3. In each of the following, if the given statement is true for all functions f that are defined on $(-\infty, \infty)$, then mark the ☐ to the left of TRUE with a ✗; otherwise, mark the ☐ to the left of FALSE with a ✗ and give a counterexample.

a. If $\lim_{x\to 0} f(x) = f(0)$, then $\lim_{x\to 0} \dfrac{f(x) - f(0)}{x}$ exists.

☐ TRUE

☒ FALSE, because it does not hold for $f(x) =$ $|x|$

b. If the graph of $y = f(x)$ has an inflection point at $(0, f(0))$ and $f(0) \neq 0$, then the graph of $y = 1/f(x)$ has an inflection point at $(0, 1/f(0))$.

☐ TRUE

☒ FALSE, because it does not hold for $f(x) =$ $1 + \sin x$

c. If f is continuous on $[-1, 1]$, then $\displaystyle\int_{-1}^{1} (f(x))^2\, dx = \left(\int_{-1}^{1} f(x)\, dx\right)^2$.

☐ TRUE

☒ FALSE, because it does not hold for $f(x) =$ 1

d. If f is continuous on $(-\infty, \infty)$ and $\displaystyle\int_{-x}^{x} f(t)\, dt = 0$ for all $x > 0$, then f is an odd function.

☒ TRUE

☐ FALSE, because it does not hold for $f(x) =$

e. If f is integrable on $[-a, a]$ and $\displaystyle\int_{-a}^{a} f(t)\, dt = 0$ for all $a > 0$, then $f(0) = 0$.

☐ TRUE

☒ FALSE, because it does not hold for $f(x) =$ $\begin{cases} 0 & \text{if } x \neq 0 \\ 1 & \text{if } x = 0 \end{cases}$