*Please refrain from using calculators, mobile phones or pagers as they are of no use to you during this exam. You are allowed 75 minutes to complete your work .. Good Luck!*

1. A plane curve $C$ is represented by the parametric equations: $x = 2 + \sin t^2$ and $y = 3 + \cos t^2$ where $0 \le t \le \sqrt{\pi}$.      [2 × 2.5 pts]

   (a) Find the length of $C$.

   (b) Find the points $t$ at which the tangent line to the curve $C$ is parallel to the $x$-axis.

2. Determine whether the following integral converges or diverges:      [5 pts]

$$\int_0^{\pi/2} \frac{1}{(\sin \frac{x}{2} - \cos \frac{x}{2})^2}\, dx$$

3. Evaluate the following integrals:      [5 × 3 pts]

   (a) $\displaystyle\int x^2\, 2^x\, dx$

   (b) $\displaystyle\int \frac{2 - 3x}{(x^2 + 1)(x + 1)^2}\, dx$

   (c) $\displaystyle\int \frac{e^x}{\sqrt{9 - 8e^x - e^{2x}}}\, dx$

   (d) $\displaystyle\int \frac{\sin^3 x}{1 - \sqrt{\cos x}}\, dx$

   (e) $\displaystyle\int \frac{\sqrt[3]{x}}{\sqrt{x}\,(\sqrt[3]{x} + 4)}\, dx$