Math 109 Calc 1 Lecture 0-1

# Review (Recap)

You should know what the **root** or **zero** of a polynomial equation is, a value that is a solution to the equation.

Example: $x^2-2x+1=0$ has a root of $x = 1$

You should know how to do long division and possibly synthetic division

Example:

$\frac{x^3-6x^2+11x-6}{x-1}$ (long division or synthetic division

$\frac{x^3-6x^2+11x-5}{x^2-x-1}$ (long division only

Given the quadratic formula $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

You should know that the **discriminant** $b^2-4ac$ can tell you how many real and/or complex roots the equation has.

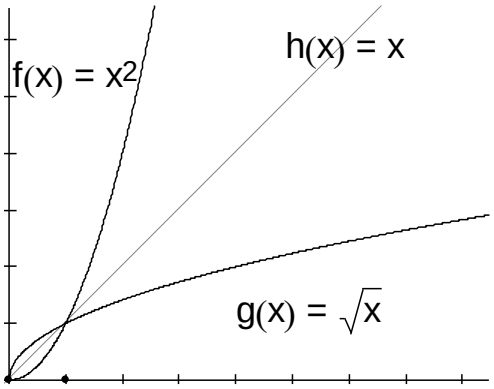
Example: $x^2+x+1=0 \quad b^2-4ac=1^2-4(1)(1)=-3$ which is negative, so the equation has two complex roots.

You should know what the **inverse function** of a function is and how to find one.

Example: $f(x)=x^2+5$

The graphs of a function and an inverse function will be mirror images across the line $y = x$

Example: $f(x)=x^2,\ f^{-1}(x)=\sqrt{x}$



**Pre-Calculus**

You should know what an **increasing function** or **decreasing function** is.

An increasing function is one where if $a < b$ then for all $a$ and $b$ in the domain of the function.

An increasing function is one where if $a < b$ then $f(a) \geq f(b)$ for all $a$ and $b$ in the domain of the function.

You should know what a **rational function** is.

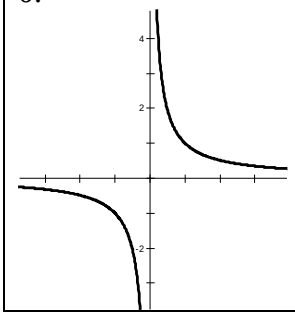
A rational function is one in the form $f(x) = \frac{P(x)}{Q(x)}$ where $P$ is a polynomial function and $Q$ is a polynomial function of degree 1 or greater.

Example: $f(x) = \frac{x^2 + 1}{x - 2}$

The domain of a rational function if not specified is assumed to be all real numbers where $Q(x) \neq 0$.

You should know how to find the **vertical asymptotes** of a rational function, the **horizontal asymptotes** if there are any, and the end behavior.

Example: $f(x) = \frac{1}{x}$ has a vertical asymptote at $x = 0$ and a horizontal asymptote at $y = 0$.




Example: $f(x) = \frac{x^3 + 5}{x^2 + 2}$

This function has no asymptotes. Its end behavior is to increase as $x$ gets large and to decrease as $x$ gets large in the negative direction.

You should know what an **exponential function** is
Example: $f(x)=10^x$

You should about log functions, the inverse functions of exponential functions.
Example: $f(x)=\log_{10} x$

You should know the laws of exponents

$a^n \cdot a^m = a^{n+m}$

$\left(a^n\right)^m = a^{nm}$

$\frac{a^n}{a^m} = a^{n-m}$

$\sqrt{a} = a^{\frac{1}{2}}$

$\sqrt[n]{a} = a^{\frac{1}{n}}$

and the laws of logs.

$\log ab = \log a + \log b$

$\log \frac{a}{b} = \log a - \log b$

$\log a^n = n \log a$

You should know what a periodic function is, $f(x+p)=f(x)$

You should know the **period** of these trigonometric functions.

Period $2\pi$ : sin(), cos(), sec(), csc()

Period $\pi$ : tan(), ctn()

You should know what the graphs of these functions look like.

You should be able to find the exact values of some specific values without a calculator.

$$\left\{0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}, \frac{3\pi}{4}, \frac{5\pi}{6}, \pi ...\right\}$$

Example: $\sin\left(\frac{\pi}{3}\right)=\frac{\sqrt{3}}{2}$

**Conic Sections (Optional)**

It may be useful to know the equations of the following conic sections

A circle centered at $(a,b)$ with radius *r*

$(x-a)^2+(y-b)^2=r^2$

A parabola with vertex at $(a,b)$

$(y-b)=k(x-a)^2$ - Vertical

$(x-b)=k(y-a)^2$ - Horizontal

An ellipse with center at $(a,b)$ and *A* and *B* the semi-major and semi-minor axes

$$\frac{(x-a)^2}{A^2}+\frac{(y-b)^2}{B^2}=1$$

A hyperbola with center at $(a,b)$

$$\frac{(x-a)^2}{A^2}-\frac{(y-b)^2}{B^2}=1$$