1. Using the limit definition of the derivative, calculate the equation of the tangent line to the function $y = \frac{3}{x}$ at the point $(1,3)$. You may use the power rule to check your answer, but in order to receive credit, you must use the limit definition.

\[
\frac{dy}{dx} = \lim_{h \to 0} \frac{f(x + h) - f(x)}{h} = \lim_{h \to 0} \frac{3}{x(x+h)} - \frac{3}{x} = \lim_{h \to 0} \frac{3}{(x)(x+h)} - \frac{3(x+h)}{(x)(x+h)} = \lim_{h \to 0} \frac{3x - 3x - 3h}{(x)(x+h)} = \lim_{h \to 0} \frac{-3}{h} = \lim_{h \to 0} \frac{-3}{x^2 + xh} = -\frac{3}{x^2}
\]

Thus our derivative at $x = 1$ is $-3$. Now, to find the tangent line, you use the point-slope formula:

\[
y - y_1 = m(x - x_1)
\]

\[
y - 3 = -3(x - 3)
\]

\[
y = -3x + 6
\]

2. Choose any two of the functions below, and use the set of differentiation rules to calculate their derivatives:

(a) $f(x) = \frac{x}{3 - e^x}$

\[
f'(x) = \frac{1 \cdot (3 - e^x) - x \cdot -e^x}{(3 - e^x)^2}
\]

(b) $g(x) = (6x + 4e^x) \cdot \sqrt{x}$

\[
g'(x) = (6 + 4e^x) \cdot \sqrt{x} + (6x + 4e^x) \cdot \frac{1}{2} x^{-\frac{1}{2}}
\]

(c) $h(x) = \sqrt{x} + \frac{x^2}{8}$

\[
h'(x) = \frac{1}{2} x^{-\frac{1}{2}} + \frac{2}{8} x
\]