All Students Take Calculus
I–All pos. II–sin III–tan IV–cos

Law of Cosines
$a^2 = b^2+c^2-2bc\cdot\cos A$

Difference of Cubes
$a^3 \pm b^3 = (a\pm b)(a^2 \mp ab + b^2)$

Arc Length
$s = r\theta$

Heron's Formula
$A = \sqrt{s(s-a)(s-b)(s-c)}$

Change of Base
$\log_b m = \dfrac{\log m}{\log b}$

Choose Formula
$C(x,y) = \dbinom{x}{y} = \dfrac{x!}{y!(x-y)!}$

Law of Sines
$\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$

Degrees to Radians
$\dfrac{A\cdot\pi}{180} = \theta$

Sector Area
$A = \dfrac{1}{2}r^2\theta$

Area of Δ
$Area = ab\cdot\dfrac{1}{2}\sin C$

Polar to (x,y)
$r^2 = x^2+y^2$
$\tan\theta = \dfrac{y}{x}$

$(\log_a b)(\log_c d) = (\log_a d)(\log_c b)$

$z = a+bi$
$|z| = \sqrt{a^2+b^2}$

$z = r\operatorname{cis}\theta$
$z^n = r^n \operatorname{cis}(n\theta)$

nth roots of $z = r\operatorname{cis}\theta$
$w_k = r^{1/n}\operatorname{cis}\left(\dfrac{\theta+2k\pi}{n}\right)$

$z_1 z_2 = r_1 r_2 \operatorname{cis}(\theta_1+\theta_2)$
$\dfrac{z_1}{z_2} = \dfrac{r_1}{r_1}\operatorname{cis}(\theta_1-\theta_2)$

Trig Identities

$\sin^2+\cos^2 = 1$

$\tan^2+1 = \sec^2$

$1+\cot^2 = \csc^2$

$2\sin u\cos u = \sin(2u)$

$\cos^2 u - \sin^2 u = \cos(2u)$

$\frac{2\tan u}{1-\tan^2 u} = \tan(2u)$

$\sin u\cos v \pm \cos u\sin v = \sin(u\pm v)$

$\cos u\cos v \mp \sin u\sin v = \cos(u\pm v)$

$\frac{\tan u \pm \tan v}{1 \mp \tan u\tan v} = \tan(u\pm v)$

$\cot = \frac{1}{\tan}$

$\csc = \frac{1}{\sin}$

$\sec = \frac{1}{\cos}$

$\sin\left(\frac{\pi}{2}-u\right) = \cos u$

$\tan\left(\frac{\pi}{2}-u\right) = \cot u$

$\sec\left(\frac{\pi}{2}-u\right) = \csc u$

$\cos\left(\frac{\pi}{2}-u\right) = \sin u$

$\cot\left(\frac{\pi}{2}-u\right) = \tan u$

$\csc\left(\frac{\pi}{2}-u\right) = \sec u$

$\frac{1-\cos 2x}{2} = \sin^2 x$

$\frac{1+\cos 2x}{2} = \cos^2 x$

$\frac{1-\cos 2x}{1+\cos 2x} = \tan^2 x$

$\pm\sqrt{\frac{1-\cos u}{2}} = \sin\frac{u}{2}$

$\pm\sqrt{\frac{1+\cos u}{2}} = \cos\frac{u}{2}$

$\frac{1-\cos u}{\sin u} = \frac{\sin u}{1+\cos u} = \tan\frac{u}{2}$

$2\sin\frac{x\pm y}{2}\cos\frac{x\mp y}{2} = \sin x \pm \sin y$

$2\cos\frac{x+y}{2}\cos\frac{x-y}{2} = \cos x + \cos y$

$-2\sin\frac{x+y}{2}\sin\frac{x-y}{2} = \cos x - \cos y$

$\sin u\cos v = \frac{1}{2}[\sin(u+v)+\sin(u-v)]$

$\cos u\sin v = \frac{1}{2}[\sin(u+v)-\sin(u-v)]$

$\cos u\cos v = \frac{1}{2}[\cos(u+v)+\cos(u-v)]$

$\sin u\sin v = \frac{1}{2}[\cos(u+v)-\cos(u-v)]$

Algebra of Functions

Let f and g be functions with domains A and B.

$(f+g)(x) = f(x) + g(x)$	Domain $A \cap B$
$(f-g)(x) = f(x) - g(x)$	Domain $A \cap B$
$(fg)(x) = f(x)g(x)$	Domain $A \cap B$
$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$	Domain $\{x \in A \cap B \mid g(x) \neq 0\}$
$(f \circ g)(x) = f(g(x))$	Domain $\{x \in B \mid g(x) \in A\}$

Polynomial Synthetic Division

$(x^3 + x^2 - 1) \div (x+2)$

$$\begin{array}{r|rrrr} -2 & 1 & 1 & 0 & -1 \\ & & -2 & 2 & -4 \\ \hline & 1 & -1 & 2 & -5 \end{array}$$

Polynomial Long Division

$$\begin{array}{r l} & x^2 \quad - x + 2 \\ \hline x+2) & x^3 \quad + x^2 \qquad - 1 \\ & -x^3 - 2x^2 \\ \hline & \qquad -x^2 \\ & \qquad\quad x^2 + 2x \\ \hline & \qquad\qquad 2x - 1 \end{array}$$

Rational Roots Theorem

$2x^3 + 2x^2 - 3x - 6$

$\pm 1, \pm 2 \qquad \pm 1, \pm 2, \pm 3, \pm 6$

Possible rational roots:

$\pm 1, \pm \frac{1}{2}, \pm 2, \pm 3, \pm \frac{3}{2}, \pm 6$

Decartes' Rule of Signs

Count num. of sign changes

$P(x) = 3x^6 + 4x^5 + 3x^3 - x - 3$

1 positive real root

$P(-x) = 3x^6 - 4x^5 - 3x^3 + x - 3$

1 or 3 negative real roots

Logarithm Formulas

$\log(m \cdot n) = \log m + \log n$

$\log\left(\frac{m}{n}\right) = \log m - \log n$

$\log(m^n) = n \cdot \log m$

$\log_b b^x = x = b^{\log_b x}$

Other trig stuff

$\cot = \frac{1}{\tan}$

$\csc = \frac{1}{\sin}$

$\sec = \frac{1}{\cos}$

Horizontal Asymptotes

$y = \frac{2x^2 - 4x + 5}{x^2 - 2x + 1}$	Original Equation
$= \frac{2x^2}{x^2}$	$x \to \infty$, other terms $\to$ tiny
$= 2$	Cancel, horizontal asymptote

Slant Asymptotes

$y = \frac{x^2 - 4x - 5}{x - 3}$	Original Equation
$= x - 1 - \frac{8}{x-3}$	Divide
$= x - 1$	$x \to \infty$, other terms $\to$ tiny

Vertical Asymptotes

$y = \frac{2x^2 - 4x + 5}{x^2 - 2x + 1}$	Original Equation
$= \frac{2x^2 - 4 + 5}{(2x-1)(x+2)}$	Factor demoniator
$x = \frac{1}{2}$ or $x = -2$	Impossible

End Behavior

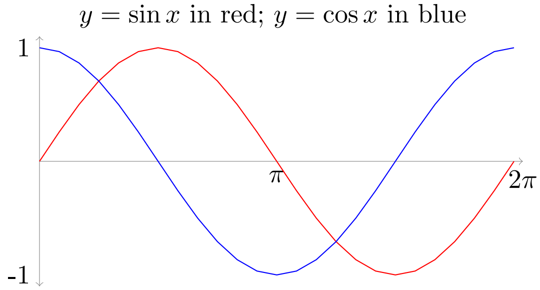
$y = x^n$, n is even

$y = -x^n$, n is even

$y = x^n$, n is odd

$y = -x^n$, n is odd

$y = \sin x$ in red; $y = \cos x$ in blue



sin/cos Graph Properties

If in form:

$y = a \sin k(x - b)$

amplitude $|a|$, period $2\pi/k$, phase shift b