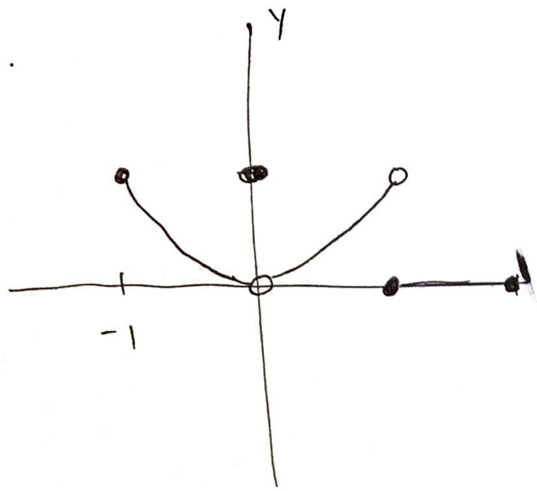
1.



(a) $\lim_{x \to -1^+} f(x) = 1$. True.

As x approaches -1 from the right, f(x) gets closer and closer to 1.

(b) $\lim_{x \to 0^-} f(x) = 1$. False.

As x approaches 0 from the left, f(x) gets closer to 0, not 1.

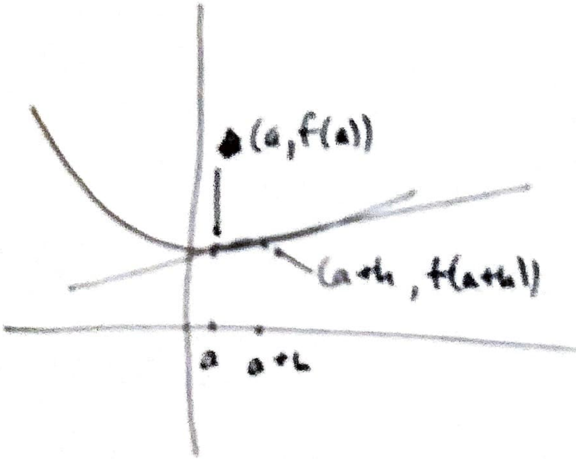
(c) $\lim_{x \to 0} f(x)$ exists. True.

This limit equals 0, because the function approaches zero from both sides. The value at $x = 0$ itself doesn't matter.

(d) $\lim_{x \to 1} f(x) = 0$. False.

Because the left-side limit is 1, and the right-side limit is 0, and they don't agree.

2 By definition $f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$.



Draw the secant line between $(a, f(a))$ and $(a+h, f(a+h))$. Its slope is

$$\frac{f(a+h) - f(a)}{(a+h) - a}$$

$$= \frac{f(a+h) - f(a)}{h}.$$

As we take the point $a+h$ closer and closer to a, the secant line approaches the tangent line, so

$$\frac{f(a+h) - f(a)}{h} \text{ approaches } \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} = f'(a).$$

3. $f(x) = x + \dfrac{9}{x}$.

$$f'(x) = \lim_{h \to 0} \frac{\left(x+h + \frac{9}{x+h}\right) - \left(x + \frac{9}{x}\right)}{h}$$

$$= \lim_{h \to 0} \frac{h + \frac{9}{x+h} - \frac{9}{x}}{h}$$

$$= \lim_{h \to 0} \frac{h + \frac{9x - 9(x+h)}{(x+h)x}}{h}$$

$$= \lim_{h \to 0} \frac{h + \frac{9x - 9x - 9h}{(x+h)x}}{h}$$

$$= \lim_{h \to 0} \frac{h - \frac{9h}{(x+h)x}}{h}$$

$$= \lim_{h \to 0} 1 - \frac{9h}{(x+h) \cdot x \cdot h}$$

$$= \lim_{h \to 0} 1 - \frac{9}{(x+h) \cdot x} = 1 - \frac{9}{x^2}.$$

The slope of the tangent line at $x = -3$ is equal to $f'(-3) = 1 - \frac{9}{(-3)^2} = 1 - \frac{9}{9} = 0$.