1 a) $f(x) = x^2$, $x=2$

$$f'(x) = \lim_{x \to x_0} \frac{f(x) - f(x_0)}{x - x_0}$$

$$f'(2) = \lim_{x \to 2} \frac{f(x) - f(2)}{x - 2}$$

$$f'(2) = \lim_{x \to 2} \frac{x^2 - 2^2}{x - 2}$$

$$f'(2) = \lim_{x \to 2} \frac{x^2 - 4}{x - 2} \qquad a = f'(x_0)$$

$$f'(2) = \lim_{x \to 2} \frac{(x+2).\cancel{(x-2)}}{\cancel{x-2}}$$

$$f'(2) = \lim_{x \to 2} x + 2 = 4$$

Equação da reta: $y - f(x_0) = f'(x_0)(x - x_0)$

$$y - f(2) = f'(2).(x-2)$$

$$y - 4 = 4(x-2)$$

$$y - 4 = 4x - 8$$

$$y = 4x - 8 + 4$$

$$y = 4x - 4$$

b) $f(x) = \frac{1}{x}$, $x = 2$

$$f'(x) = \lim_{x \to x_0} \frac{f(x) - f(x_0)}{x - x_0}$$

$$f'(2) = \lim_{x \to 2} \frac{f(x) - f(2)}{x - 2}$$

$$f'(2) = \lim_{x \to 2} \frac{\frac{1}{x} - \frac{1}{2}}{x - 2}$$

$$= \lim_{x \to 2} \frac{\frac{2 - x}{2x}}{\frac{x - 2}{1}}$$

$$-x + 2 \cdot (-1)$$
$$x - 2$$

$$= \lim_{x \to 2} \frac{2 - x}{2x} \cdot \frac{1}{x - 2}$$

$$= \lim_{x \to 2} \frac{-x + 2 \cdot 1}{2x(x - 2)}$$

$$= \lim_{x \to 2} \frac{\cancel{(x - 2)} \cdot (-1)}{2x \cancel{(x - 2)}}$$

$$= \lim_{x \to 2} -\frac{1}{2x} = -\frac{1}{4}$$

Equação da reta $y - f(x_0) = f'(x_0)(x - x_0)$

$$y - \frac{1}{2} = -\frac{1}{4}(x - 2) \Rightarrow 4y - 2 = -x + 2$$

$$4y = -x + 4$$

$$4\left(y - \frac{1}{2}\right) = -x + 2$$

$$y = -\frac{1}{4}(x + 4)$$

$$y = -\frac{1}{4}x + 1$$

① c) $f(x) = \sqrt{x}$; $x = 9$

$$f'(x) = \lim_{x \to 9} \frac{f(x) - f(x_0)}{x - x_0}$$

$$f'(9) = \lim_{x \to 9} \frac{f(x) - f(9)}{x - 9}$$

$$f'(9) = \lim_{x \to 9} \frac{\sqrt{x} - \sqrt{9}}{x - 9}$$

$$f'(9) = \lim_{x \to 9} \frac{\sqrt{x} - 3}{x - 9} \cdot \frac{\sqrt{x} + 3}{\sqrt{x} + 3}$$

$$f'(9) = \lim_{x \to 9} \frac{(\sqrt{x})^2 - 3^2}{(x-9)(\sqrt{x}+3)}$$

$$f'(9) = \lim_{x \to 9} \frac{\cancel{x - 9}}{\cancel{(x-9)} \cdot \sqrt{x}+3}$$

$$f'(9) = \lim_{x \to 9} \frac{1}{\sqrt{x} + 3} = \frac{1}{6}$$

Equação da reta: $y - f(x_0) = a(x - x_0)$

$$y - f(9) = a(x - 9)$$

$$y - 3 = \frac{1}{6}(x - 9) \quad \text{ou} \quad \boxed{x - 6y + 9 = 0}$$

$$6(y - 3) = x - 9$$

$$6y - 18 = x - 9$$

$$x - 9 + 18 - 6y = 0$$

d) $f(x) = x^2 - x \quad , \quad x = 1$

$$f'(x) = \lim_{x \to x_0} \frac{f(x) - f(x_0)}{x - x_0}$$

$$f'(1) = \lim_{x \to 1} \frac{f(x) - f(1)}{x - 1}$$

$$f'(1) = \lim_{x \to 1} \frac{x^2 - x - (1^2 - 1)}{x - 1}$$

$$f'(1) = \lim_{x \to 1} \frac{x\,\cancel{(x-1)}}{\cancel{x-1}} =$$

$$f'(1) = \lim_{x \to 1} x = 1 \;//$$

Equação da reta: $y - f(x_0) = a.(x - x_0)$

$y - f(1) = a\,(x - 1)$

$y - 0 = 1\,(x - 1)$

$\boxed{y = x - 1}$