TMTH 205 MIDTERM EXAM FORMULA SHEET

CHAPTER 13: *Exponents and Radicals*

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

$\sqrt[n]{x^m} = (\sqrt[n]{x})^m = x^{m/n}$ $\quad$ $x^0 = 1$ $\quad$ $x^{-n} = \frac{1}{x^n}$

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

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

CHAPTER 14: *Quadratic Equations*

Quadratic Formula If $ax^2 + bx + c = 0$ and $a \neq 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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 $y = kxw$

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CHAPTER 22: *Analytic Geometry*

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

Straight Line:

Slope:

- given two points on line is $m = \frac{\text{rise}}{\text{run}} = \frac{y_2 - y_1}{x_2 - x_1}$
- given angle of inclination is $m = \tan(\theta)$
- for parallel lines: $m_1 = m_2$
- for perpendicular lines: $m_1 = -\frac{1}{m_2}$

Angle of inclination:

- $\theta = \tan^{-1} m$ if slope m is nonnegative
- $\theta = \tan^{-1} m + 180°$ if slope m is negative

Angle of intersection between two lines $\tan \phi = \frac{m_2 - m_1}{1 + m_1 m_2}$

Forms of equations for straight lines:

- 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 $\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$

Circle:

Circle of radius r and centre (h, k): $(x - h)^2 + (y - k)^2 = r^2$

Parabola:

Vertex at origin, Axis Horizontal	$y^2 = 4px$
Vertex at origin, Axis Vertical	$x^2 = 4py$
Focal Width	$L = \|4p\|$

Ellipse:

Centre at origin, Major Axis Vertical	$\frac{y^2}{a^2} + \frac{x^2}{b^2} = 1$
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:

Transverse Axis Horizontal	$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$	slopes of asymptotes $= \pm\frac{b}{a}$
Transverse Axis Vertical	$\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1$	slopes of asymptotes $= \pm\frac{a}{b}$
Distance from centre to focus	$c = \sqrt{a^2 + b^2}$	
Focal Width	$L = \frac{2b^2}{a}$	