TMTH 204 MIDTERM EXAM FORMULA SHEET

CHAPTER 15: *Oblique Triangles and Vectors*

$\sin\theta = \sin(180° - \theta)$ $\cos\theta = \cos(360° - \theta)$ $\tan\theta = \tan(180° + \theta)$

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

Law of Cosines:

$a^2 = b^2 + c^2 - 2bc\cos A$ or $\cos A = \dfrac{b^2+c^2-a^2}{2bc}$

$b^2 = a^2 + c^2 - 2ac\cos B$ or $\cos B = \dfrac{a^2+c^2-b^2}{2ac}$

$c^2 = a^2 + b^2 - 2ab\cos C$ or $\cos C = \dfrac{a^2+b^2-c^2}{2ab}$

CHAPTER 17: *Graphs of the Trigonometric Functions*

Angle Conversions $1 \text{ rev} = 360° = 2\,\pi \text{ rad}$

Sine Wave as a Function of Time: $y = \text{a}\sin(\omega t + \varphi)$

amplitude $= |\text{a}|$ angular velocity $= \omega$ period $= \dfrac{2\pi}{\omega}$

frequency $= \dfrac{\omega}{2\pi}$ phase angle $= \varphi$ phase shift $= -\dfrac{\varphi}{\omega}$

Cosine and Sine Curves Related $\cos\theta = \sin(\theta + 90°)$

Sinusoidals as Phasors:

$a\sin(\omega t + \varphi)$ is identified with $a\,\angle\varphi$

$a\cos(\omega t + \varphi)$ is identified with $a\,\angle(\varphi + 90°)$

Addition of a Sine Wave and a Cosine Wave:

$A\sin\omega t + B\cos\omega t = R\sin(\omega t + \varphi)$ where $R = \sqrt{A^2 + B^2}$ and $\varphi = \arctan\frac{B}{A}$

Compiled by: Humber College Math Department
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CHAPTER 18: *Trigonometric Identities and Equations*

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

$\tan\theta = \frac{\sin\theta}{\cos\theta}$ $\cot\theta = \frac{\cos\theta}{\sin\theta}$

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

Sum and Difference Identities:

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

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

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

Double Angle Identities:

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

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

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

Function Values of Special Angles:

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

CHAPTER 21: *Complex Numbers*

The Imaginary Unit and its Powers $j = \sqrt{-1}$, $j^2 = -1$, $j^3 = -j$, $j^4 = 1$, $j^5 = j$, ...

Complex Number in Rectangular Form $a + jb$ real part $= a$, imaginary part $= b$

Complex Number in Polar Form $r \angle\theta$ magnitude $= r$, polar angle $= \theta$

Polar to Rectangular Form $r \angle\theta = a + jb$, where $a = r\cos\theta$ and $b = r\sin\theta$

Rectangular to Polar Form $a + jb = \sqrt{a^2 + b^2} \angle \tan^{-1}\left(\frac{b}{a}\right)$

Complex Current, Voltage, and Impedance:

Given $i = I_{max}\sin(\omega t + \varphi)$, $\boldsymbol{I} = I_{eff} \angle\varphi$, where $I_{eff} = \frac{I_{max}}{\sqrt{2}}$

Given $v = V_{max}\sin(\omega t + \varphi)$, $\boldsymbol{V} = V_{eff} \angle\varphi$, where $V_{eff} = \frac{V_{max}}{\sqrt{2}}$

$\boldsymbol{Z} = R + jX = \sqrt{R^2 + X^2} \angle\varphi$, where $X = X_L - X_C$ and $\varphi = \tan^{-1}\left(\frac{X}{R}\right)$

Ohm's Law for AC circuits $\boldsymbol{V} = \boldsymbol{Z}\,\boldsymbol{I}$