Using the definition, find the slope and the equation of the tangent line to the given curve at the given point:

$$f(x) = x^2 + 2x - 3, \quad x = 3$$

$$m_{tan} = 8, \quad y - 12 = 8(x - 3)$$

$$g(x) = \sqrt{2x+1}, \quad x = 1$$

$$m_{tan} = \frac{1}{\sqrt{3}}, \quad y - \sqrt{3} = \frac{1}{\sqrt{3}}(x - 1)$$

$$h(x) = \frac{3}{-2x+1}, \quad x = 2$$

$$m_{tan} = \frac{6}{9} = \frac{2}{3}, \quad y + 1 = \frac{2}{3}(x - 2)$$

Find the derivatives of the following functions from the definition:

$$f(x) = 2x^2 - 3x + 1 \qquad g(x) = \sqrt{3x-4} \qquad h(x) = \frac{1}{2x-2}$$

$$f'(x) = 4x - 3 \qquad g'(x) = \frac{3}{2\sqrt{3x-4}} \qquad h'(x) = \frac{-2}{(2x-2)^2}$$

Find the derivatives of the following functions:

$$f(x) = 5x^7 + 3x^4 - 2x^3 + 3x + \frac{1}{x} \qquad g(x) = 4x^3 + 3x^{\frac{5}{2}} - \sqrt{x}$$

$$f'(x) = 35x^6 + 12x^3 - 6x + 3 - x^{-2} \qquad g'(x) = 12x^2 + \frac{15}{2}x^{\frac{3}{2}} - \frac{1}{2\sqrt{x}}$$

$$h(x) = x^3 - \frac{2}{\sqrt{x}} + \frac{3}{x^4} + 2x^{-3/5} \qquad k(x) = \sqrt{x+1}$$

$$h'(x) = 3x^2 + x^{-3/2} - 12x^{-5} - \frac{6}{5}x^{-8/5} \qquad k'(x) = \frac{1}{2\sqrt{x+1}}$$

Find value(s) for a and b, that make the following functions differentiable everywhere.

$$f(x) = \begin{cases} x^2 + a & x > 1 \\ bx & x \leq 1 \end{cases} \qquad g(x) = \begin{cases} ax^2 - 3x + 1 & x > 2 \\ bx + 2 & x \leq 2 \end{cases}$$

$$b = 2,\ a = 1 \qquad b = -4, \quad a = \frac{-1}{4}$$