

**Verify: Product-Sum & Sum-Product Identities**

Verify the following.

1)  $\frac{\cos 8x - \cos 2x}{2 \sin 5x \sin 3x} = -1$

2)  $2 \sin 4x \cos 9x$

3)  $\frac{\sin 15x - \sin 7x}{\sin 11x}$

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## Verify: Product-Sum & Sum-Product Identities

Verify the following.

4)  $\frac{\sin 9x \sin 3x}{\cos 9x \cos 3x} = \frac{\cos 6x - \cos 12x}{\cos 12x + \cos 6x}$

5)  $\frac{\sin 8x + \sin 10x}{\sin 8x - \sin 10x}$

6)  $\cos 17x \sin 5x$

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## Verify: Product-Sum & Sum-Product Identities

Verify the following.

$$1) \quad \frac{\cos 8x - \cos 2x}{2 \sin 5x \sin 3x} = -1$$

$$\frac{\cos 8x - \cos 2x}{2 \sin 5x \sin 3x} = \frac{-2 \sin \left( \frac{8x + 2x}{2} \right) \sin \left( \frac{8x - 2x}{2} \right)}{2 \sin 5x \sin 3x}$$

Using sum to product identity

$$= \frac{-2 \sin 5x \sin 3x}{2 \sin 5x \sin 3x}$$

Cancel the common factors

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$$2) \quad 2 \sin 4x \cos 9x$$

$$2 \sin 4x \cos 9x$$

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product to sum identity

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even/odd identity

$$3) \quad \frac{\sin 15x - \sin 7x}{\sin 11x}$$

$$\frac{\sin 15x - \sin 7x}{\sin 11x} = \frac{2 \cos \left( \frac{15x + 7x}{2} \right) \sin \left( \frac{15x - 7x}{2} \right)}{\sin 11x}$$

Using sum to product identity

$$= \frac{2 \cos 11x \sin 4x}{\sin 11x}$$

$$= 2 \cot 11x \sin 4x$$

Using quotient identity

**Verify: Product-Sum & Sum-Product Identities**

Verify the following.

$$4) \frac{\sin 9x \sin 3x}{\cos 9x \cos 3x} = \frac{\cos 6x - \cos 12x}{\cos 12x + \cos 6x}$$

$$\frac{\sin 9x \sin 3x}{\cos 9x \cos 3x} = \frac{\frac{1}{2}(\cos(9x - 3x) - \cos(9x + 3x))}{\frac{1}{2}(\cos(9x + 3x) + \cos(9x - 3x))} \quad \text{Using product to sum identity}$$

$$= \frac{\frac{1}{2}(\cos 6x - \cos 12x)}{1}$$

the common factors

$$5) \frac{\sin 8x + \sin 10x}{\sin 8x - \sin 10x}$$

$$\frac{\sin 8x + \sin 10x}{\sin 8x - \sin 10x}$$

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m to product identity

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the common factors

quotient identity

even/odd identity

$$6) \cos 17x \sin 5x$$

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$$\cos 17x \sin 5x = \frac{1}{2}((\sin(17x + 5x) - \sin(17x - 5x))) \quad \text{Using product to sum identity}$$

$$= \frac{1}{2}(\sin 22x - \sin 12x)$$

$$= \frac{\sin 22x - \sin 12x}{2}$$