

Name: \_\_\_\_\_

## Exponential and Logarithmic Differentiation

1) Find the derivative of each function.

1)  $f(x) = \ln x^5$

2)  $y = \sqrt{\ln x}$

3)  $g(x) = \ln(x^3\sqrt{x^4 - 16})$

4)  $g(x) = \ln \left[ \frac{\sqrt{x^2 + 4}}{(6x - 5)^2} \right]$

5)  $y = \ln(\ln 5x)$

6)  $y = \ln \sqrt{\frac{x-4}{x+8}}$

7)  $y = x \ln(1-x)$

8)  $f(x) = (\ln(\cos 2x))^3$

9)  $y = [\ln(x^2 + 1)]^3$

10)  $y = (\cos x)^x$

11)  $y = 4^{\frac{x}{\ln x}}$

12)  $y = \ln(\tan e^{\sqrt{x}})$

13)  $y = 3^{\tan \frac{1}{x}}$

14)  $y = \tan e^x$

15)  $y = e^{\sin \frac{1}{x}}$

16)  $y = e^{\sin x}$

17)  $y = x^{\frac{1}{x}}$

18)  $y = 3^x e^x$

19)  $y = (e^x + e^{5x})^4$

20)  $f(x) = e^{-5x} \ln x$

21)  $y = \ln(\sin e^x)$

22)  $f(x) = e^{-8x}$

23)  $f(x) = 5^x$

24)  $y = \ln|\sin 3x|$

25)  $y = x^3 3^x$

26)  $g(x) = 12^{2-3x}$

27)  $f(x) = 7^\theta \sin 5\theta$

28)  $h(x) = \tan 3x \ln x^3$

29)  $y = \log_8 x$

30)  $y = \log_3 \frac{x^5}{x+4}$

2) Find  $\frac{dy}{dx}$  using logarithmic differentiation.

1)  $y = (x+1)^2(x+2)^3$

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

3) Use logarithmic differentiation to find  $\frac{dy}{dx}$ .

$$y = (2x+1)^x$$

4) Find the following logarithmic and exponential derivatives

1.  $y = \ln(\tan x + \sec x)$

2.  $y = \ln x \sqrt{x^2 + 1}$

3.  $y = (\ln x)^3$

4.  $y = \frac{1}{2} \ln\left(\frac{1+x}{1-x}\right)$

5.  $y = \ln\left(\frac{e^x}{1+e^x}\right)$

6.  $y = e^{\sqrt{x}}$

7.  $y = xe^{-x}$

8.  $y = \tan(e^{3x-2})$

9.  $y = \sqrt{x} \ln x$

10.  $y = 5^{\tan x}$

11.  $y = 2^{3x}$

5) Find the slope of the tangent line to the graph at the given point.

$y = e^{-8x}$  ; (0,1)

6) Find the derivative  $\frac{dy}{dx}$

1)  $y = e^{3x} \sin 2x$

2)  $y = e^{3x-1} \cos(3x-1)$

3)  $y = -8x^3 \ln(2t+2)$

7) If  $x = e^{-t} \ln(1+e^t)$ , show that  $\frac{dx}{dt} + x = \frac{1}{1+e^x}$

8) Challenge yourself! Find the derivative of:  $y = (x^7 + 1)^4 e^{3x} \cos 2x$