1. (10 points) Consider the following relation

\[ y(y - 1)(y - 2) = x(x^3 - 1)(x - 2) \]

(a) Graph the relation on \([-1, 3] \times [-2, 4]\) and draw the graph below,

(b) Find all of the points on the curve that have horizontal tangent lines. Use at least 6 decimal places in all of your answers.

\((0.5544584110, 2.239515686), (1.657751537, -0.5242991311)\)

(c) Find all of the points on the curve that have vertical tangent lines. Use at least 6 decimal places in all of your answers.

\((-0.1759317923, 1.577350269), (1.116060673, 1.577350269), (1.970641553, 1.577350269)\)
\((0.2183008646, 0.4226497307), (0.8461255702, 0.4226497307), (2.025969265, 0.4226497307)\)
2. (10 points) Consider the following function

\[ f(x) = \frac{1}{x} - \frac{1}{x^2} \]

(a) Use Maple to find the first 10 derivatives of the function and write them below.

\[
\begin{align*}
\frac{df}{dx} & = -\frac{x-2}{x^3} \\
\frac{d^2f}{dx^2} & = \frac{2}{x^4} \\
\frac{d^3f}{dx^3} & = -\frac{6x-4}{x^5} \\
\frac{d^4f}{dx^4} & = \frac{24}{x^6} \\
\frac{d^5f}{dx^5} & = -120\frac{x-6}{x^7} \\
\frac{d^6f}{dx^6} & = 720\frac{x-7}{x^8} \\
\frac{d^7f}{dx^7} & = -5040\frac{x-8}{x^9} \\
\frac{d^8f}{dx^8} & = 40320\frac{x-9}{x^{10}} \\
\frac{d^9f}{dx^9} & = -362880\frac{x-10}{x^{11}} \\
\frac{d^{10}f}{dx^{10}} & = 3628800\frac{x-11}{x^{12}} \\
\end{align*}
\]

(b) Using the derivatives above find a formula for \( f^{(n)}(x) \).

\[
f^{(n)}(x) = (-1)^n n! \frac{x-(n+1)}{x^{n+2}}
\]

(c) Using your formula for \( f^{(n)}(x) \) find \( f^{(1000)}(x) \).

\[
f^{(1000)}(x) = 1000! \frac{x-1001}{x^{1002}}
\]