TMTH 104
Final Exam Formula Sheet

Chapter 1: Numerical Computation

Distance $=$ Rate $\times$ Time

Amount $=$ Rate $\times$ Base (where Rate is in decimal form)

$$\text{Percent change } = \frac{(\text{new value} - \text{original value})}{\text{original value}} \times 100$$

$$\text{Percent efficiency } = \frac{\text{output}}{\text{input}} \times 100$$

$$\text{Percent error } = \frac{(\text{measured value} - \text{known value})}{\text{known value}} \times 100$$

$$\text{Percent concentration of ingredient A } = \frac{\text{amount of A}}{\text{total amount of mixture}} \times 100$$

Chapter 2: Algebra

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

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

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

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

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

Chapter 5: Graphs

slope $m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$, $\qquad$ y-intercept $= b$

Equation of line in slope-intercept form: $y = mx + b$

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Chapter 7: Right Triangles

1 rev $= 360° = 2\pi$ rad, $\quad 1° = 60'$, $\quad 1' = 60''$, $\quad 1 \text{ rad} \approx 57.3°$

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

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

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

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

$\sin(\theta) = \frac{\text{opp}}{\text{hyp}}$ $\quad \cos(\theta) = \frac{\text{adj}}{\text{hyp}}$ $\quad \tan(\theta) = \frac{\text{opp}}{\text{adj}}$

Chapter 8: Factoring

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

Chapter 9: Fractions

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

Chapter 13: Exponents and Radicals

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

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

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

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

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

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Chapter 17: Trigonometric Functions

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

amplitude $= |\text{a}|$ 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: $y = \text{a}\sin(\omega t + \phi)$

amplitude $= |\text{a}|$ 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: $\cos(\theta) = \sin(\theta + 90°)$ $(where\ \phi\ is\ in\ radians)$

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:	*Decay:*	*Growth to an Upper Limit:*
$y = ae^{nt}$	$y = ae^{-nt}$	$y = a(1 - e^{-nt})$

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):

$\log_b(M \cdot N) = \log_b(M) + \log_b(N)$ $\log_b\left(\frac{M}{N}\right) = \log_b(M) - \log_b(N)$

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

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

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

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