TMTH 220
MIDTERM EXAM FORMULA SHEET

CHAPTER 15: *Oblique Triangles and Vectors*

Law of Sines: $\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)}$

Law of Cosines:

$a^2 = b^2 + c^2 - 2bc\cos(A)$ $\qquad \cos(\mathrm{A}) = \frac{b^2+c^2-a^2}{2bc}$

$b^2 = a^2 + c^2 - 2ac\cos(B)$ $\qquad \cos(\mathrm{B}) = \frac{a^2+c^2-b^2}{2ac}$

$c^2 = a^2 + b^2 - 2ab\cos(C)$ $\qquad \cos(\mathrm{C}) = \frac{a^2+b^2-c^2}{2ab}$

CHAPTER 17: *Graphs of the Trigonometric Functions*

General Sine Wave: $y = \mathrm{a}\sin(bx + c)$

amplitude $= |\mathrm{a}|$ $\qquad$ period $= \frac{360°}{b}$ or $\frac{2\pi}{b}$ $\qquad$ frequency $= \frac{b}{360°}$ or $\frac{b}{2\pi}$

phase angle $= c$ $\qquad$ phase shift $= -\frac{c}{b}$ $\qquad$ $\cos\theta = \sin(\theta + 90°)$

Sine wave as a function of time t: $y = \mathrm{a}\sin(\omega t + \phi)$

amplitude $= |\mathrm{a}|$ $\qquad$ angular velocity $= \omega$ $\qquad$ period $= \frac{2\pi}{\omega}$

frequency $= \frac{\omega}{2\pi}$ $\qquad$ phase angle $= \phi$ $\qquad$ phase shift $= -\frac{\phi}{\omega}$

Addition of a sine wave and cosine wave:

$A\sin\omega t + B\cos\omega t = R\sin(\omega t + \phi)$ where

$R = \sqrt{A^2 + B^2}$ and $\phi = \arctan\left(\frac{B}{A}\right)$

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Transforming between Polar and Rectangular Coordinates:

$$x = r\cos\theta \quad \text{and} \quad y = r\sin\theta$$

$$r = \sqrt{x^2 + y^2} \quad \text{and} \quad \theta = \arctan\left(\frac{y}{x}\right)$$

<u>CHAPTER 18</u>: ***Trigonometric Identities and Equations***

$\cot\theta = \frac{1}{tan\theta}$ $\sec\theta = \frac{1}{tan\theta}$ $\csc\theta = \frac{1}{sin\theta}$ $\tan\theta = \frac{sin\theta}{cos\theta}$ $\cot\theta = \frac{cos\theta}{sin\theta}$

$sin^2\theta + cos^2\theta = 1$ $1 + tan^2 = sec^2\theta$ $1 + cot^2 = csc^2\theta$

Sum and Difference Identities:

$\sin(A \pm B) = \sin A\cos B \pm \cos A\sin B$

$\cos(A \pm B) = \cos A\cos B \pm \sin A\sin B$

$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \pm \tan A\tan B}$

Double-Angle Identities:

$\sin 2A = 2\,sinAcosA$

$\cos 2A = cos^2A - sin^2A$

$\cos 2A = 1 - 2\,sin^2A$

$\cos 2A = 2\,cos^2A - 1$

$\tan 2A = \frac{2\tan A}{1 - tan^2 A}$

Function Values of Special Angles:

θ		**sin** θ	**cos** θ	**tan** θ	**cot** θ	**sec** θ	**csc** θ
30^0	$\frac{\pi}{6}$	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$ or $\frac{1}{\sqrt{3}}$	$\sqrt{3}$	$\frac{2\sqrt{3}}{3}$ or $\frac{2}{\sqrt{3}}$	2
45^0	$\frac{\pi}{4}$	$\frac{\sqrt{2}}{2}$ or $\frac{1}{\sqrt{2}}$	$\frac{\sqrt{2}}{2}$ or $\frac{1}{\sqrt{2}}$	1	1	$\sqrt{2}$	$\sqrt{2}$
60^0	$\frac{\pi}{3}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\frac{\sqrt{3}}{3}$ or $\frac{1}{\sqrt{3}}$	2	$\frac{2\sqrt{3}}{3}$ or $\frac{2}{\sqrt{3}}$

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CHAPTER 21: *Complex Numbers*

The Imaginary Unit: $j = \sqrt{-1}$; $j^2 = -1$; $j^3 = -j$; $j^4 = 1$; $j^5 = j$

Complex Numbers in Polar Form:

a + jb = $r\angle\theta$ (where $r = \sqrt{a^2 + b^2}$ and θ = arctan $(\frac{b}{a})$)

Conversion from Polar to Rectangular Form:

a = r cosθ b = r sinθ

Complex Numbers in Trigonometric Form:

a + jb = r(cos θ + j sin θ) $R\angle(\omega t + \phi) = R\cos(\omega t + \phi) + R\sin(\omega t + \phi)$