

1. (4 points each) For the following statements circle True or False. If the statement is *always* true, explain why it is true. If it is false give an example of when the statement is false. Examples may be formulas or graphs.

(a) If $y(x)$ is a twice differentiable function, then $\frac{d^2y}{dx^2} = \left(\frac{dy}{dx}\right)^2$.

True

Consider $y = x^3$: $\frac{d^2y}{dx^2} = 6x$, but $\left(\frac{dy}{dx}\right)^2 = (3x^2)^2 = 9x^4$.

False

- (b) There exists a function $f(x)$ such that $f(x) > 0$, $f'(x) < 0$, and $f''(x) > 0$ for all real values of x .

True

Consider the function $f(x) = e^{-x}$.

False

- (c) If h is differentiable for all x and $h'(a) = 0$, then $h(x)$ has a local minimum or local maximum at $x = a$.

True

Consider the function $h(x) = x^3$ with $a = 0$.

False

- (d) If f and g are positive and increasing on an interval I , then f times g is increasing on I .

True

$(fg)' = f'g + g'f > 0$
since $f, f', g,$ and g' are all positive.

False