Question 1 [8 points]: Differentiate the following functions. It is not necessary to simplify final answers.

(a) $y = 4\sin\left(\sqrt{x}\right)$

[2]

(b) $f(x) = \dfrac{\left(x^2 + 3x + 2\right)^4}{2}$

[2]

(c) $y = \ln\left(x + \cos\left(x\right)\right)$

[2]

(d) $g(t) = \sec\left(e^t\right)$

[2]

Question 2 [12 points]: Differentiate the following functions. It is not necessary to simplify final answers.

(a) $y = \sqrt{1 + \cot^2(x)}$

[3]

(b) $f(x) = \dfrac{1}{1 - e^{(x^2)}}$

[3]

(c) $y = \cos(x \sin(x))$

[3]

(d) $g(t) = \tan^4(7t^3)$

[3]

Question 3 [5 points]: Use implicit differentiation to find an equation of the tangent line to the curve $x^4 - x^2y + y^4 = 1$ at the point $(-1, 1)$.

[5]

Question 4 [5 points]: Use logarithmic differentiation to find y' where $y = (1 + x)^{1/x}$.

[5]

Question 5 [5 points]: Find an equation of the tangent line to the curve $y = \log_2\left(2 + x + x^2\right)$ at the point where $x = 0$. Simplify all logarithms as much as possible in your final answer.

[5]

Question 6 [5 points]:

(i) Solve for x: $\ln\left(x^2 - 1\right) = 3$

[2]

(ii) Evaluate the limit: $\displaystyle\lim_{x \to 1} e^{-x/(1-x)^2}$

[3]

Question 7 [5 points]: Let $f(x) = \ln\left(x + e^{-x}\right)$. Determine $f''(0)$.

[5]

Question 8 [5 points]: Find all value of x at which tangent lines to $y = x^3 e^x$ are horizontal.

[5]