Vectors: Vector components: $A_x = A\cos\theta$, $A_y = A\sin\theta$; magnitude $A = \sqrt{A_x^2 + A_y^2}$; $\theta_{ref} = \tan^{-1}\dfrac{|A_y|}{|A_x|}$

Complex numbers:

$x + jy$ *rectangular form*; $r\angle\theta = r(\cos\theta + j\sin\theta)$ *polar form*; $re^{j\theta}$ *exponential form*

$x = r\cos\theta$, $y = r\sin\theta$; $r = \sqrt{x^2+y^2}$, $\theta_{ref} = \tan^{-1}\dfrac{y}{x}$

$x + jy = r(\cos\theta + j\sin\theta) = r\angle\theta$

product: $r_1\angle\theta_1 \cdot r_2\angle\theta_2 = (r_1 \cdot r_2)\angle(\theta_1 + \theta_2)$; quotient: $\dfrac{r_1\angle\theta_1}{r_2\angle\theta_2} = \dfrac{r_1}{r_2}\angle(\theta_1 - \theta_2)$

DeMoivre's theorem: $(r\angle\theta)^n = r^n\angle(n\theta)$

Logarithms and Exponential Functions:

$y = b^x$ *exponential function*, logarithmic form: $\log_b y = x$

$y = \log_b x$ *logarithmic function*

$\log_b xy = \log_b x + \log_b y$ $\log_b \dfrac{x}{y} = \log_b x - \log_b y$ $\log_b(x^n) = n\log_b x$

$\log_b 1 = 0$ $\log_b b = 1$ $\log_b(b^n) = n$

changing base of the logarithms: $\log_b x = \dfrac{\log_a x}{\log_a b}$ $\log_b x = \dfrac{\log x}{\log b}$ or $\log_b x = \dfrac{\ln x}{\ln b}$

Trigonometric functions and identities:

For graphs of $y = a\sin(bx+c)$, $y = a\cos(bx+c)$, $y = a\csc(bx+c)$, or $y = a\sec(bx+c)$:

the Amplitude $= |a|$, Period $= \dfrac{2\pi}{b}$, Displacement $= -\dfrac{c}{b}$

5 'main' points (without displacement): $0, \dfrac{Period}{4}, \dfrac{2\cdot Period}{4}, \dfrac{3\cdot Period}{4}, \dfrac{4\cdot Period}{4}$

For the graphs of $y = a\tan(bx+c)$ or $y = a\cot(bx+c)$: Period $= \dfrac{\pi}{b}$

3 'main' points (without displacement): $0, \dfrac{Period}{2}, \dfrac{2\cdot Period}{2}$

$\sin\theta\csc\theta = 1$ or $\csc\theta = \dfrac{1}{\sin\theta}$ (1) $\cos\theta\sec\theta = 1$ or $\sec\theta = \dfrac{1}{\cos\theta}$ (2) $\tan\theta = \dfrac{1}{\cot\theta}$(3)

$\dfrac{\sin\theta}{\cos\theta} = \tan\theta$ (4) $\dfrac{\cos\theta}{\sin\theta} = \cot\theta$ (5) $\sin^2\theta + \cos^2\theta = 1$ (6)

$1 + \tan^2\theta = \sec^2\theta$ (7) $1 + \cot^2\theta = \csc^2\theta$ (8)

$\sin(\alpha+\beta) = \sin\alpha\cos\beta + \sin\beta\cos\alpha$ (9) $\sin(\alpha-\beta) = \sin\alpha\cos\beta - \sin\beta\cos\alpha$ (10)

$\cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$ (11) $\cos(\alpha-\beta) = \cos\alpha\cos\beta + \sin\alpha\cos\beta$ (12)

$\tan(\alpha\pm\beta) = \dfrac{\tan\alpha \pm \tan\beta}{1 \mp \tan\alpha\tan\beta}$ (13) $\tan(2\alpha) = \dfrac{2\tan\alpha}{1 - \tan^2\alpha}$ (16)

$\sin(2\alpha) = 2\sin\alpha\cos\alpha$ (14) $\cos(2\alpha) = \cos^2\alpha - \sin^2\alpha = 2\cos^2\alpha - 1 = 1 - 2\sin^2\alpha$ (15)

$\sin\dfrac{\theta}{2} = \pm\sqrt{\dfrac{1-\cos\theta}{2}}$ (17) $\cos\dfrac{\theta}{2} = \pm\sqrt{\dfrac{1+\cos\theta}{2}}$ (18)

$-\dfrac{\pi}{2} \le \sin^{-1}x \le \dfrac{\pi}{2}$ $0 \le \cos^{-1}x \le \pi$ $-\dfrac{\pi}{2} < \tan^{-1}x < \dfrac{\pi}{2}$ $0 < \cot^{-1}x < \pi$

$0 \le \sec^{-1}x \le \pi$ $(\sec^{-1}x \ne \dfrac{\pi}{2})$ $-\dfrac{\pi}{2} \le \csc^{-1}x \le \dfrac{\pi}{2}$ $(\csc^{-1}x \ne 0)$

Solving systems of linear equations:

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}$$