

Exam 2 Study Guide

Name _____

Answer the questions in the spaces provided. Feel free to use another piece of paper for your work

1. Use the limit definition of the derivative to find the derivative of the following functions, if it exist, at the stated point:

Remember, to use $\lim_{h \rightarrow 0} \frac{f(x+h)-f(x)}{h}$.

(a) $f(x) = 2(x+1)^2$, $x = 3$

$g(x) = (3x^2 + 4x)$, $x = 5$

2. Use the limit definition of the derivative to find the derivative of the following functions, if it exist:

Remember, to use $\lim_{h \rightarrow 0} \frac{f(x+h)-f(x)}{h}$.

(a) $h(x) = (13x+4)^{1/2}$

$g(x) = \cos(x)$

3. Find the derivative of the following functions, if it exist:

*This time you **DON'T** have to use $\lim_{h \rightarrow 0} \frac{f(x+h)-f(x)}{h}$.*

(a) $f(x) = \cot(x)$

$$g(x) = \cos(x) + 4x(x-1)^2$$

(b) $h(x) = 2(\sin(x) + \frac{1}{(x+5)^2})$

$$j(x) = \tan(x) + \frac{1}{\sin(x)}$$

4. Give each of the following rules:

(a) Product Rule

(b) Quotient Rule

(c) Power Rule

(d) Chain Rule

5. Find the derivative of the following functions, if it exist:

*This time you **DON'T** have to use $\lim_{h \rightarrow 0} \frac{f(x+h)-f(x)}{h}$.*

(a) $f(x) = \cot(\sqrt{x})$

$g(x) = \sqrt{\cos(x)} + 4x - \frac{1}{x}$

(b) $h(x) = \frac{(x+2)^2}{2x+3}$

$j(x) = \frac{\tan(x)}{\sqrt{2x^2+x}}$

6. Find the stated derivative of the following functions, if it exist:

*This time you **DON'T** have to use $\lim_{h \rightarrow 0} \frac{f(x+h)-f(x)}{h}$.*

Example: $\frac{d^2}{dx^2} x^2 = 2$

(a) $\frac{d^2}{dx^2} (\sqrt{x})$

$\frac{d}{dx} \left(\frac{d}{dx} (\cos(\sqrt{x})) \right)$

(b) $\frac{d^3}{dx^3} \left(\frac{1}{2x+3} \right)$

$\frac{d}{dx} \left(\frac{\tan(x)}{\sqrt{2x^2+x}} \right)$

7. Find the derivative of the following functions, if it exist:

*This time you **DON'T** have to use $\lim_{h \rightarrow 0} \frac{f(x+h)-f(x)}{h}$.*

$$f(x) = \cos(t)$$

$$g(t) = \sqrt{t^2 + 4}$$

$$h(t) = \frac{1}{x}$$

(a) $f(t) h(t)$

$$g(t) / h(t)$$

(b) $(f \circ h \circ g)(t)$

$$g(t) + h(t)$$

8. Apply implicit differentiation:

(a) $\cos(x) + y = 4$

$$\frac{x}{y} = \tan(x)$$

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

$$\sqrt{xy} = x$$

9. Find the tangent line of the following function at the corresponding point:

(a) $x^2 + y^2 = 2$, $(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$

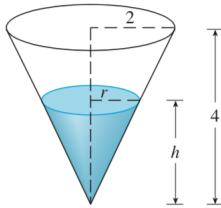
$$f(x) = (3x + 2)^2, (6, 400)$$

(b) $g(x) = \frac{1}{x}$, $(5, 1/5)$

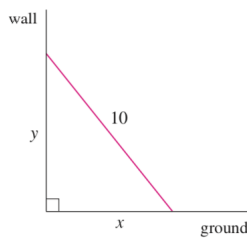
$$h(x) = \cos(x) + 4x, (\pi/2, 2\pi)$$

10. Solve the following relate rates problems:

- (a) A water tank has the shape of an inverted circular cone with base radius 2m and height 4m. If water is being pumped into the tank at a rate of $\frac{1}{2}$ m/min, find the rate at which the water level is rising when the water is 5m deep.



A ladder 10ft long rests against a vertical wall. If the bottom of the ladder slides away from the wall at a rate of 3ft/s, how fast is the top of the ladder sliding down the wall when the bottom of the ladder is 2.5ft from the wall?



11. State each of the following tests/theorems:

(a) Rolles Theorem

(b) The First Derivative Test

(c) The Second Derivative Test

(d) Increasing/Decreasing Test

(e) Concavity Test

(f) Mean Value Theorem

12. Sketch the following functions using the derivative methods discussed in class:

(a) $f(x) = \frac{2x^2}{(x^2+4)}$

(b) $g(x) = \frac{x^3-8}{x^2+36}$