Final exam Math106

Question 1(3+3+3)

a) Use the substitution $u = x^2 + 4$ to compute $\int x^3\sqrt{x^2 + 4}\,dx$.

b) Find the number(s) c that satisfies the conclusion of the mean value theorem for the function $f(x) = -x^2 + 4x$ on $[0,3]$.

c) Evaluate the integral $\int \dfrac{1}{\sqrt{e^{4x}-16}}\,dx$

Question 2(2+3+3)

a) Evaluate the integral $\int \dfrac{\sinh x}{\sqrt{9+(\cosh x)^2}}\,dx$

b) Find the indefinite integral $\int \dfrac{\ln x}{x^5}\,dx$

c) Compute $\int (\sec x)^6\,dx$

Question 3(3+3+2)

a) Find $\lim_{x \to 0}(1 + 8x^2)^{\frac{1}{x^2}}$

b) Evaluate the integral $\int \dfrac{8x+32}{(x-2)(x^2-4)}\,dx$

c) Compute $\int \dfrac{1}{\sqrt{x^2-4x+2}}\,dx$

Question 4(3+3+3)

a) Sketch the region bounded by $y = \sqrt{x+2}$, $y = -x$, and the x-axis and find its area.

b) Find the volume of the solid obtained by revolving the region bounded by

   $y = (x-1)^2$ and $y = 3 - x$ about the x-axis.

c) Compute the area of the surface obtained by revolving the curve
   $y = \sqrt{9 - x^2}$ $-2 \leq x \leq 2$ about the x.axis.

Question5(3+3)

a) Find the arc length of the parametric curve $x = \frac{t^4}{4}$, $y = \frac{t^6}{6}$ $0 \leq t \leq 1$

b) Sketch the region inside $r = 2$ and outside $r = 4 - 4cos\theta$ and find its area.