

Trigonometric Chain Rule

Differentiate in radians. Give each answer in exact factored form.

1.

$$y = -1 \cdot \sec\left(\frac{1}{2} \cdot x^3 - 2\right)$$

2.

$$y = \frac{1}{2} \cdot \left(-2 \cdot \sin(x) - 1\right)^4$$

3.

$$y = \frac{-1}{2} \cdot \cot\left(-2 \cdot x^3 - 2\right)$$

4.

$$y = \frac{3}{2} \cdot \left(\frac{3}{2} \cdot \csc(x) + 2\right)^4$$

5.

$$y = \frac{-1}{2} \cdot \cos(x - 1)$$

6.

$$y = -3 \cdot \left(-3 \cdot \tan(x)\right)^4$$

7.

$$y = -1 \cdot \left(3 \cdot \sec(x) - 2\right)^6$$

8.

$$y = 3 \cdot \sin\left(-2 \cdot x^3\right)$$

9.

$$y = -2 \cdot \left(-2 \cdot \cot(x) - 2\right)^3$$

10.

$$y = 3 \cdot \csc\left(x^2 - 1\right)$$

Trigonometric Chain Rule

Answer Key

Differentiate in radians. Give each answer in exact factored form.

1. $y = -1 \cdot \sec\left(\frac{1}{2} \cdot x^3 - 2\right)$
 $dy/dx = \frac{-3}{2} \cdot x^2 \cdot \sec\left(\frac{1}{2} \cdot x^3 - 2\right) \cdot \tan\left(\frac{1}{2} \cdot x^3 - 2\right)$

Formula valid where $\cos(u) \neq 0$; $u = 1/2 \cdot x^3 - 2$.

2. $y = \frac{1}{2} \cdot (-2 \cdot \sin(x) - 1)^4$
 $dy/dx = -4 \cdot (-2 \cdot \sin(x) - 1)^3 \cdot \cos(x)$

Formula valid for all real inputs.

3. $y = \frac{-1}{2} \cdot \cot(-2 \cdot x^3 - 2)$
 $dy/dx = -3 \cdot x^2 \cdot \csc(-2 \cdot x^3 - 2)^2$

Formula valid where $\sin(u) \neq 0$; $u = -2 \cdot x^3 - 2$.

4. $y = \frac{3}{2} \cdot \left(\frac{3}{2} \cdot \csc(x) + 2\right)^4$
 $dy/dx = -9 \cdot \left(\frac{3}{2} \cdot \csc(x) + 2\right)^3 \cdot \csc(x) \cdot \cot(x)$

Formula valid where $\sin(u) \neq 0$; $u = x$.

5. $y = \frac{-1}{2} \cdot \cos(x - 1)$
 $dy/dx = \frac{1}{2} \cdot \sin(x - 1)$

Formula valid for all real inputs.

6. $y = -3 \cdot (-3 \cdot \tan(x))^4$
 $dy/dx = 36 \cdot (-3 \cdot \tan(x))^3 \cdot \sec(x)^2$

Formula valid where $\cos(u) \neq 0$; $u = x$.

7. $y = -1 \cdot (3 \cdot \sec(x) - 2)^6$
 $dy/dx = -18 \cdot (3 \cdot \sec(x) - 2)^5 \cdot \sec(x) \cdot \tan(x)$

Formula valid where $\cos(u) \neq 0$; $u = x$.

8. $y = 3 \cdot \sin(-2 \cdot x^3)$
 $dy/dx = -18 \cdot x^2 \cdot \cos(-2 \cdot x^3)$

Formula valid for all real inputs.

9. $y = -2 \cdot (-2 \cdot \cot(x) - 2)^3$
 $dy/dx = -12 \cdot (-2 \cdot \cot(x) - 2)^2 \cdot \csc(x)^2$

Formula valid where $\sin(u) \neq 0$; $u = x$.

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Differentiate in radians. Give each answer in exact factored form.

10. $y = 3 \cdot \csc(x^2 - 1)$

$$dy/dx = -6 \cdot x \cdot \csc(x^2 - 1) \cot(x^2 - 1)$$

Formula valid where $\sin(u) \neq 0$; $u = x^2 - 1$.