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Trigonometric Phenomena - Lesson 3

Double Angle Formulae

LI

- Use the 2 Double Angle Formulae.

SC

- Exact Trig. Values.
- Manipulating Fractions.

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Double Angle Formulae

$$\boxed{\sin(2A) = 2\sin A\cos A}$$

$$\boxed{\begin{aligned}\cos(2A) &= \cos^2 A - \sin^2 A \\ &= 2\cos^2 A - 1 \\ &= 1 - 2\sin^2 A\end{aligned}}$$

Can get $\sin(2A)$ from the addition formula $\sin(A + A)$.

Can get $\cos(2A)$ (1st one) from the addition formula $\cos(A + A)$; 2nd and 3rd ones are then obtained by using $\sin^2 A + \cos^2 A = 1$.

Example 1

Write $\sin(12X)$ in terms of $\sin(6X)$ and $\cos(6X)$.

$$\sin(12X) = \sin(2(6X))$$

$$\sin(2A) = 2\sin A\cos A$$

$$\text{Let } A = 6X$$

$$= \boxed{2\sin(6X)\cos(6X)}$$

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Example 2

Find the exact values of :

(a) $\cos^2 75^\circ - \sin^2 75^\circ$.

(b) $2 \sin \frac{\pi}{8} \cos \frac{\pi}{8}$.

(c) $1 - 2 \sin^2 165^\circ$.

(a) $\cos^2 75^\circ - \sin^2 75^\circ = \cos(2(75^\circ))$

$= \cos 150^\circ$

$= -\cos 30^\circ$ use symmetry of cosine graph

$= \boxed{-\frac{\sqrt{3}}{2}}$

(b) $2 \sin \frac{\pi}{8} \cos \frac{\pi}{8} = \sin\left(2\left(\frac{\pi}{8}\right)\right)$

$= \sin \frac{\pi}{4}$

$= \boxed{\frac{1}{\sqrt{2}}}$

(c) $1 - 2 \sin^2 165^\circ = \cos(2(165^\circ))$

$= \cos 330^\circ$

$= \cos 30^\circ$ use symmetry of cosine graph

$= \boxed{\frac{\sqrt{3}}{2}}$

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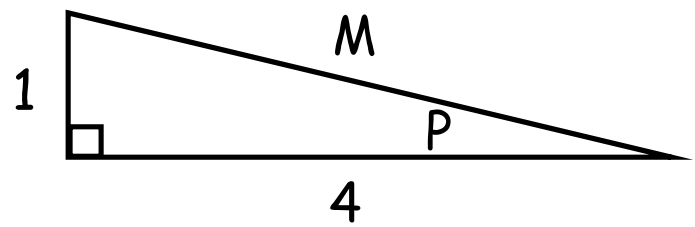
Example 3

If P is an acute angle with $\tan P = \frac{1}{4}$,

find the exact value of $\cos(2P)$.

$$M = \sqrt{1^2 + 4^2}$$

$$M = \sqrt{17}$$



$$\boxed{\sin P = \frac{1}{\sqrt{17}} \qquad \cos P = \frac{4}{\sqrt{17}}}$$

$$\cos 2P = \cos^2 P - \sin^2 P$$

$$= \left(\frac{4}{\sqrt{17}}\right)^2 - \left(\frac{1}{\sqrt{17}}\right)^2$$

$$= \frac{16}{17} - \frac{1}{17}$$

$$= \boxed{\frac{15}{17}}$$

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