarrow +\infty$
 as $x \rightarrow +\infty$, $f(x) \rightarrow +\infty$

b.) Even

c.) 3

d.) pos LC

e.) 4



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Ex 3: For each function:

a.) describe end behavior b.) state degree c.) state leading coefficient

d.) sketch the general shape of the graph

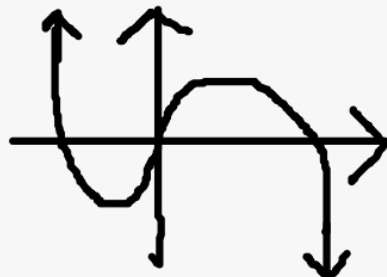
D. $f(x) = -4x^3 + 2x - 1$
as $x \rightarrow -\infty, f(x) \rightarrow +\infty$

a) as $x \rightarrow +\infty, f(x) \rightarrow -\infty$

b) 3

c) -4

d)



E. $f(x) = 5x^4 - 2x^3 + 2x - 5$
as $x \rightarrow -\infty, f(x) \rightarrow +\infty$

a) as $x \rightarrow +\infty, f(x) \rightarrow +\infty$

b) 4

c) 5

d)



Polynomial Functions



Obj: Identify general shapes of graphs of polynomial functions.

Obj: State the end behavior of polynomial functions.

Obj: Determine the leading coefficient and degree of a polynomial function.

Obj: Determine the number of real zeros from the graph of a polynomial function.

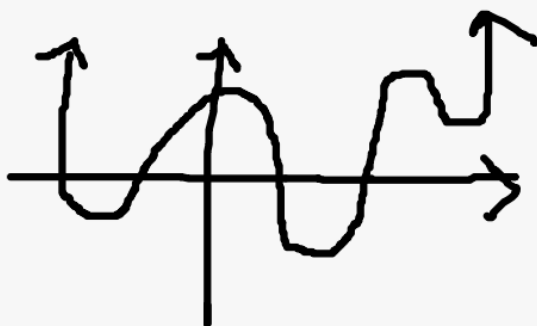


Ex 4: Sketch a graph of a polynomial function that has the following characteristics.

A.) 3rd degree, 3 real zeros, negative leading coefficient ↓



B.) 6th degree, 4 real zeros, positive leading coefficient



C.) 5th degree, 4 real zeros, positive leading coefficient





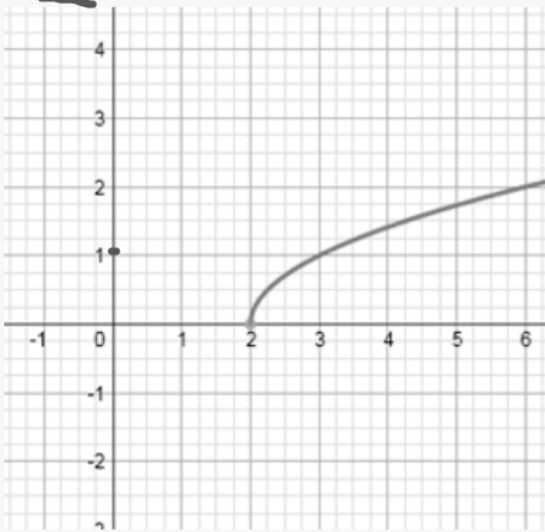
Polynomial Functions



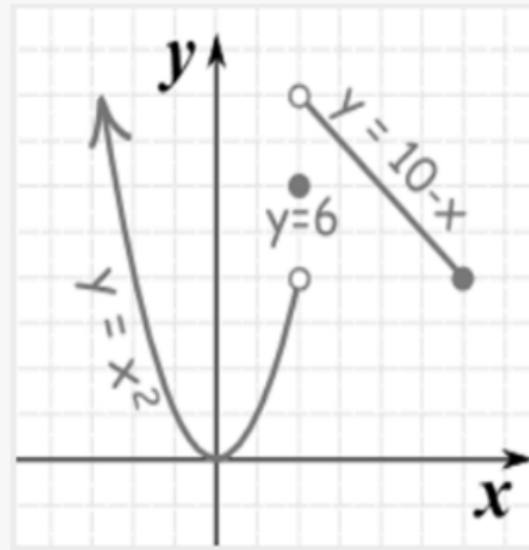
Obj: Evaluate functions from a graph and an equation.

Ex 5: Evaluate the function given the graph and/or the equation. $\sqrt{3-2} = \sqrt{1} = 1$

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



$$h(x) = \begin{cases} x^2 & \text{if } x < 2 \\ 6 & \text{if } x = 2 \\ 10 - x & \text{if } x > 2 \text{ and } x \leq 6 \end{cases}$$



$$t(x) = \begin{cases} (x-2)^2 & \text{if } x < -1 \\ |3x| & \text{if } x \geq -1 \text{ and } x < 4 \\ 1 & \text{if } x \geq 4 \end{cases}$$

a) $f(3) = 1$

b) $h(4) = 10 - 4 = 6$

c) $t(6) = 1$

d) $t(-1) = |3(-1)| = 3$

e) $h(-1) = (-1)^2 = 1$

f) $f(27) = 5$

$\sqrt{27-2} = \sqrt{25} = 5$