

**Question 1. [3 marks]**

Give the derivative of the following function

$$f(x) = \int_2^{\sqrt{x^2+4}} e^{t^2-4} dt.$$

**Question 2. [3 marks]**

Find the area of the region enclosed between the curves  $y = 1 - e^{-2x}$  and  $y = 3 + \cos x$  from  $x = 0$  to  $x = \pi$ .

**Question 3. [2+2+2+2=8 marks]**

Evaluate the following integrals

1.  $\int_1^e \frac{(\ln x)^3}{x} dx$  (Use substitution)
2.  $\int_0^{\frac{\pi}{2}} (x+1) \cos x dx$  (Use integration by parts)
3.  $\int_0^{\frac{\pi}{6}} \sin^2 x \cos^3 x dx$ .
4.  $\int_0^1 \frac{e^x}{2e^x + 3} dx$ .

**Question 4. [2+2+2=6 marks]**

1. Evaluate the following integrals

(i)  $\int_3^4 \frac{1}{x^2 + x - 2} dx$       (ii)  $\int_0^1 \frac{1}{x^2 + 2x + 2} dx$ .

2. Evaluate the following improper integral

$$\int_0^3 \frac{2}{\sqrt{3-x}} dx.$$