

Calc 1: Special Technique & Review

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DIRECTIONS

Problems 1-6 use logarithmic differentiation (Special Technique): take \ln of both sides, differentiate implicitly, then solve for dy/dx . Problems 7-10 cover normal lines, limit definition of derivative, simplification, and domain/range.

1 Find dy/dx if:

$$y = 3^{-x}$$

Answer: _____

2 Find dy/ds if:

$$y = 2s^2$$

Answer: _____

3 Find dy/dt if:

$$y = 2^{\sin 3t}$$

Answer: _____

4 Find dy/dx if:

$$y = (x + 1)^x$$

Answer: _____

5 Find dy/dx if:

$$y = x^{x+1}$$

Answer: _____

6 Find dy/dx if:

$$y = x^{\sin x}$$

Answer: _____

7 Find the normal line at (1, 1):

$$f(x) = x^3$$

Answer: _____

8 Evaluate the limit:

$$\lim_{h \rightarrow 0} \frac{5(x+h)^3 - 5x^3}{h}$$

Answer: _____

9 Simplify:

$$e^{\ln 2} + \ln x^2$$

Answer: _____

10 Find domain and range of:

$$y = -\sqrt{-x}$$

Answer: _____

Answer Key & Solutions

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TEACHER NOTES

Problems 1-6: In both sides, differentiate, multiply by original function. #7: $f'(1)=3$ (slope of tangent); normal slope = $-1/3$. #8: limit definition gives $d/dx[5x^3] = 15x^2$. #9: $e^{(\ln 2 + \ln x^2)} = 2x^2$. #10: need $-x \geq 0$, so $x \leq 0$.

1 Find dy/dx if:

$$y = 3^{-x}$$

$$= \frac{dy}{dx} = -\ln(3) \cdot 3^{-x}$$

2 Find dy/ds if:

$$y = 2^{s^2}$$

$$= \frac{dy}{ds} = \ln 2 \cdot 2s \cdot 2^{s^2}$$

3 Find dy/dt if:

$$y = 2^{\sin 3t}$$

$$= \frac{dy}{dt} = 3\ln 2 \cdot \cos(3t) \cdot 2^{\sin 3t}$$

4 Find dy/dx if:

$$y = (x + 1)^x$$

$$= \frac{dy}{dx} = \left[\ln(x + 1) + \frac{x}{x + 1} \right] (x + 1)^x$$

5 Find dy/dx if:

$$y = x^{x+1}$$

$$= \frac{dy}{dx} = \left[\frac{x+1}{x} + \ln x \right] x^{x+1}$$

6 Find dy/dx if:

$$y = x^{\sin x}$$

$$= \frac{dy}{dx} = \left(\frac{\sin x}{x} + \ln x \cos x \right) x^{\sin x}$$

7 Find the normal line at $(1, 1)$:

$$f(x) = x^3$$

$$= y = -\frac{1}{3}x + \frac{4}{3}$$

8 Evaluate the limit:

$$\lim_{h \rightarrow 0} \frac{5(x+h)^3 - 5x^3}{h}$$

$$= 15x^2$$

9 Simplify:

$$e^{\ln 2 + \ln x^2}$$

$$= 2x^2$$

10 Find domain and range of:

$$y = -\sqrt{-x}$$

$$= D: (-\infty, 0], \quad R: (-\infty, 0]$$