In your Notes: Write down

1 **Ch 8 - Polynomials**

2 **Check your HW with the solutions** record your score on the old Recording sheet (pink)

3 Then pick up the **Warm Up**

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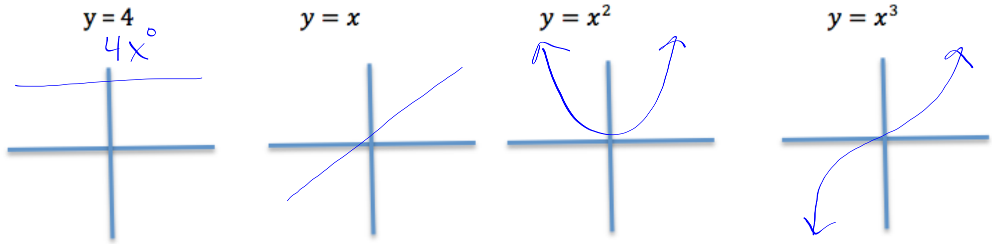
2. Sketch the following parent functions (hopefully by recognition, not by using your GDC)

$y = 4$ ($4x^0$) $\quad y = x \quad y = x^2 \quad y = x^3$



These are all polynomials with different degrees

Notation for Polynomials

The **general equation** of a second-degree (quadratic) polynomial is often written in the form $f(x) = ax^2 + bx + c$, and the general equation of a third-degree (cubic) polynomial is often written in the form $f(x) = ax^3 + bx^2 + cx + d$.

For a polynomial with an undetermined degree n, it is unknown how many letters will be needed for the coefficients. Instead of using a, b, c, d, e, etc., mathematicians use only the letter a, and they used subscripts, as shown below.

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

This general polynomial has degree n and coefficients $a_n, a_{n-1}, \ldots, a_1, a_0$.

For example, for $7x^4 - 5x^3 + 3x^2 + 7x + 8$, the degree is 4. In this specific case, a_n is a_4 and $a_4 = 7$, a_{n-1} is $a_3 = -5$, a_{n-2} is $a_2 = 3$, $a_1 = 7$, and $a_0 = 8$.

For each of the following polynomial expressions, find the degree, list all coefficients, and then label them ~~a_0~~ a_n through ~~a_n~~ a_0.

$$f(x) = 2x^4 + \overset{0x^3}{} 5x^2 - 3x + 9$$

degree 4

$a_4 = 2$ ~~$a_4 = 2$~~

$a_3 = 0$ $a_2 = 5$ $a_1 = -3$ $a_0 = 9$

$$f(x) = x^3 + 10x^2$$

degree 3

$a_3 = 1$ $a_2 = 10$ $a_1 = 0$ $a_0 = 0$

Multi-variable term

$6x^3y^4$ $6x^3x^4$

Polynomial Not a Polynomial

x^1

$8x^0$

HW
checking

2. **For each function below,** state if it is a polynomial. **IF** the answer is "yes", fill out the remaining columns *The first is done for you.*

	Polynomial?	Standard. Form	Leading Coefficient	Degree	Name based on degree	Name based on # terms
$P(x) = x^3 - 5x^4 + 7$						
$Q(x) = -4x^2 + 6x^5$						
$R(x) = x - 4x^3 + 4 + 3x^2$						
$T(x) = (2x + 1)(x - 5)$						
$F(x) = 40x$						

3. The left side of the following equation is a polynomial. Polynomial equation
The polynomial happens to be in factored form rather than standard form w
and find all of the solutions:

$$x(2x+1)(3x-5)=0$$

4. Factor the following quadratic polynomial .... (into two factors) $\cancel{n^2 - 20n + 3}$

$18n^2 - 15n + 2$

	$6n$	-1
$3n$	$18n^2$	$-3n$
-2	$-12n$	2

$36n^2$

$-3n$ $-12n$

$-15n$

$(6n-1)(3n-2)$

5. Simplify the following polynomials. *(simplify normally means eliminate all parentheses and put into "standard" form.)*

$(2x+1)(10x^3 - x^2 + 3x - 7)$ *some people like to use a box to keep things organized*

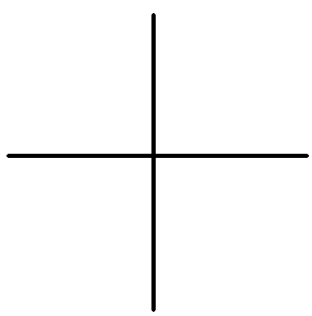
$(2x+1)(10x^3 - x^2 + 3x - 7)$

$20x^4 - 2x^3 + 6x^2 - 14x + 10x^3 - x^2 + 3x - 7$

$20x^4 + 8x^3 + 5x^2 - 11x - 7$

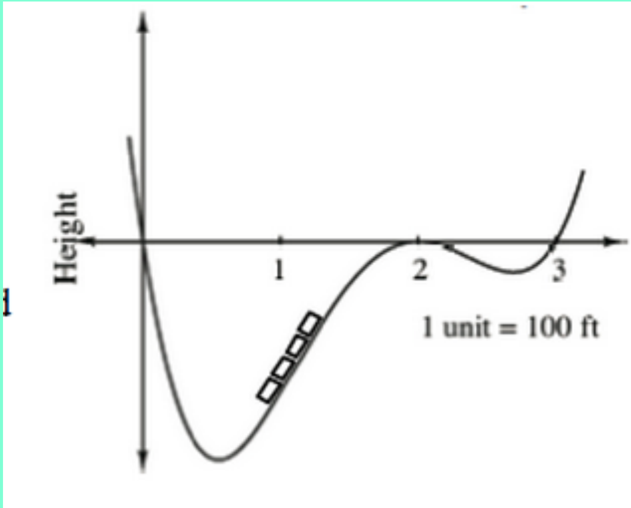
6. Now it is GDC time. Graph the polynomial, $P_1(x) = (x-2)((x-5)^2$. Without simplifying it, can you tell what family it belon[g] to? ____________________

a) Sketch it



b) Label all x-intercepts on your sketch

c) How are the x-intercepts related to the given function ?



$y =$

Quickly check your HW

Aim

Notes

"big and small"

details

of polynomial functions

Polynomial
bare bones

$\boxed{\text{Any Number} \cdot x^{\text{Whole Number}}}$

Polynomial | Not a Polynomial

$-3x^7$ | $3\sqrt{x}$

100 | $\frac{4}{x^2} = 4x^{-2}$

$5x^3$

$\frac{3}{2}x^2$

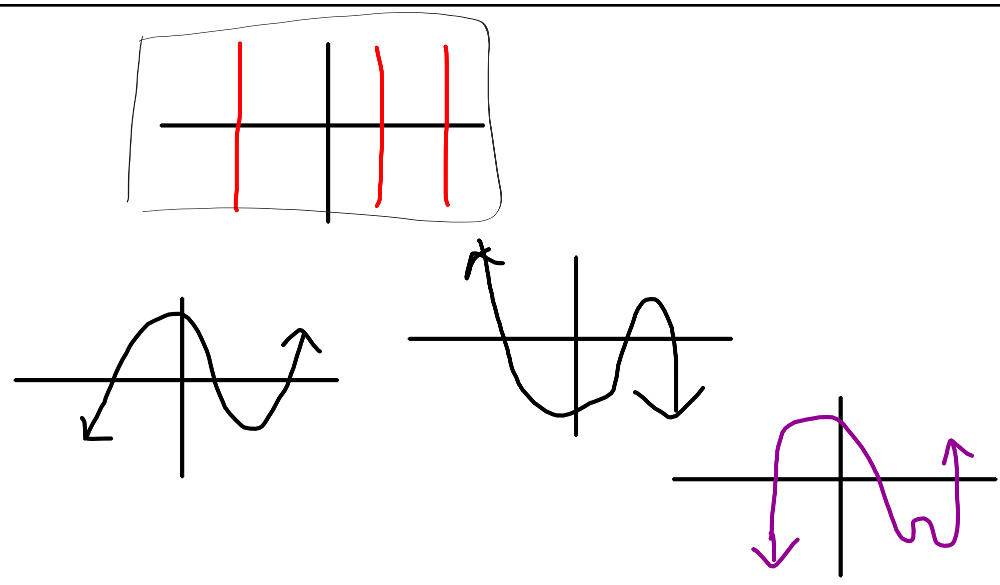
$\sqrt{13}\,x^8$

Polynomials are made up one or more monomials.

monomials: number • variable$^{\text{exponent}}$

polynomial: $3x^{40} + 7x^{12}$

Polynomial Graphs
can be complex



Therefore.....

it helps to know the Big Picture before you graph

Predict the degree

	parent	degree
$Q(x) = (x-1)(x-5)(x+10)$ $(x^2-6x+5)(x+10)$	x^3	3
$G(x) = x(x+3)^2(x+1)$ $x \cdot x^2 \cdot x$	x^4	4

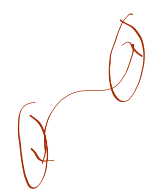
$P(x) = (x+2)(x+3)(x+4)^5$ $1x^7$ 7

$P(x) = (x+2)(x+3)(x+4)^5$ $-4x^7$ 7

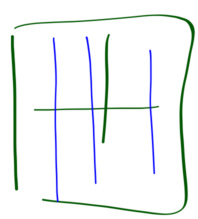
-4

from last night's HW → $P_1(x) = (x-2)(x+5)^2$

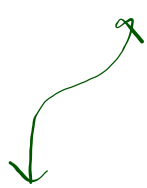
x x^2



What is the parent ? x^3



predicted shape ?



Predict the degree

$$P(x) = 3(x+2)(x+3)^2(x+4)^5$$

Leading term: $3x^8$

degree: 8

leading coefficient 3

Chapter 8 is very graphing calculator intensive.....

Your GDC will help you learn some things.....

so, eventually, you <u>won't</u> need it for those same things later.

So, lets learn about a potential tool on the GDC

graph $y = x^2 - 3x + 2.2$

ZOOM - IN

ZOOM - BOX

~~ZOOM FIT~~

P_2

No GDC

P_1 P_2 P_3

$$P_2(x) = 2(x-2)(x+2)(x-3)$$ $2x^3$

How many distinct factors? 4

How many x-intercepts would you predict? 3

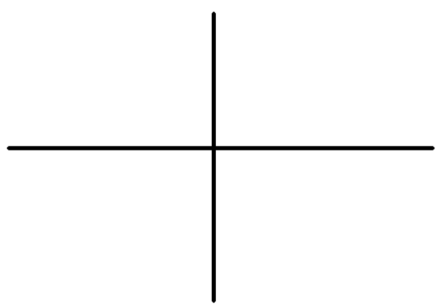
what is the degree? 3

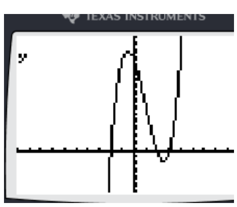
What would the leading coefficient be? 2

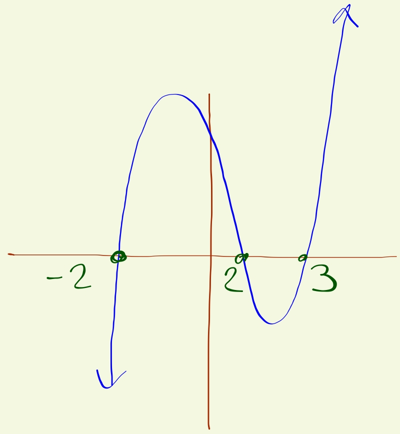
leading term? $2x^3$

$$P_2(x) = 2(x-2)(x+2)(x-3)$$

Now graph and sketch it







$$y = 2(x-2)(x+2)(x-3)$$

$$P_2(x) = 2(x-2)(x+2)(x-3)$$

Did the factor 2 have an effect on the x-intercepts ?

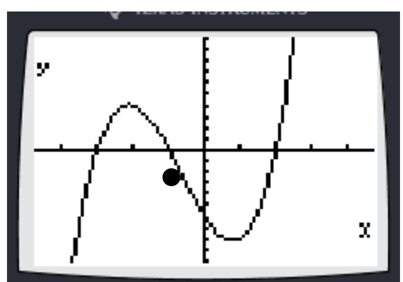
have an effect on the y-intercept ?

The leading coefficient of polynomials:

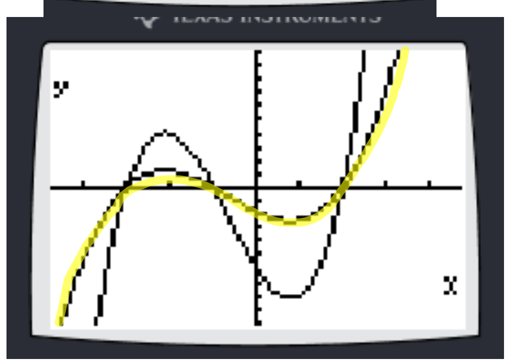
- Affect the y-intercepts
- but do not change the x-intercepts of functions.

example

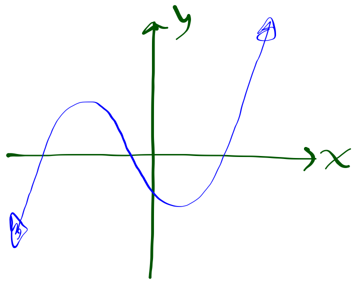
$y = (x-2)(x+3)(x+1)$



$y = \frac{1}{3}(x-2)(x+3)(x+1)$



Desribing End Behavior



Sketch

<u>Left</u> As $x \to -\infty$, $y \to -\infty$

<u>Right</u> As $x \to \infty$, $y \to +\infty$

$\downarrow \quad \uparrow$

$P_3(x)$

$$P_1(x) = (x-2)(x+5)^2$$

$$P_2(x) = 2(x-2)(x+2)(x-3)$$

$$P_3(x) = x^4 - 21x^2 + 20x$$

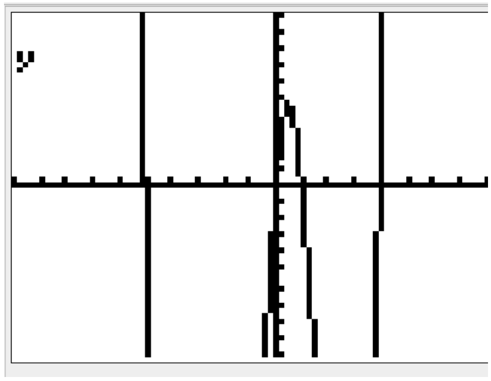
What is different about...

What x-intercepts can you determine before graphing? $x =$

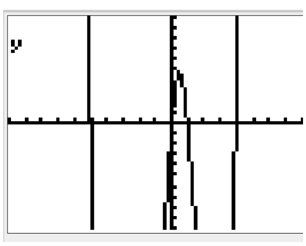
→ sketch function

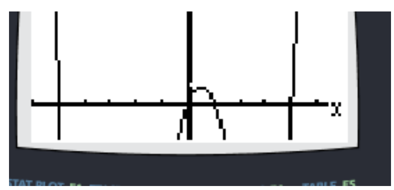
$$P_3(x) = x^4 - 21x^2 + 20x$$

a) Leading term
b) Lead. coeff
c) Degree
d) Make a large neat sketch.
e) Label x-intercepts
f Label y-intercept
g) # turns
h) end behavior

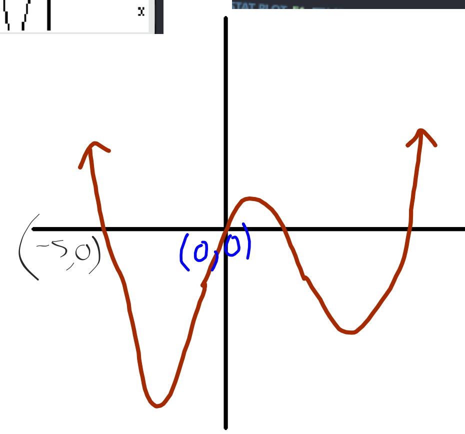


$P_3(x) = x^4 - 21x^2 + 20x$





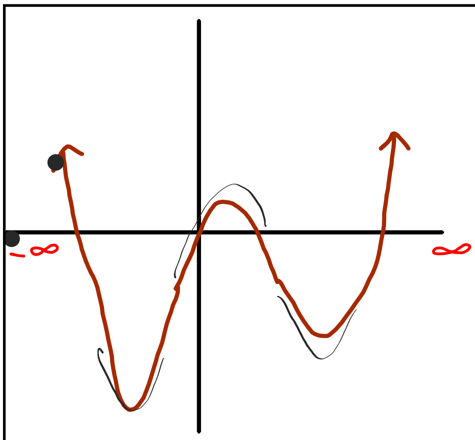
d) Appropriate sketch for notes



$$P_3(x) = x^4 - 21x^2 + 20x$$

a) Leading term x^4
b) Lead. coeff 1
c) Degree 4

d) x-intercepts



d) Make a large neat sketch

e) Label x-intercepts

f Label y-intercept

g) # turns 3

h) end behavior

Left: As $x \to -\infty$, $y \to +\infty$

Right: As $x \to \infty$, $y \to \infty$

now

P_4

sketch

P_4

a) Leading term
b) Lead. coeff
c) Degree
d) Make a large neat sketch
e) Label x-intercepts
f Label y-intercept
g) # turns
h) end behavior

sketch

P_4

$= (x+3)^2(x+1)(x-1)(x-5)$

a) Leading term
b) Lead. coeff
c) Degree
d) Make a large neat sketch
e) Label x-intercepts
f Label y-intercept
g) # turns
h) end behavior

Part 1 of:

Assigment

on page 372 there are 8 functions.

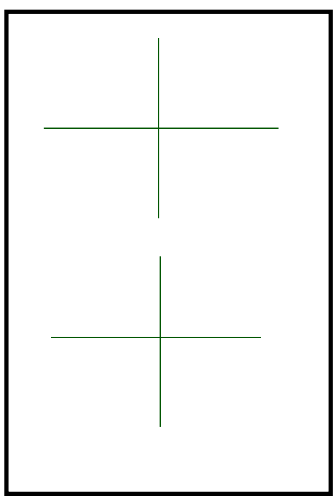
~~P_1 P_2 P_3~~ P_4

P_5 P_6 P_7 P_8

Each person in your group will Analyze 2 of

P_5 P_6 P_7 P_8

At least one has to be P_6



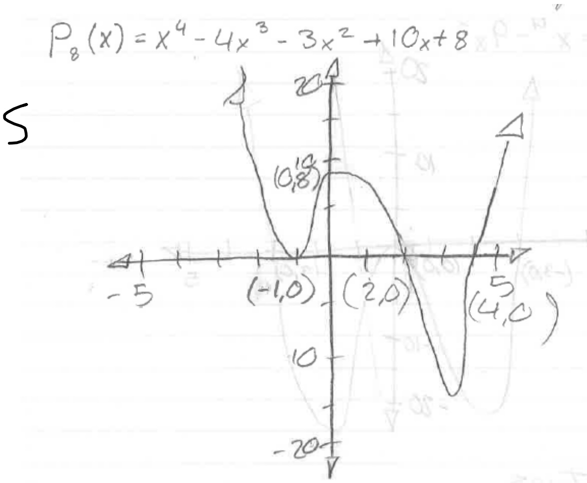
Requirements for EACH Function

a) Leading term
b) Lead. coeff
c) Degree
d) Make a large neat sketch.
e) Label x-intercepts
f Label y-intercept
g) # turns
h) end behavior

Take time on each

✓ Neat
✓ Accurate

don't need
• tic marks



Assignment:

Worksheet:

Polynomial Intro Assignment #2

Added to the new recording sheet • (purple)

The • Pink recording (with its • assignments • is due Tuesday)