Trigonometry

Maximum & Minimum Value

	Minimum	Maximum
• **sin θ, cos θ** [odd power]	−1	+1
• **sin θ, cos θ** [even power]	0	+1
• **tan θ, cot θ** [odd power]	−∞	+∞
• **tan θ, cot θ** [even power]	0	+∞
• **sec θ, cosec θ** [odd power]	−∞	+∞
• **sec θ, cosec θ** [even power]	+1	+∞

- **$a \sin^2 \theta + b \cos^2 \theta$**

if $a > b$	if $b > a$
$\max \to a$	$\max \to b$
$\min \to b$	$\min \to a$

- **$\sin^n \theta \cdot \cos^n \theta$**

$$\text{Max} \Rightarrow \frac{1}{2^n} \quad \left| \begin{array}{l} \text{Min} \to n \to \text{odd} \to \dfrac{-1}{2^n} \\ \text{Min} \to n \to \text{even} \to 0 \end{array} \right.$$

- **$\sin^{2n} \theta + \cos^{2m} \theta$**

$$\text{Maximum} \to 1$$
$$\text{Min} \Rightarrow \text{Put } \theta = 45°$$

- **$a \sin \theta + b \cos \theta$**

$$\text{Max} \Rightarrow +\sqrt{a^2 + b^2}$$
$$\text{Min} \Rightarrow -\sqrt{a^2 + b^2}$$

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$a \sin^2 \theta + b \operatorname{cosec}^2 \theta$	$a \cos^2 \theta + b \sec^2 \theta$
if $a < b$	if $a < b$
$\min = a + b$	$\min = a + b$
if $b > a$	if $b > a$
$\min = 2\sqrt{ab}$	$\min = 2\sqrt{ab}$

- **$a\,\text{cosec}^2\,\theta + b\,\sec^2\,\theta$**

$$\text{Min} = \left(\sqrt{a} + \sqrt{b}\right)^2$$

- **$a\tan^2\theta + b\cot^2\theta$**

$$\text{Min} = 2\sqrt{ab}$$

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