ACT II Subject Test
Math Level 2 – Reference sheet
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Equation of a line		
Standard form	$Ax + By + C$	• A, B, C are real numbers. • $A \geq 0$ A and B are not both zero.
Slope- intercept form	$y = mx + b$	$m = slope, b = y - intercept$
Point -Slope form	$y - y_1 = m(x - x_1)$	
Slope	$m = \frac{y_2 - y_1}{x_2 - x_1}$	(x_1, y_1) and (x_2, y_2) are 2 points
Quadratics		
Standard form of a quadratic equation	$ax^2 + bx + c = 0$	a, b and c are constants where $a \neq 0$
Quadratic formula	$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$	
Coordinate Geometry		
Midpoint	$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$	(x_1, y_1) and (x_2, y_2) are 2 points
Distance formula	$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$	
Area, Volume, and Surface Area of Polygon and Solids		
Triangle	$A = \frac{1}{2}bh$	$A = Area$ $b = base$ $h = height$ $a = apothom$ $p = Perimeter$ $V = Volume$ $B = Area\ of\ base$ $SA = Surface\ Area$ $P = Perimeter\ of\ base$ $r = radius$ $l = slant\ height$ $\pi = 3.142$
Parallelogram	$A = bh$	
Trapezoid	$A = \frac{1}{2}(b_1 + b_2)h$	
Regular Polygon	$A = \frac{1}{2}ap$	
Prism	$V = Bh$	
Regular Prism	$SA = 2B + Ph$	
Circular Cylinder	$V = \pi r^2 h$	
Right Circular Cylinder	$SA = 2\pi r^2 + 2\pi rh$	
Pyramid	$V = \frac{1}{3}Bh$	
Right Pyramid	$SA = B + \frac{1}{2}Pl$	
Circular cone	$V = \frac{1}{3}\pi r^2 h$	
Right Circular Cone	$SA = \pi r^2 + \pi rl$	
Sphere	$V = \frac{4}{3}\pi r^3$ $SA = 4\pi r^2$	

Angles of Polygon

Sum of Degree Measures of the interior Angles of a Polygon	$180(n-2)$	n = number of sides
Degree Measures of an interior Angle of a Regular Polygon	$\frac{180(n-2)}{n}$	

Circles

Equation of a circle	$(x-h)^2+(y-k)^2=r^2$	$center\ (h,k)$ $r = radius$ $A = Area$ $C = circumference$ $d = diameter$ $\pi = 3.142$
Area formula	$A = \pi r^2$	
Circumference Formula	$C = 2\pi r = \pi d$	
Area of a sector with central angle θ	$A = \frac{\theta}{360}\pi r^2$	

Parabolas

Opening vertically	$y = a(x-h)^2 + k$	$a = constant$
Axis of symmetry	$x = h$	$(h,k) = vertex$
focus	$\left(h, k + \frac{1}{4a}\right)$	
directrix	$x = k - \frac{1}{4a}$	
Opening horizontally	$x = a(y-k)^2 + h$	
Axis of symmetry	$y = k$	
focus	$\left(h + \frac{1}{4a}, k\right)$	
directrix	$y = h - \frac{1}{4a}$	

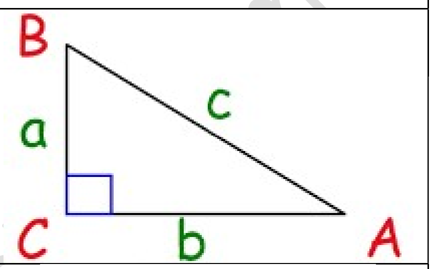
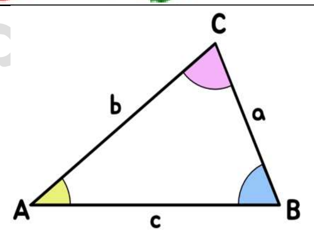
Ellipses

Major Axis Horizontal	$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$	$a, b = positive\ constants$ $where\ a > b$ $c = \sqrt{a^2 - b^2}$ $A = Area$ $\pi = 3.142$
Foci	$(h \pm c, k)$	
Major Axis Vertical	$\frac{(y-k)^2}{a^2} + \frac{(x-h)^2}{b^2} = 1$	
Foci	$(h, k \pm c)$	
Area	$A = \pi ab$	

Hyperbolas

Transverse Axis Horizontal	$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$	$a, b = positive\ constants$ $where\ a > b$ $c = \sqrt{a^2 + b^2}$
Foci	$(h \pm c, k)$	
Transverse Axis Horizontal	$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$	
Foci	$(h, k \pm c)$	

Right Triangles

Pythagorean Theorem	$a^2 + b^2 = c^2$	
Right Triangle Trigonometry	$\sin A = \frac{a}{c}$ $\cos A = \frac{b}{c}$ $\tan A = \frac{a}{b}$	
Law of Sines	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$	
Law of Cosine	$c^2 = a^2 + b^2 - 2ab\cos C$	
Area of a Triangle	$Area = \frac{1}{2}bc\sin A$ $= \sqrt{s(s-a)(s-b)(s-c)}$	

Sequences

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

Interest

Simple interest	$I = Prt$	$r = rate$ $t = time$ $I = interest$ $P = Principle$ $A = Amount\ of\ money\ after\ t\ years$ $n = number\ of times\ interest\ is\ compound\ annually$ $e = 2.718$
Compound Interest	$A = P\left(1 + \frac{r}{n}\right)^{nt}$	

Counting

Combinations	${}_kC_m = C(k,m) = \frac{k!}{(k-m)!m!}$	$k = number\ of\ objects\ in\ a\ set$ $m = number\ of\ objects\ selected$
Permutations	${}_kP_m = P(k,m) = \frac{k!}{(k-m)!}$	

Exponential Growth and Decay

Periodic	$N_t = N_0(1+r)^t$	$N_t = value\ at\ time\ t\ or\ after$ $t\ time\ period$ $r = rate\ of\ growth$ $t = time\ or\ number\ of$ $time\ periods$ $e = 2.718$
Continuous	$N_t = N_0 e^{rt}$	

Polar Coordinates and Vectors

De Moivre's Theorem	$[r(\cos\theta + i\sin\theta)]^n = r^n(\cos n\theta + i\sin n\theta)$	$r = radious, distance\ from$ $the\ origin$ $\theta = angle\ measure\ in$ $standard\ position$ $n = exponent$
Conversion: Polar to rectangular coordinates	$x = r\cos\theta$ $y = r\sin\theta$	
Conversion: rectangular to Polar coordinates	$r = \sqrt{x^2+y^2}$, $\theta = \arctan\frac{y}{x}\ \ when\ x > 0$ $\theta = \pi + \arctan\frac{y}{x}\ \ when\ x < 0$	
Product of Complex Numbers in Polar Form	$[r_1(\cos\theta_1 + i\sin\theta_1)][r_2(\cos\theta_2 + i\sin\theta_2)] = r_1r_2[\cos(\theta_1+\theta_2) + i\sin(\theta_1+\theta_2)]$	
Inner Product of Vectors in Plane	$\boldsymbol{a} + \boldsymbol{b} = a_1b_1 + a_2b_2$	$\boldsymbol{a} = \langle a_1, a_2\rangle$ **vector in the plane**
Inner Product of Vectors in Plane	$\boldsymbol{a} + \boldsymbol{b} = a_1b_1 + a_2b_2 + a_3b_3$	$\boldsymbol{a} = \langle a_1, a_2, a_3\rangle$ **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	$M^{-1} = \frac{1}{\det M}\begin{bmatrix} d & -b \\ -c & a\end{bmatrix}$	Where $M = \begin{bmatrix} a & b \\ c & d\end{bmatrix}$

Trigonometry	
Sum and difference identities	
$\sin(\alpha \pm \beta) = \sin\alpha\cos\beta \pm \cos\alpha\sin\beta$ $\cos(\alpha \pm \beta) = \cos\alpha\cos\beta \mp \sin\alpha\sin\beta$ $\tan(\alpha \pm \beta) = \frac{\tan\alpha \pm \tan\beta}{1 \mp \tan\alpha\tan\beta}$	$\beta = angle\ measure\ in\ standard\ position$
Double-Angle Identities	
$\sin 2\theta = 2\sin\theta\cos\theta$ $\cos 2\theta = \cos^2\theta - \sin^2\theta$ $\tan 2\theta = \frac{2\tan\theta}{1-\tan^2\theta}$	$\theta = angle\ measure\ in\ standard\ position$
Half-Angle Identities	
$\sin\frac{\alpha}{2} = \pm\sqrt{\frac{1-\cos\alpha}{2}}$ $\cos\frac{\alpha}{2} = \pm\sqrt{\frac{1+\cos\alpha}{2}}$ $\tan\frac{\alpha}{2} = \pm\sqrt{\frac{1-\cos\alpha}{1+\cos\alpha}}\quad where\ \cos\alpha \neq -1$	$\alpha = angle\ measure\ in\ standard\ position$

Miscellaneous		
Distance, Rate, Time	$D = rt$	$D = distance$ $r = rate$ $t = time$
Direct Variation (y varies directly with x)	$y = kx$	$k = variation\ constant$
Inverse Variation (y varies indirectly with x)	$y = \frac{k}{x}$	

Key to Symbols

ΔABC … … … … … … … . . Triangle ABC
$\angle ABC$ … … … … … … … . . Angle ABC
$m\angle ABC$ … … … … … … … measure of Angle ABC
$\overleftrightarrow{AB}$ … … … … … … … … … . Line AB
$\overline{AB}$ … … … … … … … … … . Line segment AB
AB … … … … … … … … … . length of line segment AB
$Circle\ O$ … … … … … … … Circle with centre O
$\widehat{AB}$ … … … … … … … … … . Arc AB
$\perp$ … … … … … … … … … … … is perpendicular to
$\parallel$ ⋯ … … … … … … … … … … is parallel to
$\cong$ ⋯ … … … … … … … … … . . is congruent to
$\sim$ … … … … … … … … … … … is similar to
$\approx$ ⋯ … … … … … … … … … . . is approximately equal