

**Verify - Double & Half-Angle Identities**

Verify the following.

1)  $\frac{1 - \cos 2x}{2 \sin x} = \sin x$

2)  $\sin 3x = 3 \sin x - 4 \sin^3 x$

3)  $\tan \frac{x}{2} \csc x = \sec x$

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## Verify - Double & Half-Angle Identities

Verify the following.

4)  $2 \sin^2 x + \cos 2x = 1$

5)  $\frac{\sin 2x}{1 - \cos 2x} =$

6)  $\frac{2 \tan x}{\cot^2 x - 1} = \tan$

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## Verify - Double & Half-Angle Identities

Verify the following.

$$1) \quad \frac{1 - \cos 2x}{2 \sin x} = \sin x$$

$$\frac{1 - \cos 2x}{2 \sin x} = \left( \frac{1 - \cos 2x}{2} \right) \left( \frac{1}{\sin x} \right)$$

$$= \sin^2 x \frac{1}{\sin x}$$

Using double-angle identity

=

$$2) \quad \sin 3x = 3 \sin x - 4 \sin^3 x$$

$$\sin 3x =$$

=

=

=

=

=

=

=

$$3) \quad \tan \frac{x}{2} \csc x = \frac{1}{1 + \cos x}$$

$$\tan \frac{x}{2} \csc x = \frac{\sin \frac{x}{2}}{\cos \frac{x}{2}} \frac{1}{\sin x}$$

$$= \left( \frac{\sin \frac{x}{2}}{1 + \cos x} \right) \left( \frac{1}{\sin x} \right)$$

$$= \left( \frac{\sin \frac{x}{2}}{1 + \cos x} \right) \left( \frac{1}{2 \sin \frac{x}{2} \cos \frac{x}{2}} \right)$$

$$= \frac{1}{1 + \cos x}$$

Using sum identity

Using double-angle

identities

multiply

Using Pythagorean identity

multiply

simplify

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Using reciprocal identity

Using half-angle identity

Cancel the common factors

## Verify - Double & Half-Angle Identities

Verify the following.

4)  $2 \sin^2 x + \cos 2x = 1$

$$2 \sin^2 x + \cos 2x = 2 \sin^2 x + 1 - 2 \sin^2 x \quad \text{Using double-angle identity}$$

$$= 2 \sin^2 x + 1 - 2 \sin^2 x \quad \text{Simplify}$$

$$= 1$$

5)  $\frac{\sin 2x}{1 - \cos 2x} =$

$$\frac{\sin 2x}{1 - \cos 2x}$$

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double-angle identities

common factors

quotient identity

6)  $\frac{2 \tan x}{\cot^2 x - 1} = \tan 2x$

$$\frac{2 \tan x}{\cot^2 x - 1} = \frac{2 \tan x}{\frac{1}{\tan^2 x} - 1} \quad \text{Using reciprocal identity}$$

$$= \left( \frac{2 \tan x}{1 - \tan^2 x} \right) \tan^2 x \quad \text{Combine quotients}$$

$$= \tan 2x \tan^2 x \quad \text{Using double-angle identity}$$