Pre-Calculus FINAL EXAM Formula Sheet

Chapter 5 (Trigonometry)

Reciprocal Identities

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

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

Pythagorean Identities

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

Sum Formulas

$\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$

$\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$

$\tan(\alpha + \beta) = \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta}$

Difference Formulas

$\cos(\alpha - \beta) = \cos\alpha\cos\beta + \sin\alpha\sin\beta$

$\sin(\alpha - \beta) = \sin\alpha\cos\beta - \cos\alpha\sin\beta$

$\tan(\alpha - \beta) = \frac{\tan\alpha - \tan\beta}{1 + \tan\alpha\tan\beta}$

Double-Angle Formulas

$\sin 2\theta = 2\sin\theta\cos\theta$

$\cos 2\theta = \cos^2\theta - \sin^2\theta$

$= 1 - 2\sin^2 x$

$= 2\cos^2 - 1$

$\tan 2\theta = \frac{2\tan\theta}{1 - \tan^2\theta}$

Half-Angle Formulas

$\sin\frac{\alpha}{2} = \pm\sqrt{\frac{1-\cos\alpha}{2}}$

$\cos\frac{\alpha}{2} = \pm\sqrt{\frac{1+\cos\alpha}{2}}$

$\tan\frac{\alpha}{2} = \frac{1-\cos\alpha}{\sin\alpha}$

Chapter 10 (Sequences & Series)

	ARITHMETIC	GEOMETRIC
SEQUENCE	$a_n = a_1 + (n-1)d$	$a_n = a_1 r^{n-1}$
SERIES	$S_n = \frac{n(a_1 + a_n)}{2}$	$S_n = \frac{a_1(1-r^n)}{1-r}$
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$		$S = \frac{a_1}{1-r}$

Chapter 12 (Limits)

$$\frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + f(x)g'(x).$$

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}.$$

Chapter 7 (Conic Sections)

Parabolas

	Vertical Direction of Opening	**Horizontal Direction of Opening**
Equation	$(x-h)^2 = 4p(y-k)$	$(y-k)^2 = 4p(x-h)$
Axis of Symmetry	$x = h$	$y = k$
Vertex	(h, k)	(h, k)
Focus	$(h, k+p)$	$(h+p, k)$
Directrix	$y = k-p$	$x = h-p$

Circles

Equation	$(x-h)^2 + (y-k)^2 = r^2$
Radius	r
Center	(h, k)

Ellipses

	Horizontal Major Axis	**Vertical Major Axis**
Equation	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1$
Center	(h, k)	(h, k)
Vertices	$(h \pm a, k)$	$(h, k \pm a)$
Major Axis	$y = k, \text{length of } 2a$	$x = h, \text{length of } 2a$
Minor Axis	$x = h, \text{length of } 2b$	$y = k, \text{length of } 2b$
Foci	$(h \pm c, k)$	$(h, k \pm c)$

a is the distance from center to vertices, *b* is the distance from center to co-vertices,
c is the distance from center to foci, $c^2 = a^2 - b^2$

Hyperbolas

	Horizontal Transverse Axis	**Vertical Transverse Axis**
Equation	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$
Equations of Asymptotes	$y - k = \pm \frac{b}{a}(x-h)$	$y - k = \pm \frac{a}{b}(x-h)$
Center	(h, k)	(h, k)
Vertices	$(h \pm a, k)$	$(h, k \pm a)$
Transverse Axis	$y = k, \text{length of } 2a$	$x = h, \text{length of } 2a$
Conjugate Axis	$x = h, \text{length of } 2b$	$y = k, \text{length of } 2b$
Foci	$(h \pm c, k)$	$(h, k \pm c)$

a is the distance from center to vertices, *b* is the distance from center to co-vertices,
c is the distance from center to foci, $c^2 = a^2 + b^2$