



SCORE: \_\_\_ / 20 POINTS

What day of the month is your birthday? \_\_\_

What are the last 2 digits of your address? \_\_\_

What are the last 2 digits of your zip code? \_\_\_

What are the last 2 digits of your social security number? \_\_\_

[IF YOU DO NOT HAVE A SOCIAL SECURITY NUMBER,  
USE YOUR STUDENT ID NUMBER]**NO CALCULATORS ALLOWED**Find the derivatives of the following functions. SIMPLIFY YOUR ANSWERS.

SCORE: \_\_\_ / 12 POINTS

[a]  $f(x) = \sec^3 x^5$

$$f'(x) = (3 \sec^2 x^5) (\sec x^5 \tan x^5) \cdot (5x^4) \cdot \frac{1}{2}$$

$$= 15x^4 \sec^3 x^5 \tan x^5$$

[b]  $f(x) = \frac{(\ln x)^2}{x^2}$

$$f'(x) = \frac{(2 \ln x) \cdot \frac{1}{x} \cdot x^2 - (\ln x)^2 \cdot 2x}{x^4} \cdot \frac{1}{2}$$

$$= \frac{2x \ln x - 2x (\ln x)^2}{x^4}$$

$$= \frac{2 \ln x (1 - \ln x)}{x^3}$$

[c]  $f(x) = 2^{-5x} \tan^{-1} x$

$$f'(x) = (2^{-5x}) (\ln 2) (-5) \tan^{-1} x + 2^{-5x} \cdot \frac{1}{1+x^2}$$

$$= -(5 \ln 2) 2^{-5x} \tan^{-1} x + \frac{2^{-5x}}{1+x^2}$$

$$= \frac{2^{-5x}}{1+x^2} ((-5 \ln 2)(1+x^2) \tan^{-1} x + 1)$$

[d]  $f(x) = \sin^{-1}(\cos x)$

$$f'(x) = \frac{1}{\sqrt{1-\cos^2 x}} \cdot (-\sin x)$$

$$= \frac{1}{\sin x} \cdot (-\sin x)$$

$$= -1$$

Find  $\frac{dy}{dx}$  for the following. SIMPLIFY YOUR ANSWERS WHERE CONVENIENT.

SCORE: \_\_\_ / 8 POINTS

[a]  $\sqrt{3x+5y} - x^2 = y^3$  **SEE ALTERNATE SOLUTION**

$$\frac{1}{2} (3x+5y)^{-\frac{1}{2}} (3+5y') - 2x = 3y^2 y'$$

$$\frac{3+5y'}{2\sqrt{3x+5y}} - 2x = 3y^2 y'$$

$$3+5y' - 4x\sqrt{3x+5y} = 6y^2 \sqrt{3x+5y} y'$$

$$(5y' - 6y^2 \sqrt{3x+5y}) y' = 4x\sqrt{3x+5y} - 3$$

$$\frac{dy}{dx} = y' = \frac{4x\sqrt{3x+5y} - 3}{5 - 6y^2 \sqrt{3x+5y}}$$

[b]  $y = (\cot x)^x$

$$\ln y = \ln (\cot x)^x$$

$$\ln y = x \ln \cot x$$

$$\frac{1}{y} y' = \ln \cot x + x \frac{1}{\cot x} (-\csc^2 x)$$

$$= \ln \cot x - \frac{x \sin x}{\cos x \sin^2 x}$$

$$= \ln \cot x - x \sec x \csc x$$

$$\frac{dy}{dx} = y' = (\cot x)^x \cdot (\ln \cot x - x \sec x \csc x)$$

**SEE ALTERNATE ANSWERS**

SEE ALTERNATE ANSWER





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[a]  $f(x) = \sec^3 x^5$

[b]  $f(x) = \frac{(\ln x)^2}{x^2}$

ALSO ACCEPTABLE AS  
FINAL ANSWER

$$f'(x) = \frac{2 \ln x - 2(\ln x)^2}{x^3}$$

[c]  $f(x) = 2^{-5x} \tan^{-1} x$

[d]  $f(x) = \sin^{-1}(\cos x)$

Find  $\frac{dy}{dx}$  for the following. SIMPLIFY YOUR ANSWERS WHERE CONVENIENT.

SCORE: \_\_\_ / 8 POINTS

[a]  $\sqrt{3x+5y} - x^2 = y^3$  ALTERNATE

SOLUTION

$$\sqrt{3x+5y} = x^2 + y^3$$

$$\frac{1}{2} \sqrt{3x+5y} = x^4 + 2x^2y^3 + y^6$$

$$\frac{1}{2} \sqrt{3x+5y} = \frac{1}{2} \sqrt{4x^3 + 4xy^3 + 6x^2y^2y' + 6y^5y'}$$

$$\frac{1}{2} (5 - 6x^2y^2 - 6y^5)y' = 4x^3 + 4xy^3 + 3$$

$$y' = \frac{4x^3 + 4xy^3 + 3}{5 - 6x^2y^2 - 6y^5} \cdot \frac{1}{2}$$

[b]  $y = (\cot x)^x$

ALSO ACCEPTABLE AS  
FINAL ANSWER

$$\frac{dy}{dx} = y' = (\cot x)^x$$

$$\frac{1}{2} \left[ \ln \cot x - \frac{x}{\sin x \cos x} \right]$$

OR

$$\frac{dy}{dx} = y' = (\cot x)^x$$

$$\frac{1}{2} \left[ \ln \cot x - x \cot x \csc^2 x \right]$$