

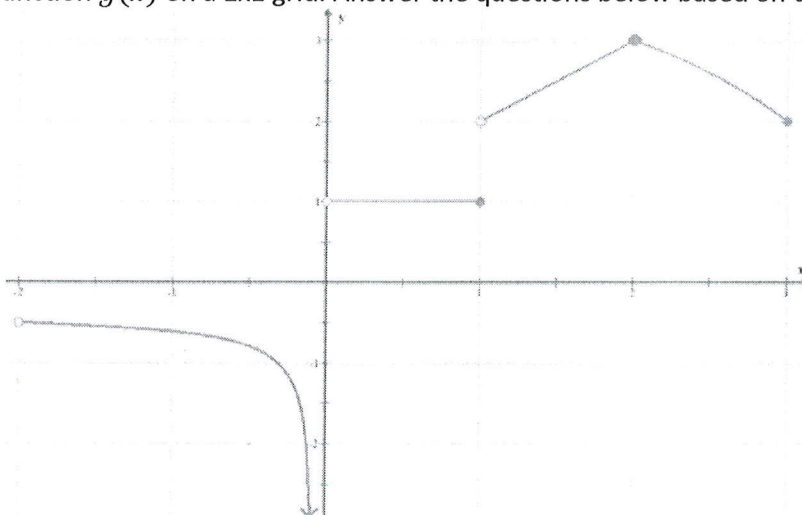
Name: ANSWERS

Instructions: No calculators! Answer all problems in the space provided! Do your rough work on scrap paper.

1. Complete the following rules, where they appear, c is a constant, f, g, u are differentiable functions:

- (a) Define $f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ (using limits)
- (b) $\frac{d}{dx} x^n = nx^{n-1}$ (c) $\frac{d}{dx} e^u = u'e^u$ (d) $\frac{d}{dx} \ln u = \frac{u'}{u}$
- (e) $\frac{d}{dx} (f \cdot g) = f' \cdot g + f \cdot g'$ (f) $\frac{d}{dx} \frac{f}{g} = \frac{f'g - fg'}{g^2}$
- (g) $\frac{d}{dx} f(g(x)) = f'(g(x)) \cdot g'(x)$

2. Below is the graph of a function $g(x)$ on a 1x1 grid. Answer the questions below based on the graph.



- (a) State the x -values for which the function is not continuous: $x = -2, 0, 1$ (all or nothing)
- (b) State the x -values for where the derivative does not exist: $x = -2, 0, 1, 2$ (one to omit 3)

3. Compute:

- (a) $\frac{d}{dx} \frac{3\sqrt{x} + 2 + x}{\sqrt{x}} = -x^{-3/2} + \frac{1}{2}x^{-1/2}$
- (b) $\frac{d}{dx} x \ln x = \ln x + 1$
- (c) $\frac{d}{dx} \frac{e^x}{\ln x} = \frac{e^x \ln x - e^x \cdot \frac{1}{x}}{(\ln x)^2}$ OR $\frac{e^x (x \ln x - 1)}{x(\ln x)^2}$ NB, $(\ln x)^2 = \ln^2 x \neq \ln x^2$

Bonus:

1. Find $y' = \frac{dy}{dx}$:

- (a) $x^2 + y^2 + 3xy = \ln y \Rightarrow y' = \frac{-(2x+3y)}{3x+2y-\frac{1}{y}}$ OR $-\frac{2xy+3y^2}{3xy+2y^2-1}$
- (b) $y = x^x \Rightarrow y' = x^x (\ln x + 1)$