TMTH 202
FINAL EXAM FORMULA SHEET

CHAPTER 11: *Determinants*

Cramer's Rule:

$$x = \frac{\begin{vmatrix} c_1 & b_1 \\ c_2 & b_2 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}} \qquad y = \frac{\begin{vmatrix} a_1 & c_1 \\ a_2 & c_2 \end{vmatrix}}{\begin{vmatrix} a_1 & b_1 \\ a_2 & b_2 \end{vmatrix}} \qquad \Delta = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} \neq 0$$

$$x = \frac{\begin{vmatrix} k_1 & b_1 & c_1 \\ k_2 & b_2 & c_2 \\ k_3 & b_3 & c_3 \end{vmatrix}}{\Delta} \qquad y = \frac{\begin{vmatrix} a_1 & k_1 & c_1 \\ a_2 & k_2 & c_2 \\ a_3 & k_3 & c_3 \end{vmatrix}}{\Delta} \qquad z = \frac{\begin{vmatrix} a_1 & b_1 & k_1 \\ a_2 & b_2 & k_2 \\ a_3 & b_3 & k_3 \end{vmatrix}}{\Delta}$$

CHAPTER 12: *Matrices*

$AA^{-1} = A^{-1}A = I$ and $X = A^{-1}B$

CHAPTER 14: *Quadratic Equations*

Quadratic Formula: $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

CHAPTER 17: *Graphs of the Trigonometric Functions*

General Sine Wave: $y = \text{a} \sin(bx + c)$

amplitude $= |\text{a}|$ — period $= \dfrac{360°}{b}$ or $\dfrac{2\pi}{b}$ — frequency $= \dfrac{b}{360°}$ or $\dfrac{b}{2\pi}$

phase angle $= c$ — phase shift $= -\dfrac{c}{b}$ — $\cos\theta = \sin(\theta + 90°)$

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

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

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

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Addition of a sine wave and cosine wave:

$$A \sin \omega t + B \cos \omega t = R \sin(\omega t + \phi) \quad \text{where}$$

$$R = \sqrt{A^2 + B^2} \quad \text{and} \quad \phi = \arctan\left(\frac{B}{A}\right)$$

Transforming between Polar and Rectangular Coordinates:

$$x = r \cos \theta \quad \text{and} \quad y = r \sin \theta$$

$$r = \sqrt{x^2 + y^2} \quad \text{and} \quad \theta = \arctan\left(\frac{y}{x}\right)$$

<u>CHAPTER 18:</u> *Trigonometric Identities and Equations*

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

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

<u>CHAPTER 20:</u> *Exponential and Logarithmic Functions*

Growth

$y = ae^{nt}$

Decay

$y = ae^{-nt}$

Growth to an Upper Limit

$y = a(1-e^{-nt})$

Compound Interest

$y = a(1 + n)^t$ $y = a\left(1 + \frac{n}{m}\right)^{mt}$

Doubling Time and Half-Life

$t = \frac{\ln 2}{n}$

$\log_b N = a$ $b^a = N$

$\log\left(\frac{M}{N}\right) = \log M - \log N$

$\log(MN) = \log M + \log N$

$\log M^n = n \log M$

CHAPTER 22: *Analytic Geometry*

Straight Line

Distance formula.	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Equation of Straight line (General Form)	Ax + By + C = 0
Equation of Straight line (Slope-Intercept Form)	$y = mx + b$
Equation of Straight line (Point-slope Form)	$m = \frac{y - y_1}{x - x_1}$
	or $y - y_1 = m(x - x_1)$
Equation of Straight line (Two-point form)	$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$
Intersection angle between two lines	$\tan \phi = \frac{m_2 - m_1}{1 + m_1 m_2}$

Circle

Standard Equation (Circle of Radius r) Centre at (h, k)	$(x - h)^2 + (y - k)^2 = r^2$

Parabola

Standard Equation (Vertex at origin) Axis Horizontal	$y^2 = 4px$
Standard Equation (Vertex at origin) Axis Vertical	$x^2 = 4py$
Focal Width	$L = \lvert 4p \rvert$

Ellipse

Standard Equation (Centre at origin) Major axis vertical	$\frac{y^2}{a^2} + \frac{x^2}{b^2} = 1$
Standard Equation (Centre at origin) Major axis horizontal	$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

Distance from centre to focus. $c = \sqrt{a^2 - b^2}$

Focal width (where *a* is semi-major axis) $L = \frac{2b^2}{a}$

Hyperbola

Standard equation (Trans. horizontal) $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ slopes = $\pm \frac{b}{a}$

Standard equation (Trans. vertical) $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$ slopes = $\pm \frac{a}{b}$

Distance from centre to focus $c = \sqrt{a^2 + b^2}$

Focal Width $L = \frac{2b^2}{a}$