MAT 122 Cheat Sheet

Double-Angle Formulas: $\sin(2u) = 2\sin(u)\cos(u)$, $\cos(2u) = \cos^2(u) - \sin^2(u) = 2\cos^2(u) - 1 = 1 - 2\sin^2(u)$,

Power-Reducing Formulas: $\sin^2(u) = \dfrac{1-\cos(2u)}{2}$, $\cos^2(u) = \dfrac{1+\cos(2u)}{2}$, $\tan^2(u) = \dfrac{1-\cos(2u)}{1+\cos(2u)} = \dfrac{\sin^2(u)}{\cos^2(u)}$

Half-Angle Formulas: $\sin\left(\dfrac{u}{2}\right) = \pm\sqrt{\dfrac{1-\cos(u)}{2}}$, $\cos\left(\dfrac{u}{2}\right) = \pm\sqrt{\dfrac{1+\cos(u)}{2}}$, $\tan\left(\dfrac{u}{2}\right) = \dfrac{1-\cos(u)}{\sin(u)} = \dfrac{\sin\left(\frac{u}{2}\right)}{\cos\left(\frac{u}{2}\right)}$!!!

You determine "±" deal, by determining the quadrant in which $\dfrac{u}{2}$ resides.

Product-to-Sum Formulas

$\sin u \sin v = \frac{1}{2}[\cos(u - v) - \cos(u + v)]$

$\cos u \cos v = \frac{1}{2}[\cos(u - v) + \cos(u + v)]$

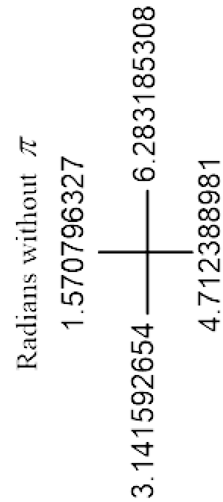
$\sin u \cos v = \frac{1}{2}[\sin(u + v) + \sin(u - v)]$

Sum-to-Product Formulas

$\sin u + \sin v = 2\sin\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$

$\cos u + \cos v = 2\cos\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$

$\cos u - \cos v = -2\sin\left(\frac{u+v}{2}\right)\sin\left(\frac{u-v}{2}\right)$



Pythagorean Identities

$\tan^2(x) + 1 = \sec^2(x)$

$\cot^2(x) + 1 = \csc^2(x)$

Angle Sum Formulas

$\sin(u+v) = \sin(u)\cos(v) + \sin(v)\cos(u)$

$\cos(u+v) = \cos(u)\cos(v) - \sin(u)\sin(v)$

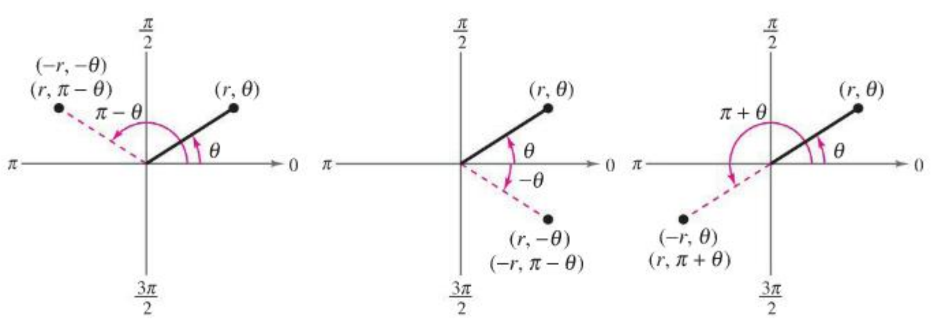
Law of Sines $\dfrac{\sin A}{a} = \dfrac{\sin B}{b} = \dfrac{\sin C}{c}$ **Law of Cosines** $a^2 = b^2 + c^2 - 2bc\cos A$

Heron's $Area = \sqrt{s(s-a)(s-b)(s-c)}$, where $s = \dfrac{a+b+c}{2}$. **Length:** $s = r\theta$, **Area:** $A = \dfrac{1}{2}r^2\theta$.

Vectors: $\bar{u} = \langle a, b\rangle \Rightarrow \|\bar{u}\| = \sqrt{\bar{u} \bullet \bar{u}} = \sqrt{a^2 + b^2}$ $\quad \bar{u} = \langle u_1, u_2\rangle$ *and* $\bar{v} = \langle v_1, v_2\rangle \Rightarrow \bar{u} \bullet \bar{v} = u_1v_1 + u_2v_2$ $\quad \cos\theta = \dfrac{\bar{u} \bullet \bar{v}}{\|\bar{u}\|\|\bar{v}\|}$

$proj_{\bar{v}}\bar{u} = \dfrac{\bar{u} \bullet \bar{v}}{\|\bar{v}\|^2}\bar{v}$ **Complex #s** $z^{\frac{1}{n}} = \sqrt[n]{r}\left(\cos\left(\dfrac{\theta + 2k\pi}{n}\right) + i\sin\left(\dfrac{\theta + 2k\pi}{n}\right)\right)$, $k = 0, 1, 2, \ldots n-1$

$z^n = r^n(\cos(n\theta) + i\sin(n\theta))$



Symmetry with Respect to the Line $\theta = \frac{\pi}{2}$

Symmetry with Respect to the Polar Axis

Symmetry with Respect to the Pole

The graph of a polar equation is symmetric with respect to the following when the given substitution yields an equivalent equation.

1. The line $\theta = \pi/2$: Replace (r, θ) by $(r, \pi - \theta)$ or $(-r, -\theta)$.
2. The polar axis: Replace (r, θ) by $(r, -\theta)$ or $(-r, \pi - \theta)$.
3. The pole: Replace (r, θ) by $(r, \pi + \theta)$ or $(-r, \theta)$.