1. (a) \[ \lim_{x \to 1^-} \frac{x^2 - 4x + 3}{x - 1} = \lim_{x \to 1^-} \frac{(x-1)(x-3)}{x - 1} \]

\[ = \lim_{x \to 1^-} (x - 3) = 1 - 3 = -2 \]

(b) \[ \lim_{x \to 1^-} \frac{(x-1)^2}{x - 1} = \lim_{x \to 1^-} \frac{(x-1)(x-1)}{x - 1} \]

\[ = \lim_{x \to 1^-} (x - 1) = 1 - 1 = 0 \]

(c) \[ \lim_{x \to 1^-} \sqrt{1-x} = \sqrt{1-1} = 0 \]

(d) \[ \lim_{x \to 1^-} \ln (1-x) = -\infty \]

3. (a) \[ \lim_{x \to a} \frac{f(x) - f(a)}{x - a} \]

\[ = \lim_{x \to a} \frac{\frac{1}{x+a} - \frac{1}{a^2+4}}{x - a} = \lim_{x \to a} \left( \frac{1}{x^2 + 4} - \frac{1}{a^2 + 4} \right) \cdot \frac{1}{x - a} \]

\[ = \lim_{x \to a} \frac{a^2 + 4 - x^2 - 4}{(x^2 + 4)(a^2 + 4)} \cdot \frac{1}{x - a} = \lim_{x \to a} \frac{a^2 - x^2}{(x^2 + 4)(a^2 + 4)(x - a)} \]

\[ = \lim_{x \to a} \frac{-1(x^2 - a^2)}{(x^2 + 4)(a^2 + 4)(x - a)} = \lim_{x \to a} \frac{-1(x-a)(x+a)}{(x^2 + 4)(a^2 + 4)(x - a)} \]

\[ = \lim_{x \to a} \frac{-1(x + a)}{(x^2 + 4)(a^2 + 4)} = \frac{-2a}{(a^2 + 4)^2} = f'(a) \]
(b) \[ f'(x) = \frac{-2x}{(x^2 + 4)^2} \]
\[ f'(2) = \frac{-2(2)}{(2^2 + 4)^2} = -\frac{1}{16} \]

(c) The equation of the line tangent to the curve \( f(x) \) is given by
\[ y - y_1 = f'(x)(x - x_1) \]
\[ y - \frac{1}{8} = -\frac{1}{16}(x - 2) \]

4. (a) \[ y = \left(\frac{1 - 2x}{1 + 2x}\right)^{3/4} \]
\[ \frac{dy}{dx} = \frac{3}{4} \left(\frac{1 - 2x}{1 + 2x}\right)^{-1/4} \cdot \frac{(1 + 2x)(-2) - (1 - 2x)(2)}{(1 + 2x)^2} = \frac{-3}{(1 + 2x)^2} \cdot \left(\frac{1 - 2x}{1 + 2x}\right)^{-1/4} \]

(b) \[ y = (x^3 - 1) \ln(1 + \sqrt{x}) \]
\[ \frac{dy}{dx} = (x^3 - 1) \left[ \frac{1}{1 + \sqrt{x}} \right] + 3x^2 \ln(1 + \sqrt{x}) \]

(c) \[ y = \frac{1}{x^2 - 3x - 5} \]
\[ \frac{dy}{dx} = -\frac{1}{x^2 - 3x - 5} \cdot \left(2x - 3\right) = \frac{3 - 2x}{(x^2 - 3x - 5)^2} \]

(d) \[ x + \ln y = \sqrt{1 + xy^2} \]
\[ 1 + \frac{d(\ln y)}{dy} \frac{dy}{dx} = \frac{1}{2} (1 + xy^2)^{-1/2} 
\[ \left[ y^2 + x \frac{d(y^2)}{dy} \frac{dy}{dx} \right] \]
\[ \frac{1}{2\sqrt{1 + xy^2}} \left[ y^2 + 2xy \frac{dy}{dx} \right] \]
\[ \frac{1}{y} \frac{dy}{dx} - \frac{2xy}{2\sqrt{1 + xy^2}} \frac{dy}{dx} = \frac{y^2}{2\sqrt{1 + xy^2}} - 1 \]
\[ \frac{dy}{dx} \left[ \frac{1}{y} - \frac{2xy}{2\sqrt{1 + xy^2}} \right] = \frac{y^2 - 2\sqrt{1 + xy^2}}{2\sqrt{1 + xy^2}} \]
\[ \frac{dy}{dx} \left[ \frac{2\sqrt{1 + xy^2} - 2xy^2}{2y\sqrt{1 + xy^2}} \right] = \frac{y^2 - 2\sqrt{1 + xy^2}}{2\sqrt{1 + xy^2}} \]
\[ \frac{dy}{dx} = \frac{y^2 - 2\sqrt{1 + xy^2}}{2\sqrt{1 + xy^2}} \cdot \frac{2y\sqrt{1 + xy^2} - 2xy^2}{2\sqrt{1 + xy^2} - 2y^2} = \frac{y^3 - 2\sqrt{1 + xy^2}}{2\sqrt{1 + xy^2} - 2y^2} \]