TMAT 102
FINAL EXAM FORMULA SHEET

CHAPTER 1: *Numerical Computation*

Distance = Rate × Time Amount = Rate × Base (where rate is in decimal form)

$$\%\ change = \frac{new\ value - original\ value}{original\ value} \times 100 \qquad \%\ error = \frac{Measured\ Value - Known\ value}{Known\ value} \times 100$$

$$\%\ efficiency = \frac{output}{input} \times 100 \qquad \%\ conc.\ of\ A = \frac{Amount\ of\ A}{Total\ Amount\ of\ Mixture} \times 100$$

CHAPTER 2: Algebra

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

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

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

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

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

CHAPTER 5: Graphs

Slope $m = \frac{rise}{rum} = \frac{y_2 - y_1}{x_2 - x_1}$ y-intercept = b

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

CHAPTER 7: ***Right Triangles and Vectors***

1 rev = 360° = 2π rad $\quad 1^0 = 60' \quad 1' = 60'' \quad 1\,rad \approx 57.3^0$

Given (x, y) ≠ (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 $(a \pm b)^2 = a^2 \pm 2ab + b^2$ $a^2 - b^2 = (a - b)(a + b)$

CHAPTER 8: Fractions $\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$ $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{ad}{bc}$

distance = speed × time

work done = rate of work × time

amount of flow = flow rate × time

CHAPTER 11: Determinants

Second order determinant: $\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$

Cramer's rule: Given system $a_1x + b_1y = c_1$ $a_2x + b_2y = c_2$

$x = \frac{\begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}}$ $y = \frac{\begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}}$

Where $\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix} \neq 0$

CHAPTER 13: Exponents and Radicals

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

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

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

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

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

CHAPTER 15: *Oblique Triangles and Vectors*

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

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

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

Law of Cosines:

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

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

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

CHAPTER 16: ***Radian Measure, Arc Length and Rotation***

1 rev = 360° = 2π radians

Arc Length: $\theta = \frac{s}{r}$ (where θ is in radians)

Area of a Sector: $A = \frac{r^2\theta}{2}$ (where $\boldsymbol{\theta}$ is in radians)

Area of a Segment:

$$A = r^2\arccos\left(\frac{r-h}{r}\right) - (r-h)\sqrt{2rh - h^2}$$

(*where* arccos $\left(\frac{r-h}{r}\right)$ 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