

Books, watches, notes or cell phones are not allowed. The only calculators allowed are the Sharp EL-531**. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work.

Question 1. (1 mark each) Integrate the following indefinite integrals:

a.

$$\int \frac{1}{x^{1/3}} dx = \int x^{-1/3} dx = \frac{x^{-1/3+1}}{-1/3+1} + C = \frac{x^{2/3}}{2/3} + C = \frac{3}{2} x^{2/3} + C$$

b.

$$\int \sec x dx = \ln |\sec x + \tan x| + C$$

c.

$$\int \cot x dx = \ln |\sin x| + C$$

d.

$$\int \frac{1}{x\sqrt{x^2-11}} dx = \int \frac{1}{x\sqrt{x^2-(\sqrt{11})^2}} dx = \frac{1}{\sqrt{11}} \operatorname{arcsec} \frac{x}{\sqrt{11}} + C$$

e.

$$\int \frac{1}{x} dx = \ln|x| + C$$

f.

$$\int \sin x dx = -\cos x + C$$

Question 2. (4 marks) Find f .

$$f''(\theta) = 3\sin\theta + 2\cos\theta \quad f(0) = 0, \quad f(\pi) = 0$$

$$f'(\theta) = \int f''(\theta) d\theta = \int 3\sin\theta + 2\cos\theta d\theta = -3\cos\theta + 2\sin\theta + C$$

$$f(\theta) = \int f'(\theta) d\theta = \int -3\cos\theta + 2\sin\theta + C d\theta = -3\sin\theta - 2\cos\theta + C\theta + D$$

$$0 = f(0)$$

$$0 = -3\cos(0) - 2\sin(0) + C(0) + D$$

$$0 = 3$$

$$0 = f(\pi)$$

$$0 = -3\cos(\pi) - 2\sin(\pi) + C(\pi) + 3$$

$$0 = -3(-1) - 2(0) + C\pi + 3$$

$$C = \frac{6}{\pi}$$

$$f(\theta) = -3\cos\theta - 2\sin\theta + \frac{6}{\pi}\theta + 3$$