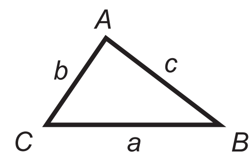
QualityCore®

QualityCore® Reference Sheet
Precalculus

Triangles

Law of Sines	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$	
Law of Cosines	$a^2 = b^2 + c^2 - 2bc \cos A$	
Area of a Triangle	$\text{Area} = \frac{1}{2}bc \sin A$ $\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$	s = semi-perimeter = $\frac{(a+b+c)}{2}$



Conic Sections

Circle	$(x-h)^2 + (y-k)^2 = r^2$	(h,k) = center, r = radius
Parabola, opening vertically	$y = a(x-h)^2 + k$	axis of symmetry $x = h$ focus $\left(h, k + \frac{1}{4a}\right)$, directrix $y = k - \frac{1}{4a}$
Parabola, opening horizontally	$x = a(y-k)^2 + h$	axis of symmetry $y = k$ focus $\left(h + \frac{1}{4a}, k\right)$, directrix $x = h - \frac{1}{4a}$
Ellipse, major axis horizontal	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1, a > b$	foci $(h \pm c, k)$ where $c^2 = a^2 - b^2$
Ellipse, major axis vertical	$\frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1, a > b$	foci $(h, k \pm c)$ where $c^2 = a^2 - b^2$
Area of an ellipse	$A = \pi ab$	
Hyperbola, transverse axis horizontal	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	foci $(h \pm c, k)$ where $c^2 = a^2 + b^2$
Hyperbola, transverse axis vertical	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$	foci $(h, k \pm c)$ where $c^2 = a^2 + b^2$

Sequences and Series

Arithmetic Sequence	$a_n = a_1 + (n-1)d$	a_n = nth term
Arithmetic Series	$s_n = \frac{n}{2}(a_1 + a_n)$	a_1 = first term n = number of the term
Geometric Sequence	$a_n = a_1(r^{n-1})$	d = common difference r = common ratio
Finite Geometric Series	$s_n = \frac{a_1 - a_1 r^n}{1-r}$ where $r \neq 1$	s_n = sum of the first n terms s = sum of all the terms
Infinite Geometric Series	$s = \frac{a_1}{1-r}$ where $\lvert r \rvert < 1$	

Exponential Functions

Discretely Compounded Interest	$A = p\left(1 + \frac{r}{n}\right)^{nt}$	A = amount of money after t years p = starting principal r = interest rate
Continuously Compounded Interest	$A = pe^{rt}$	n = compound periods per year t = number of years $e \approx 2.718$
Discrete, Continuous Exponential Growth	$N_t = N_0(1+r)^t$, $N_t = N_0e^{rt}$	N_t = value after t time periods r = rate of growth t = time periods

continued

Polar Coordinates and Vectors

De Moivre's Theorem	$[r(\cos\theta + i\sin\theta)]^n = r^n(\cos n\theta + i\sin n\theta)$	r = radius, distance from origin θ = angle in standard position n = exponent
Conversion: Polar to Rectangular Coordinates	$x = r\cos\theta$ $y = r\sin\theta$	
Conversion: Rectangular to Polar Coordinates	$r = \sqrt{x^2 + y^2}$, $\theta = \arctan\frac{y}{x}$, when $x > 0$ $\theta = \arctan\frac{y}{x} + \pi$, when $x < 0$	
Product of Complex Numbers in Polar Form	$r_1(\cos\theta_1 + i\sin\theta_1)\cdot r_2(\cos\theta_2 + i\sin\theta_2) = r_1r_2[\cos(\theta_1 + \theta_2) + i\sin(\theta_1 + \theta_2)]$	
Inner Product of Vectors	$\mathbf{a}\cdot\mathbf{b} = a_1b_1 + a_2b_2 + a_3b_3$	$\mathbf{a} = \langle a_1, a_2\rangle$ vector in the plane $\mathbf{a} = \langle a_1, a_2, a_3\rangle$ vector in space

Matrices

Determinant of a 2×2 Matrix	$\det\begin{bmatrix} a & b \\ c & d \end{bmatrix} = ad - bc$
Determinant of a 3×3 Matrix	$\det\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & j \end{bmatrix} = a\cdot\det\begin{bmatrix} e & f \\ h & j \end{bmatrix} - b\cdot\det\begin{bmatrix} d & f \\ g & j \end{bmatrix} + c\cdot\det\begin{bmatrix} d & e \\ g & h \end{bmatrix}$
Inverse of a 2×2 Matrix	$M^{-1} = \frac{1}{\det M}\begin{bmatrix} d & -c \\ -b & a \end{bmatrix}$ where $M = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$

Trigonometry

Sum and Difference Identities	$\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \cos\alpha\sin\beta$ $\cos(\alpha \pm \beta) = \cos\alpha\cos\beta \mp \sin\alpha\sin\beta$ $\tan(\alpha \pm \beta) = \frac{\tan\alpha \pm \tan\beta}{1 \mp \tan\alpha\tan\beta}$	α, β, θ = angles, from positive x-axis
Double-Angle Identities	$\sin 2\theta = 2\sin\theta\cos\theta$ $\cos 2\theta = \cos^2\theta - \sin^2\theta$ $\tan 2\theta = \frac{2\tan\theta}{1 - \tan^2\theta}$	
Half-Angle Identities	$\sin\frac{\alpha}{2} = \pm\sqrt{\frac{1 - \cos\alpha}{2}}$ $\cos\frac{\alpha}{2} = \pm\sqrt{\frac{1 + \cos\alpha}{2}}$ $\tan\frac{\alpha}{2} = \pm\sqrt{\frac{1 - \cos\alpha}{1 + \cos\alpha}}$, where $\cos\alpha \neq -1$	