

MTH 112: Identities and Formulas Reference Sheet

This sheet will be provided to students during exams.

Law of Sines $\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$	Law of Cosines $c^2 = a^2 + b^2 - 2ab \cos(C)$
Double Angle Identities $\sin(2A) = 2 \sin(A) \cos(A)$ $\cos(2A) = 1 - 2 \sin^2(A)$ $\cos(2A) = 2 \cos^2(A) - 1$ $\cos(2A) = \cos^2(A) - \sin^2(A)$ $\tan(2A) = \frac{2 \tan(A)}{1 - \tan^2(A)}$	Sum and Difference Identities $\sin(A + B) = \sin(A) \cos(B) + \cos(A) \sin(B)$ $\sin(A - B) = \sin(A) \cos(B) - \cos(A) \sin(B)$ $\cos(A + B) = \cos(A) \cos(B) - \sin(A) \sin(B)$ $\cos(A - B) = \cos(A) \cos(B) + \sin(A) \sin(B)$ $\tan(A + B) = \frac{\tan(A) + \tan(B)}{1 - \tan(A) \tan(B)}$ $\tan(A - B) = \frac{\tan(A) - \tan(B)}{1 + \tan(A) \tan(B)}$
Half Angle Identities $\sin\left(\frac{A}{2}\right) = \pm \sqrt{\frac{1 - \cos(A)}{2}}$ $\cos\left(\frac{A}{2}\right) = \pm \sqrt{\frac{1 + \cos(A)}{2}}$ $\tan\left(\frac{A}{2}\right) = \frac{1 - \cos(A)}{\sin(A)}$	Product-to-Sum Identities $\sin(A) \sin(B) = \frac{1}{2} [\cos(A - B) - \cos(A + B)]$ $\cos(A) \cos(B) = \frac{1}{2} [\cos(A - B) + \cos(A + B)]$ $\sin(A) \cos(B) = \frac{1}{2} [\sin(A - B) + \sin(A + B)]$
Conic Sections: Ellipses IMPLICIT EQUATION: $1 = \frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2}$ PARAMETRIC SYSTEM: $\begin{cases} x = a \cos(t) + h \\ y = b \sin(t) + k \end{cases}$	Sum of Sine and Cosine Identity $A_1 \sin(\omega t) + A_2 \cos(\omega t) = A \sin(\omega t + \phi)$ where $A = \sqrt{A_1^2 + A_2^2}$ and $\tan(\phi) = \frac{A_2}{A_1}$, and ϕ satisfies $\cos(\phi) = \frac{A_1}{A}$ and $\sin(\phi) = \frac{A_2}{A}$
Dot Product $\vec{v} \cdot \vec{w} = v_1 w_1 + v_2 w_2$	Sum-to-Product Identities $\sin(A) + \sin(B) = 2 \sin\left(\frac{A+B}{2}\right) \cos\left(\frac{A-B}{2}\right)$ $\sin(A) - \sin(B) = 2 \cos\left(\frac{A+B}{2}\right) \sin\left(\frac{A-B}{2}\right)$ $\cos(A) + \cos(B) = 2 \cos\left(\frac{A+B}{2}\right) \cos\left(\frac{A-B}{2}\right)$ $\cos(A) - \cos(B) = -2 \sin\left(\frac{A+B}{2}\right) \sin\left(\frac{A-B}{2}\right)$
Angle Between Vectors $\cos(\theta) = \frac{\vec{v} \cdot \vec{w}}{\ \vec{v}\ \ \vec{w}\ }$	
Euler's Formula $re^{i\theta} = r \cos(\theta) + r \sin(\theta) \cdot i$	