Surfaces and Partial Differentiation – 2021/20 GCE AS Additional Pure Further Mathematics A

1. Nov/2021/Paper_Y535/01/No.2

The surface S is given by $z = x^2 + 4xy$ for $-6 \leqslant x \leqslant 6$ and $-2 \leqslant y \leqslant 2$.

(a) (i) Write down the equation of any **one** section of S which is parallel to the x-z plane. **[1]**

(ii) Sketch the section of **(a)(i)** on the axes provided in the Printed Answer Booklet. **[2]**

(b) Write down the equation of any **one** contour of S which does **not** include the origin. **[1]**

2. Nov/2021/Paper_Y535/01/No.5

A trading company deals in two goods. The formula used to estimate z, the total weekly cost to the company of trading the two goods, in tens of thousands of pounds, is

$$z = 0.9x + \frac{0.096y}{x} - x^2y^2,$$

where x and y are the masses, in thousands of tonnes, of the two goods.

You are given that $x > 0$ and $y > 0$.

(a) In the first week of trading, it was found that the values of x and y corresponded to the stationary value of z.

Determine the total cost to the company for this week. **[7]**

(b) For the second week, the company intends to make a small change in either x or y in order to reduce the total weekly cost.

Determine whether the company should change x or y. (You are not expected to say by how much the company should reduce its costs.) **[4]**

3. Nov/2020/Paper_Y535/01/No.2

An open-topped rectangular box is to be manufactured with a fixed volume of $1000\,\text{cm}^3$. The dimensions of the base of the box are x cm by y cm. The surface area of the box is $A\,\text{cm}^2$.

(a) Show that $A = xy + 2000\left(\frac{1}{x} + \frac{1}{y}\right)$. **[4]**

(b) **(i)** Use partial differentiation to determine, in exact form, the values of x and y for which A has a stationary value. **[5]**

(ii) Find the stationary value of A. **[2]**