TMTH 114
Final Exam Formula Sheet

Chapter 7: Right Triangles

1 rev = 360° = 2π rad, $1° = 60'$, $1' = 60''$, 1 rad ≈ 57.3°

$\sin\theta = \frac{\text{opp}}{\text{hyp}}$, $\cos\theta = \frac{\text{adj}}{\text{hyp}}$, $\tan\theta = \frac{\text{opp}}{\text{adj}}$

$c^2 = a^2 + b^2$ (*Pythagorean Theorem*)

Given $(x, y) \neq (0,0)$ on terminal arm of angle θ, let $r = \sqrt{x^2 + y^2}$. Then:

$\sin\theta = \frac{y}{r}$ $\cos\theta = \frac{x}{r}$ $\tan\theta = \frac{y}{x}$

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

Chapter 8: Factoring

$(a \pm b)^2 = a^2 \pm 2ab + b^2$ $a^2 - b^2 = (a-b)(a+b)$

Chapter 9: Fractions

$\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$ $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{ad}{bc}$

Chapter 13: Exponents and Radicals

$\sqrt[n]{a} = a^{1/n}$ $a^{m/n} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$

Given nonzero real numbers x and y, and integers m and n:

$x^1 = x$ $x^0 = 1$ $x^{-n} = \frac{1}{x^n}$

$(x^m)^n = x^{m \cdot n}$ $x^m \cdot x^n = x^{m+n}$ $\frac{x^m}{x^n} = x^{m-n}$

$(xy)^n = x^n y^n$ $\left(\frac{x}{y}\right)^n = \frac{x^n}{y^n}$ $\left(\frac{x}{y}\right)^{-n} = \left(\frac{y}{x}\right)^n$

Chapter 14: Quadratic Equations

Given $ax^2 + bx + c = 0$, where $a \neq 0$, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ (quadratic formula)

Compiled by: Humber College Math Department
Last revision: 06/2015

Chapter 15: Oblique Triangles and Vectors

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

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

Law of Cosines: $a^2 = b^2 + c^2 - 2bc\cos A$ $\cos \mathrm{A} = \frac{b^2+c^2-a^2}{2bc}$

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

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

Chapter 17: Trigonometric Functions

Sine wave as a function of an angle x: $y = \mathrm{a}\sin(bx + c)$

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

phase angle $= c$ phase shift $= -\frac{c}{b}$

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

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

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

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

Sinusoidals as phasors:

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

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

Chapter 18: Trigonometric Identities and Equations

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

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

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

Chapter 19: Ratio, Proportion, and Variation

Direct Variation: $y = kx$ or $\frac{y_2}{y_1} = \frac{x_2}{x_1}$

Power Variation: $y = kx^n$ or $\frac{y_2}{y_1} = \frac{(x_2)^n}{(x_1)^n}$

Inverse Variation: $y = \frac{k}{x}$ or $\frac{y_2}{y_1} = \frac{x_1}{x_2}$

Joint Variation: $y = kxw$

Chapter 20: Exponential and Logarithmic Functions

Growth: $y = ae^{nt}$

Decay: $y = ae^{-nt}$

Growth to an Upper Limit: $y = a\,(1 - e^{-nt})$

Exponential Form: $y = b^x$ *Logarithmic Form:* $\log_b y = x$

Properties of logarithms (where $b, M, N > 0$, $b \neq 1$, and p is a real number):

$\log_b MN = \log_b M + \log_b N$ $\log_b \frac{M}{N} = \log_b M - \log_b N$

$\log_b M^p = p \cdot \log_b M$ $\log_b 1 = 0$ $\log_b b = 1$

$\log_b b^M = M$ $b^{\log_b M} = M$ $\log_b a = \frac{\log a}{\log b} = \frac{\ln a}{\ln b}$

Common logarithm: $\log x = \log_{10} x$

Natural logarithm: $\ln x = \log_e x$, where $e \approx 2.718$

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: $x + jy$ $x =$ real part, $y =$ imaginary part

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

Polar to Rectangular Form: $r\,\angle\theta = r\cos\theta + j\,r\sin\theta$

Rectangular to Polar Form: $x + j\,y = \sqrt{x^2 + y^2}\ \angle \tan^{-1}\left(\frac{y}{x}\right)$

Complex current, voltage, and impedance:

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

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

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

Ohm's Law for AC circuits: $V = Z\,I$

Chapter 22: Analytic Geometry

Distance Formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$m = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$, where (x_1, y_1) and (x_2, y_2) are two distinct points on the line

$m = \tan\theta$, where θ is the line's angle of inclination

$\theta = \begin{cases} \tan^{-1} m, & \text{if } m \geq 0 \\ \tan^{-1} m + 180°, & \text{if } m < 0 \end{cases}$, where m is the line's slope

Equation of Straight Line:

- General Form: $Ax + By + C = 0$
- Slope-Intercept Form: $y = mx + b$
- Point-Slope Form: $y - y_1 = m(x - x_1)$
- Two-point Form: $\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$