TMTH 105
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 n :

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

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

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

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: $\quad y = mx + b$

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Chapter 6: Geometry

2-Dimensional Shape	Formulas
Circle	Circumference $= 2\pi r$ or πd
	Area $= \pi r^2$ or $\frac{\pi d^2}{4}$
Square	Perimeter $= 4s$
	Area $= s^2$
Rectangle	Perimeter $= 2(l + w)$
	Area $= lw$
Parallelogram	Perimeter $= 2(a + b)$
	Area $= bh$
Rhombus	Perimeter $= 4s$
	Area $= sh$
Trapezoid	Perimeter $= a + b + c + d$
	Area $= \frac{(a+b)h}{2}$
Triangle	Area $= \frac{bh}{2}$ or using Hero's Formula, Area $= \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$

3-Dimensional Shape	Formulas
Cube	Volume $= a^3$
	Surface Area $= 6a^2$
Rectangular parallelepiped	Volume $= lwh$
	Surface Area $= 2(lw + hw + lh)$
Any cylinder or prism	Volume = (area of base)(altitude)
Right cylinder or prism	Lateral surface area = (perimeter of base)(altitude) (not including bases)
Sphere	Volume $= \frac{4}{3}\pi r^3$
	Surface area $= 4\pi r^2$
Any cone or pyramid	Volume $= \frac{h}{3}$(area of base)
Right circular cone or regular pyramid	Lateral surface area $= \frac{s}{2}$(perimeter of base)
Frustum (any cone or pyramid)	Volume $= \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)$
Frustum (right circular cone or regular pyramid)	Lateral surface area $= \frac{s}{2}$(sum of base perimeters) $= \frac{s}{2}(P_1 + P_2)$

Chapter 7: Right Triangles

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

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

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

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

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

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

Chapter 8: Factoring

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

Chapter 9: Fractions

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

$distance = speed \times time$

$work\ done = rate\ of\ work \times time$

$amount\ of\ flow = flow\ rate \times time$

Chapter 11: Determinants

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

Cramer's Rule: Given system $\begin{matrix} a_1x + b_1y = c_1 \\ a_2x + b_2y = c_2 \end{matrix}$, $x = \frac{\begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}} \qquad y = \frac{\begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}}$

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Chapter 13: Exponents and Radicals

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

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

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

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

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

Chapter 14: Quadratic Equations

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

Chapter 15: Oblique Triangles and Vectors

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

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

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

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

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

Chapter 16: Radian Measure and Arc Length

$\theta = \frac{s}{r}$ (where θ is a central angle in radians, s is a length of an intercepted arc, and r is a radius of a circle)

Area of sector $= \frac{r^2\theta}{2}$ (where θ is a central angle in radians and r is a radius of a circle)

Area of segment $= r^2 \cdot \cos^{-1}\left(\frac{r-h}{r}\right) - (r-h) \cdot \sqrt{2rh - h^2}$ (where r is a radius of a circle, h is a height of a segment, and $\cos^{-1}\left(\frac{r-h}{r}\right)$ 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 $\frac{y_2}{y_1} = \frac{x_1}{x_2}$

$Joint\ Variation$: $y = kxw$