Question 1: Find the following derivatives (Take care to use proper notation; it is not necessary to simplify your answers):

(a) $f(x) = x^2 e^{-2/x}$

[2]

(b) $y = \ln(\sec^2 x)$

[2]

(c) $g(t) = t \arctan(2t) - 2^t$

[3]

(d) $y = \log_5 (1 + e^{\ln(x^2)})$

[3]

Question 2: The equation $x^y = e$ defines y implicitly as a function of x. Find the equation of the tangent line to the corresponding curve at the point $(e, 1)$. (Hint: y can be expressed explicitly as a function of x.)

[5]

Question 3: Suppose $f(x) = x^3 + 3\sin(x) + 2\cos(x)$. Find $(f^{-1})'(2)$, the derivative of the inverse function at $x = 2$.

[5]

Question 4: Evaluate the following limits, if they exist. If a limit does not exist because it is $+\infty$ or $-\infty$, state which with an explanation of your reasoning.

(a) $\displaystyle\lim_{x\to 0} \frac{8x^2}{\cos(x) - 1}$

[3]

(b) $\displaystyle\lim_{x\to 0^+} \frac{\ln(e^x - 1)}{\ln(x)}$

[3]

(c) $\displaystyle\lim_{x\to 1^+} x^{1/(1-x)}$

[4]

Question 5: Determine the absolute minimum and maximum values of $f(x) = x^4 - 2x^2 - 3$ on the interval $[-2, 2]$

[10]

Question 6: For this question let $f(x) = (x^2 - 4)^{2/3}$

(a) Determine the intervals on which f is increasing or decreasing.

[8]

(b) Determine the local (or relative) maximum and minimum values of f.

[2]