Name_____

Differentiation - Inverse Trigonometric Functions

Date_____ Period_____

Differentiate each function with respect to x.

1) $y = \cos^{-1} -5x^3$

2) $y = \sin^{-1} -2x^2$

3) $y = \tan^{-1} 2x^4$

4) $y = \csc^{-1} 4x^2$

5) $y = \left(\sin^{-1} 5x^2\right)^3$

6) $y = \sin^{-1} \left(3x^5 + 1\right)^3$

7) $y = \left(\cos^{-1} 4x^2\right)^2$

8) $y = \cos^{-1} \left(-2x^3 - 3\right)^3$

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Differentiation - Inverse Trigonometric Functions

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Differentiate each function with respect to x.

1) $y = \cos^{-1} -5x^3$

$$\frac{dy}{dx} = -\frac{1}{\sqrt{1-(-5x^3)^2}} \cdot -15x^2$$

$$= \frac{15x^2}{\sqrt{1-25x^6}}$$

2) $y = \sin^{-1} -2x^2$

$$\frac{dy}{dx} = \frac{1}{\sqrt{1-(-2x^2)^2}} \cdot -4x$$

$$= -\frac{4x}{\sqrt{1-4x^4}}$$

3) $y = \tan^{-1} 2x^4$

$$\frac{dy}{dx} = \frac{1}{(2x^4)^2+1} \cdot 8x^3$$

$$= \frac{8x^3}{4x^8+1}$$

4) $y = \csc^{-1} 4x^2$

$$\frac{dy}{dx} = -\frac{1}{|4x^2|\sqrt{(4x^2)^2-1}} \cdot 8x$$

$$= -\frac{2}{x\sqrt{16x^4-1}}$$

5) $y = \left(\sin^{-1} 5x^2\right)^3$

$$\frac{dy}{dx} = 3 \cdot \left(\sin^{-1} 5x^2\right)^2 \cdot \frac{1}{\sqrt{1-(5x^2)^2}} \cdot 10x$$

$$= \frac{30x \cdot \left(\sin^{-1} 5x^2\right)^2}{\sqrt{1-25x^4}}$$

6) $y = \sin^{-1} \left(3x^5+1\right)^3$

$$\frac{dy}{dx} = \frac{1}{\sqrt{1-\left((3x^5+1)^3\right)^2}} \cdot 3(3x^5+1)^2 \cdot 15x^4$$

$$= \frac{45x^4(3x^5+1)^2}{\sqrt{1-(3x^5+1)^6}}$$

7) $y = \left(\cos^{-1} 4x^2\right)^2$

$$\frac{dy}{dx} = 2\cos^{-1} 4x^2 \cdot -\frac{1}{\sqrt{1-(4x^2)^2}} \cdot 8x$$

$$= -\frac{16x\cos^{-1} 4x^2}{\sqrt{1-16x^4}}$$

8) $y = \cos^{-1} \left(-2x^3-3\right)^3$

$$\frac{dy}{dx} = -\frac{1}{\sqrt{1-\left((-2x^3-3)^3\right)^2}} \cdot 3(-2x^3-3)^2 \cdot -6x^2$$

$$= \frac{18x^2(-2x^3-3)^2}{\sqrt{1-(-2x^3-3)^6}}$$