

## Question 1:

(a)[3] Evaluate:  $\lim_{x \rightarrow \infty} \frac{7e^{5x} - 5e^{7x}}{7e^{7x} + 5e^{5x}}$

(b)[3] Differentiate:  $f(x) = 5^{\sin(2x) + \sqrt{x}}$

(c)[4] Use logarithmic differentiation to determine  $y'$ :

$$y = \frac{\cos^2(x)\sqrt{1+3x}}{e^{x^2}}$$

**Question 2:**

(a)[3] Find  $y'$ :  $y = \log_5(xe^{-x})$  .

(b)[3] Determine  $f''(1)$ :  $f(x) = x[1 - \ln(x)]$  .

(c)[4] Determine the equation of the tangent line to the curve

$$\ln(x + 2y) = e^{xy} - 1$$

at the point  $(1, 0)$  .

**Question 3 [10]:** A balloon is rising at a constant speed of 2 m/s. A person is running in a straight line on level ground at a constant speed of 4 m/s. At the instant when the person passes under the rising balloon it is 20 m above the person. How fast is the distance between the person and balloon increasing 5 seconds later? (Use calculus to find the solution, state a clear conclusion, and give units with your final answer.)

**Question 4:**

(a)[5] Determine the linearization  $L(x)$  of  $f(x) = e^{x-(1/x)}$  at  $a = 1$ .

(b)[5] Use a linear approximation (or differentials if you prefer) to estimate  $\sqrt{9.1}$ .

**Question 5:** For this question use the function  $f(x) = (x^2 - 9)^2$ .

(a)[4] Determine the intervals of increase and decrease of  $f(x)$ .

(b)[1] State the relative extreme values of  $f(x)$ , if any.

(c)[4] Determine the intervals of concavity of  $f(x)$ .

(d)[1] State the inflections points, if any.