

Verify: Product-Sum & Sum-Product Identities

Verify the following.

1) $\frac{\sin x - \sin 3x}{\cos x + \cos 3x} = -\tan x$

2) $\frac{\cos 12x \cos 14x}{\cos 14x + \cos 12x}$

3) $4 \sin x \cos 8x$

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Verify: Product-Sum & Sum-Product Identities

Verify the following.

4) $12 \cos 13x \sin 7x = 6 (\sin 20x - \sin 6x)$

5) $\frac{\cos 6x + \cos 4x}{\sin 6x + \sin 4x}$

6) $2 + \frac{\sin 5x - \sin 3x}{\cos 3x \sin 5x}$

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Verify: Product-Sum & Sum-Product Identities

Verify the following.

$$1) \quad \frac{\sin x - \sin 3x}{\cos x + \cos 3x} = -\tan x$$

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

Using sum to product identities

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

Cancel the common factors

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Quotient identity

Even/odd identity

$$2) \quad \frac{\cos 12x \cos 2x}{\cos 14x + \cos 10x}$$

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Product to sum identity

$$\frac{\cos 12x \cos 2x}{\cos 14x + \cos 10x}$$

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Cancel the common factors

$$3) \quad 4 \sin x \cos 8x$$

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$$4 \sin x \cos 8x = 4 \left(\frac{1}{2} (\sin (x+8x) + \sin (x-8x)) \right)$$

Using product to sum identity

$$= 4 \left(\frac{1}{2} (\sin 9x + \sin 7x) \right)$$

$$= 2 (\sin 9x + \sin 7x)$$

Simplify

Verify: Product-Sum & Sum-Product Identities

Verify the following.

4) $12 \cos 13x \sin 7x = 6 (\sin 20x - \sin 6x)$

$$12 \cos 13x \sin 7x = 12 \left(\frac{1}{2} (\sin (13x + 7x) - \sin (13x - 7x)) \right) \text{ Using product to sum identity}$$

$$= 12 \left(\frac{1}{2} (\sin 20x - \sin 6x) \right)$$

5) $\frac{\cos 6x + \cos 4x}{\sin 6x + \sin 4x}$

$$\frac{\cos 6x + \cos 4x}{\sin 6x + \sin 4x}$$

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6) $2 + \frac{\sin 5x - \sin x}{\cos 3x \sin 2x}$

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

$$= 2 + \frac{2 \cos 3x \sin 2x}{\cos 3x \sin 2x}$$

$$= 4$$

Using sum to product identity

Cancel the common factors