Calculus

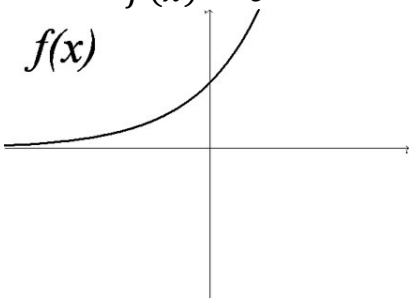
4.1 Exp and Log Derivatives

Name:_____

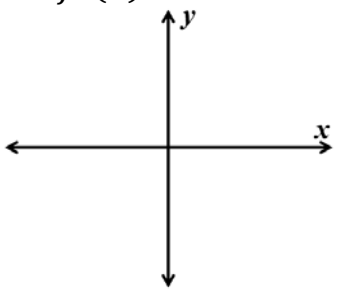
Notes

Recall: Sketch the graph of the derivative of $f(x)$.

$f(x) = e^x$



$f'(x) =$



Derivative of Exponential Functions (base e):

No chain rule	With chain rule
$\frac{d}{dx}e^x =$	$\frac{d}{dx}e^u =$

Find the derivative of $f(x)$.

1. $f(x) = e^{2x-3x^2}$

2. $f(x) = e^{\sin x}$

Derivative of Exponential Functions (not base e):

No chain rule	With chain rule
$\frac{d}{dx}a^x =$	$\frac{d}{dx}a^u =$

3. Find the derivative of $y = 3^{6x} + 4$

4.1 Exp and Log Derivatives

Notes

Write your questions and thoughts here!

Derivative of Logarithmic Functions (base e):

No chain rule	With chain rule
$\frac{d}{dx}\ln x =$	$\frac{d}{dx}\ln u =$

Find the derivative of $f(x)$.

4. $f(x) = \ln(\cos(x^2))$

5. $f(x) = \ln\left(\sqrt[3]{x}\right)$

Derivative of Logarithmic Functions (not base e):

No chain rule	With chain rule
$\frac{d}{dx}\log_a x =$	$\frac{d}{dx}\log_a u =$

Find the derivative of $f(x)$.

6. $f(x) = \log_4(2x^5)$

7. $f(x) = \log_6(3x\tan x)$

Now summarize what you learned!

4.1 Exponential and Log Derivatives

Calculus Name: _____ **Practice**

Find the derivative of each function.

1. $f(x) = e^{2x^2}$	2. $f(x) = e^{x^4}$	3. $f(x) = \ln(2x^3)$	4. $f(x) = \ln(x - 5x^5)$
5. $f(x) = e^{\cos(7x^3)}$	6. $f(x) = e^{\sin(5x^9)}$	7. $f(x) = \ln(x^6 + 5)$	
8. $f(x) = \ln\left(2x\sqrt{1+x}\right)$	9. $f(x) = 8^{\cos x}$	10. $f(x) = e^{x \sin x}$	
11. $f(x) = \log_7(x^4)$	12. $f(x) = \ln x \log x$	13. $f(x) = \ln(\sin 4x) - x^4$	
14. $f(x) = e^{\pi x} - \ln(e^{\pi x})$	15. $f(x) = e^{-5x} \cos 2x$	16. $f(x) = \frac{e^{\tan 3x}}{3}$	

17. $f(x) = 2^{\tan x}$

18. $f(x) = \log\sqrt{10^{5x}}$

19. $f(x) = \frac{x}{e^{3x}}$

20. $f(x) = x^7 7^x$

21. $f(x) = \ln 11^x$

22. $f(x) = e^{2x} - 2^{ex}$

23. $f(x) = \cos(\ln(2x^2))$

24. If $f(x) = e^{x^2}$, what is the equation of the tangent line at $x = 1$.

25. At what coordinate point(s) is the tangent line of $f(x) = \ln(x^3)$ parallel to $y = 7 + 2x$.

26. $f(x) = \ln(x^2)$ on the interval $1 < x < e$. On this interval, when will the average rate of change equal the instantaneous rate of change. [This is applying the Mean Value Theorem]

27. Find the values of x where the tangent to the graph of $y = e^{2x}$ is parallel to $12x - 2y = 6$.

28. Find the values of x where the tangent to the graph of $y = \frac{1}{e^{3x}}$ is parallel to $5x + y = 109$.

4.1 Exponential and Log Derivatives

Test Prep

1. $\frac{d}{dx}(\ln(3x)\,5^{2x}) =$

(A) $\frac{5^{2x}}{x} + 2\ln(5)\ln(3x)\,5^{2x}$ (B) $\frac{5^{2x}}{3x} - 2x\ln(3x)\,5^{2x}$ (C) $\frac{5^{2x}}{x} - \ln(5)\ln(3x)\,5^{2x}$

(D) $\frac{5^{2x}}{3x} + 2\ln(3x)5^{2x}$ (E) $\frac{5^{2x}}{x} + \ln(5)\ln(3x)\,5^{2x}$

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2. The position of a particle moving along the x-axis is given by $x(t) = e^{2t} - e^{t}$ for all $t \geq 0$. When the particle is at rest, the acceleration of the particle is

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$ (C) $\ln\frac{1}{2}$ (D) 2 (E) 4

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3. What is the slope of the curve $y = 3^{\sin x} - 2$ at its first positive x-intercept?

(A) 0.683 (B) 1.643 (C) 1.705 (D) 1.805 (E) 2

4. Let $f(x) = 2e^{3x}$ and $g(x) = 5x^3$. At what value of x do the graphs of f and g have parallel tangents?

(A) -0.445 (B) -0.366 (C) -0.344 (D) -0.251 (E) -0.165

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5. If $y = 3\cos\left(\frac{x}{3}\right)$ then $\frac{d^2y}{dx^2} =$

(A) $-3\cos\left(\frac{x}{3}\right)$ (B) $-3\sin\left(\frac{x}{3}\right)$ (C) $-\frac{1}{3}\cos\left(\frac{x}{3}\right)$ (D) $-\frac{1}{3}\sin\left(\frac{x}{3}\right)$ (E) $-\cos\left(\frac{x}{3}\right)$

FREE RESPONSE **Your score: _____ out of 4**

2005 Form B AB3

A graphing calculator may be required. Use the space below the problem to show work and solutions.

1. A particle moves along the x-axis so that its velocity v at time t, for $0 \le t \le 5$, is given by

$$v(t) = \ln(t^2 - 3t + 3)$$

(a) Find the acceleration of the particle at time $t = 4$.

(b) Find all times t in the open interval $0 < t < 5$ at which the particle changes direction. During which time intervals, for $0 < t < 5$, does the particle travel to the left?