Learning Target(s): I am able to identify and evaluate polynomial functions.
I am able to use direct and synthetic substitution to evaluate polynomial functions.
I am able to identify the end behavior and graph a polynomial function.

Notes: 5.2 Evaluate and Graph Polynomial Functions

Polynomial – A monomial or a sum of monomials. (many)

Polynomial function – exponents are whole numbers, coefficients are real numbers.
* no negatives, no decimals

$\frac{x}{x^1}$ $x^{\frac{1}{2}}$

p. 337 Types of Common Polynomial Functions

Degree	Type
0	constant
1	linear
2	quadratic
3	cubic
4	quartic

standard form: terms are written in descending order from left to right

degree: highest exponent

leading coefficient: coefficient of the L.C. highest exponent term

Ex. 1 Decide whether the function is a polynomial function. If so, write it in standard form, state its degree, type, and leading coefficient.

a. $f(x) = 3x^3 + 4x^{2.5} - 6x^2$

No, decimal

b. $f(x) = x^2 + 3.7x + 9x^4$

Yes! $f(x) = 9x^4 + x^2 + 3.7x$
Deg = 4
type = quartic
L.C. = 9

Synthetic Substitution – An alternate method to evaluate a polynomial function using fewer operations than direct substitution.

Ex. 2 Use **synthetic substitution** to evaluate $f(x) = -x^4 + 3x^3 + x^2 - 4x - 1$ when $x = -2$

- Write the coefficients of f(x) in order of descending exponents

−2	−1	3	1	−4	−1
	↓	2 ↓	−10 ↓	18 ↓	−28 ↓
	−1 ↗	5 ↗	−9 ↗	14 ↗	−29

← in box: add down

outside box: multiply →

Ex. 3 Solve the same problem using **direct substitution:**

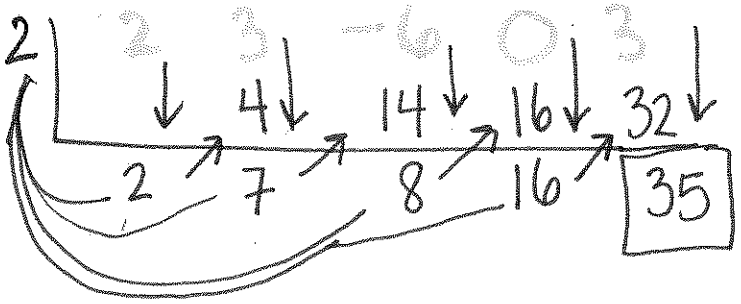
$f(x) = -x^4 + 3x^3 + x^2 - 4x - 1$ when x = -2

$f(x) = -(-2)^4 + 3(-2)^3 + (-2)^2 - 4(-2) - 1$

$= \boxed{-29}$

Ex. 4 Use synthetic substitution to evaluate $f(x) = 2x^4 + 3x^3 - 6x^2 + 3$ when x = 2.

**If you are missing a term you MUST use a zero as a place holder!!



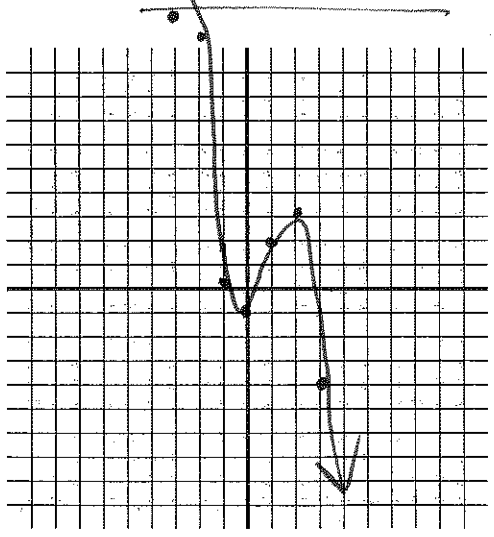
End behavior – The behavior of a polynomial function's graph as x approaches positive infinity or negative infinity.

$+\infty$ $-\infty$

Ex. 5 Graph $f(x) = -x^3 + 2x^2 + 2x - 1$ deg 3 odd L.C. -1 negative ↘

Use a graphing calculator to make a table of values and plot the points. Check the end behavior.

x	y
-3	38
-2	11
-1	0
0	-1
1	2
2	3
3	-4



End Behavior: as x approaches $+\infty$, $f(x) \to -\infty$

as x approaches $-\infty$, $f(x) \to +\infty$