Calculus Name_____



# Some Review

**Use L'Hôpital's Rule to evaluate the limit if it can be applied. If it cannot be applied, write a * next to your answer.**

1) $\lim_{x \to 1} \frac{2 \ln x}{x}$

2) $\lim_{x \to \infty} \frac{x}{e^{2x}}$

3) $\lim_{x \to 0} \frac{4x}{\ln (x + 1)}$

4) $\lim_{x \to 0} \frac{e^{2x} - 1}{x^3}$

5) $\lim_{x \to 1} \frac{5(x - 1)}{\ln x}$

6) $\lim_{x \to 0^+} \frac{2(e^x + e^{-x})}{x}$

7) $\lim_{x \to 3} \frac{\sqrt{x + 1} - 2}{x - 3}$

8) $\lim_{x \to 1} \frac{5 \ln x^2}{x^2 - 1}$

**Differentiate each function with respect to *x*.**

9) $y = (\ln 3x^3)^5$

10) $y = \ln (x^3 + 2)^4$

11) $y = e^{(4x^4 + 3)^2}$

12) $y = e^{(5x^2 + 1)^2}$

13) $y = (4x^5 + 5)^5 \ln 5x^4$

14) $y = (e^{x^5} + 1) \cdot e^{3x^3}$

15) $y = \dfrac{\ln 3x^3}{(3x^2 + 2)^3}$

16) $y = \dfrac{\ln 3x^2}{e^{5x^3}}$

17) $y = 3^{5x^2}$

18) $y = \log_4 3x^2$

19) $y = (5x^2 - 2) \cdot 2^{3x^3}$

20) $y = \log_5 4x^3 \cdot (5x^5 + 1)$

21) $y = 3^{x^3}(3x^4 - 5)$

22) $y = 3^{2x^5}(2x^3 - 1)$

**For each problem, find the equation of the line tangent to the function at the given point. Your answer should be in slope-intercept form.**

23) $y = e^{-x-2}$ at $(-3, e)$

24) $y = -\ln(x + 2)$ at $(4, -\ln 6)$

25) $y = \ln(-x + 1)$ at $(-2, \ln 3)$

26) $y = e^x$ at $\left(-2, \frac{1}{e^2}\right)$

**For each problem, find the equation of the line normal to the function at the given point. If the normal line is a vertical line, indicate so. Otherwise, your answer should be in slope-intecept form.**

27) $y = -\ln(x + 2)$ at $(0, -\ln 2)$

28) $y = -e^{-x-1}$ at $(-2, -e)$

**For each problem, find the values of *c* that satisfy the Mean Value Theorem.**

29) $y = 2x^2 - 4x - 1;\ \ [0, 3]$

30) $y = x^3 - x^2 - 4;\ \ [-1, 1]$

**For each problem, determine if the Mean Value Theorem can be applied. If it can, find all values of *c* that satisfy the theorem. If it cannot, explain why not.**

31) $y = \dfrac{x^2 - 9}{3x};\ \ [-6, -1]$

32) $y = \dfrac{x^2 - 4}{4x};\ \ [-4, 1]$

33) $y = -(7x - 7)^{\frac{2}{3}};\ \ [-1, 2]$

**For each problem, determine if Rolle's Theorem can be applied. If it can, find all values of *c* that satisfy the theorem. If it cannot, explain why not.**

34) $y = x^3 - 3x^2 - x;\ \ [-1, 3]$

35) $y = \dfrac{x^2 - 16}{-x + 5};\ \ [-2, 4]$

36) $y = \dfrac{-x^2 + 4}{3x};\ \ [-2, 2]$

37) $y = \dfrac{-x^2 + 9}{x + 4};\ \ [-3, 3]$

# Answers to Some Review

1) 0 *
2) 0
3) 4
4) $\infty$
5) 5
6) $\infty$ *
7) $\frac{1}{4}$
8) 5

9) $\frac{dy}{dx} = 5 \cdot (\ln 3x^3)^4 \cdot \frac{1}{3x^3} \cdot 9x^2$
$= \frac{15 \cdot (\ln 3x^3)^4}{x}$

10) $\frac{dy}{dx} = \frac{1}{(x^3+2)^4} \cdot 4(x^3+2)^3 \cdot 3x^2$
$= \frac{12x^2}{x^3+2}$

11) $\frac{dy}{dx} = e^{(4x^4+3)^2} \cdot 2(4x^4+3) \cdot 16x^3$
$= 32x^3 e^{(4x^4+3)^2}(4x^4+3)$

12) $\frac{dy}{dx} = e^{(5x^2+1)^2} \cdot 2(5x^2+1) \cdot 10x$
$= 20x e^{(5x^2+1)^2}(5x^2+1)$

13) $\frac{dy}{dx} = (4x^5+5)^5 \cdot \frac{1}{5x^4} \cdot 20x^3 + \ln 5x^4 \cdot 5(4x^5+5)^4 \cdot 20x^4$

14) $\frac{dy}{dx} = (e^{x^5}+1) \cdot e^{3x^3} \cdot 9x^2 + e^{3x^3} e^{x^5} \cdot 5x^4$

15) $\frac{dy}{dx} = \frac{(3x^2+2)^3 \cdot \frac{1}{3x^3} \cdot 9x^2 - \ln 3x^3 \cdot 3(3x^2+2)^2 \cdot 6x}{\left((3x^2+2)^3\right)^2}$

16) $\frac{dy}{dx} = \frac{e^{5x^3} \cdot \frac{1}{3x^2} \cdot 6x - \ln 3x^2 \cdot e^{5x^3} \cdot 15x^2}{\left(e^{5x^3}\right)^2}$

17) $\frac{dy}{dx} = 3^{5x^2} \ln 3 \cdot 10x$

18) $\frac{dy}{dx} = \frac{1}{3x^2 \ln 4} \cdot 6x$
$= \frac{2}{x \ln 4}$

19) $\frac{dy}{dx} = (5x^2-2) \cdot 2^{3x^3} \ln 2 \cdot 9x^2 + 2^{3x^3} \cdot 10x$

20) $\frac{dy}{dx} = \log_5 4x^3 \cdot 25x^4 + (5x^5+1) \cdot \frac{1}{4x^3 \ln 5} \cdot 12x^2$

21) $\frac{dy}{dx} = 3^{x^3} \cdot 12x^3 + (3x^4-5) \cdot 3^{x^3} \ln 3 \cdot 3x^2$

22) $\frac{dy}{dx} = 3^{2x^5} \cdot 6x^2 + (2x^3-1) \cdot 3^{2x^5} \ln 3 \cdot 10x^4$

23) $y = -ex - 2e$

24) $y = -\frac{1}{6}x + \frac{-3 \ln 6 + 2}{3}$

25) $y = -\frac{1}{3}x + \frac{3 \ln 3 - 2}{3}$

26) $y = \frac{1}{e^2} \cdot x + \frac{3}{e^2}$

27) $y = 2x - \ln 2$

28) $y = -\frac{1}{e} \cdot x + \frac{-e^2-2}{e}$

29) $\left\{\frac{3}{2}\right\}$

30) $\left\{-\frac{1}{3}\right\}$

31) $\left\{-\sqrt{6}\right\}$

32) The function is not continuous on [–4, 1]

33) The function is not differentiable on (–1, 2)

34) $\left\{\frac{3+2\sqrt{3}}{3}, \frac{3-2\sqrt{3}}{3}\right\}$

35) f(a) doesn't equal f(b)

36) The function is not continuous on [–2, 2]

37) $\left\{-4+\sqrt{7}\right\}$