Warmup

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

$g(x) = x - 2$

Find

$(f \circ g)x$

$f(g(x))$

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

$= x^3 - 6x^2 + 12x - 8 + 2x - 4$

$= x^3 - 6x^2 + 14x - 12$

$g(f(2))$

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

$= 8 + 4$

$= 12$

$g(12) = 12 - 2$

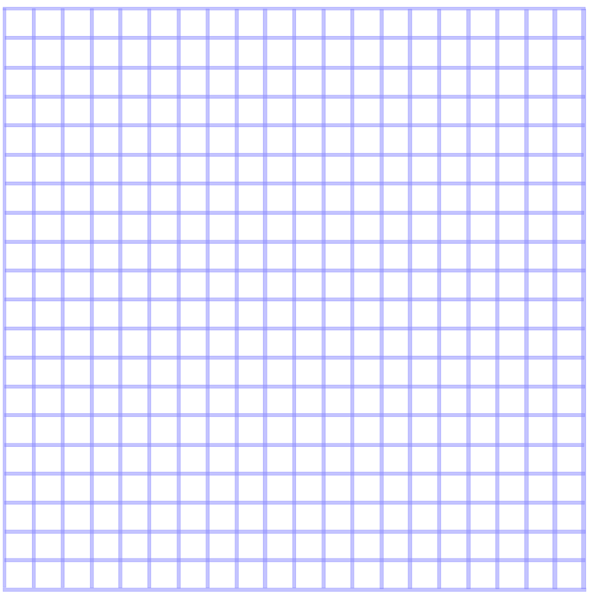
$= 10$

Questions From Homework

1c) $y = x^2 - 4$

$$0 = (x-2)(x+2)$$

$x - 2 = 0$	$x + 2 = 0$
$x = 2$	$x = -2$



Polynomial Functions

Polynomial - an algebraic expression consisting of two or more terms. A polynomial usually contains only one variable. Within each term the variable is raised to a non-negative integer power, and is multiplied by a constant. The simplest types of polynomials are binomials (two terms) and trinomials (three terms)

Degree of a Polynomial - the greatest power to which the variable is raised; for example, the degree of the trinomial $x^4 - 2x + 5$ **is 4**

A *polynomial* function with real coefficients can be represented by

$$y = f(x) = ax^n + bx^{n-1} + cx^{n-2} + \ldots + \square x^0$$

where *a, b, c, etc.* are real numbers. The shape of the graph of the function is affected by the value of *n (the Degree of the Polynomial)*, the values of the cooefficients, and whether the value of *a* is positive or negative.

Cubic Functions

3rd degree Polynomials. $\longleftrightarrow$ $y = ax^3 + bx^2 + cx + d$

(Cubic Functions)

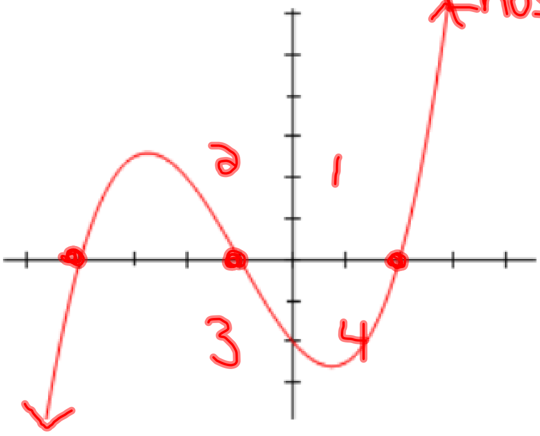
stretch factor

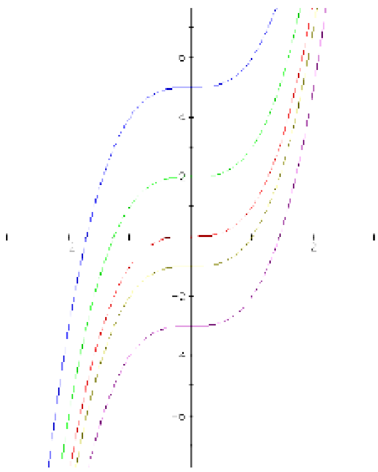
factored form $y = a(x - r_1)(x - r_2)(x - r_3)$

(Good for finding the roots)

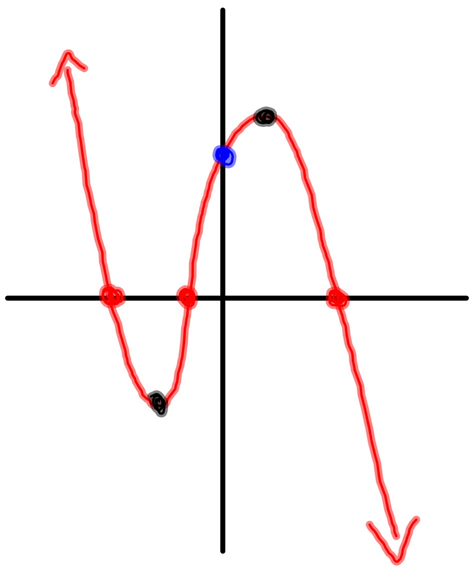
roots

a > 0 (positive) Start in Q3
Ends in Q1





a < 0 (negative) Start in Q2
Ends in Q4



A cubic function has three roots. Either one or three of these roots will be real numbers. Any other roots are complex numbers. The number of *x-intercepts* on the graph of the corresponding cubic function *y= f(x)* depends on the nature of the roots.

Degree = 3

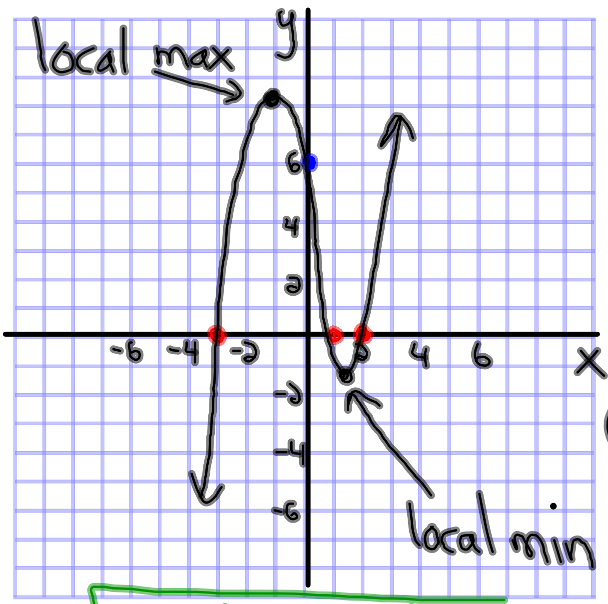
Three different real roots

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

① xint (y=0)

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

$x-1=0$	$x-2=0$	$x+3=0$
$x=1$	$x=2$	$x=-3$



② y int (x=0)

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

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

$y = 6$

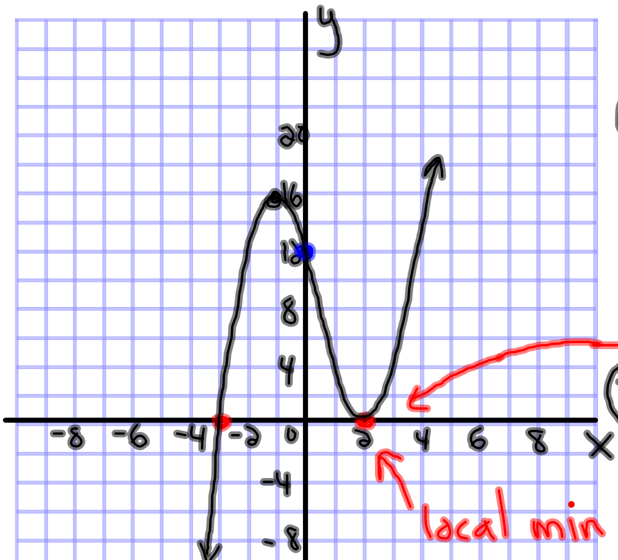
③ Stretch factor

a = 1 (Positive)

Start in Q3

Ends in Q1

Three real roots (2 are equal)



Degree = 3

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

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

① **xint (y=0)**

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

$x = -3, \boxed{2, 2}$ → Double root

② **yint (x=0)**

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

$y = (3)(-2)^2$

$y = 12$

③ **Stretch factor**

a = 1 (Positive)

Starts in Q3

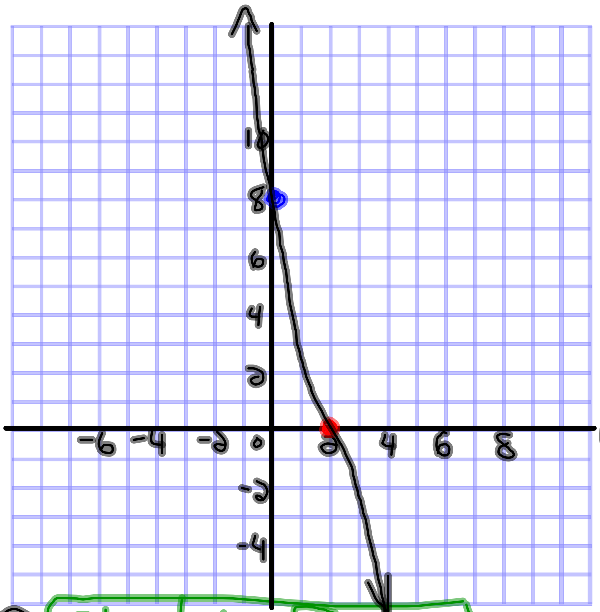
Ends in Q1

Three equal real roots

Degree = 3

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

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



① xint (y=0)

$0 = -(x-2)(x-2)(x-2)$

$x = 2, 2, 2$

② yint (x=0)

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

$y = -(-2)^3$

$y = -(-8)$

$y = 8$

③ Stretch Factor

a = -1 (Negative)

Starts in Q2

Ends in Q4

Local Maximum - is the highest point in its immediate region of *x-values.*
This may or may not be the greatest value of the function over its entire domain.

Local Minimum - is the lowest point in its immediate region of *x-values.*
This may or may not be the smallest value of the function over its entire domain.

Calculating Max and Min values on the TI-83

Homework