

3. Circle one: true or false?

8 pts

- (a) **TRUE** FALSE: If $f(x)$ is differentiable at $x = a$, it must be continuous at $x = a$.
- (b) TRUE **FALSE**: If $f(x)$ is continuous at $x = a$, it must be differentiable at $x = a$.
- (c) TRUE **FALSE**: If $f(x)$ is not differentiable at $x = a$, it must be discontinuous at $x = a$.
- (d) **TRUE** FALSE: If $f(x)$ is discontinuous at $x = a$, it must be not differentiable at $x = a$.

4. Find the derivative of the function $f(x) = \sqrt{1+2x}$ using the definition of the derivative. (To receive credit, you must use limits in calculating your answer.)

8 pts

$$\begin{aligned} & \lim_{h \rightarrow 0} \frac{\sqrt{1+2(x+h)} - \sqrt{1+2x}}{h} \quad \left(\frac{\sqrt{1+2(x+h)} + \sqrt{1+2x}}{\sqrt{1+2(x+h)} + \sqrt{1+2x}} \right) \\ = & \lim_{h \rightarrow 0} \frac{(x+2(x+h)) - (x+2x)}{h(\sqrt{1+2(x+h)} + \sqrt{1+2x})} = \lim_{h \rightarrow 0} \frac{2h}{h(\sqrt{1+2(x+h)} + \sqrt{1+2x})} \\ = & \frac{2}{2\sqrt{1+2x}} = \frac{1}{\sqrt{1+2x}} \end{aligned}$$

5. Find the derivative with respect to x of the function $f(x) = \frac{x}{x + \frac{c}{x}}$.

8 pts

$$f(x) = \frac{x}{x + c x^{-1}}, \quad f'(x) = \frac{(x + c x^{-1}) \cdot 1 - x(1 - c x^{-2})}{(x + c x^{-1})^2}$$