THIS PAPER IS NOT TO BE REMOVED FROM THE EXAMINATION HALLS

**UNIVERSITY OF LONDON** **CO0001 ZA**

**Diploma Examination**

**COMPUTING AND INFORMATION SYSTEMS AND CREATIVE COMPUTING**

**Mathematics for Business**

Wednesday 16 May 2018: 10.00 – 13.00

Time allowed: 3 hours

There are **TEN** questions on this paper. Candidates should answer all **TEN** questions. All questions carry equal marks and full marks can be obtained for complete answers to **TEN** questions. The marks for each part of a question are indicated at the end of the part in [.] brackets.

There are 100 marks available on this paper.

A handheld calculator may be used when answering questions on this paper but it must not be pre-programmed or able to display graphics, text or algebraic equations. The make and type of machine must be stated clearly on the front cover of the answer book.

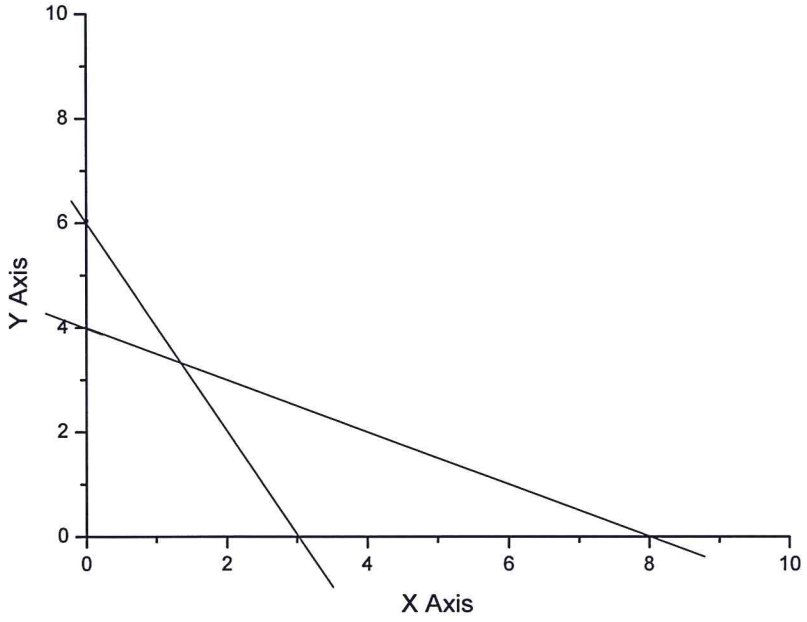
Graph paper is provided at the end of this question paper. If used, it must be detached and fastened securely inside the answer book.

**Question 1**

(a) Show that the equation of one of the two lines in the graph below is $y = -\frac{1}{2}x + 4$ and find the equation of the other line. [4]

(b) Find the point of intersection of these lines, leaving your solution as a fraction. [3]

(c) Find the set of inequalities that completely describe the region, including the boundaries, contained by these two lines and the $x$ and $y$ axes in the graph below. [3]



## Question 2

(a) Given the matrices

$$\mathbf{P} = \begin{pmatrix} 4 & -1 \\ 2 & 0 \\ -2 & 1 \end{pmatrix}, \quad \mathbf{Q} = \begin{pmatrix} 1 & -3 & 2 \\ 0 & 1 & 4 \end{pmatrix}, \quad \mathbf{R} = \begin{pmatrix} 3 & -1 \\ 1 & 2 \end{pmatrix}$$

either find the following matrices or say why they are undefined.

i. **PQ**

ii. **QP**

iii. $\mathbf{P}^t + 2\mathbf{Q}$

iv. $\mathbf{Q}^t\mathbf{P}$

[8]

(b) Matrix **Q** is an augmented matrix which represents a $2 \times 2$ system of linear equations in two unknowns $x$ and $y$. Write down this system. [2]

## Question 3

(a) Sketch the graph of the function with equation

$$y = x^2 - 7x + 12$$

showing its intercepts and the co-ordinates of its vertex. [6]

(b) Given that a company has profit function

$$\Pi(q) = -q^2 + 7q - 12$$

state:

i. its maximum profit;

ii. its break-even points.

[4]

## Question 4

(a) Consumption is given by

$$C = Y - 4ln(1 + Y)$$

where $Y$ is income.

i. What is consumption when $Y = 30$?

ii. Calculate the marginal propensity to consume, $\frac{dC}{dY}$, when $Y = 35$. Give your answer correct to two decimal places.

[4]

(b) Differentiate the following with respect to $x$. You do not need to simplify your answers.

i. $y = \frac{5}{3x^2 - 4x}$

ii. $y = \frac{1}{x}(3x^2 - 4x)$

iii. $y = e^{(3x^2 - 4x)}$

[6]

## Question 5

(a) Solve the following equations.

i. $7(5 - x) = 3x$

ii. $\frac{3}{x-2} = \frac{4}{x}$ [5]

(b) Two banks sell travellers cheques for different amounts. Bank A sells them at 2% commission, but Bank B charges a flat rate of $3 plus 1% commission. How many dollars worth of travellers cheques must I buy for the bank charges to be equal? [5]

## Question 6

A linear programming problem produces the feasible region described by the following constraints.

$$\begin{aligned} 40x + 20y &\leq 400 \\ 6x + 8y &\leq 96 \\ x &\geq 0 \\ y &\geq 0 \end{aligned}$$

Given the problem is to maximise profit of $3x + 2y$, and showing clearly all your calculations:

(a) sketch a graph to show the feasible region, finding its corners; [6]

(b) find the values of $x$ and $y$ which produce the maximum profit; [3]

(c) state the maximum profit. [1]

## Question 7

Output, $Q$, in thousands of units is given by the following equation where $t$ is the time in years since the product was first produced.

$$Q = t^3 - 6t^2 + 9t$$

(a) Show $Q = t(t-3)(t-3)$. [1]

(b) Sketch the graph of this ouput function, showing where it cuts the axes. [3]

(c) What was the maximum output achieved in the first three years and when was this maximum achieved? [5]

(d) The company ceased trading after ten years. What was the output at this time? [1]

## Question 8

(a) Simplify the following.

i. $log_{16}4$

ii. $log_3\frac{1}{9}$

iii. $(\frac{b^6}{4})^{-\frac{1}{2}}$

[4]

(b) The percentage, $y$, of car drivers who own a sat nav (GPS) $t$ years after they first came onto the market is modelled by the equation.

$$y = 100 - 65e^{-0.01t}$$

i. Find the percentage of drivers who own a sat nav twelve years after they were introduced to the market.

ii. After how many years will 50% of drivers have a sat nav?

iii. What happens to $y$ as time goes on?

[6]

## Question 9

Evaluate the following integrals, showing all your working.

(a)

$$\int_1^2 (3x^2 + 2x)dx$$

[3]

(b)

$$\int_2^3 (\frac{1}{x-1})dx$$

[3]

(c)

$$\int_0^1 (e^{2x})dx$$

[4]

**Question 10**

(a) Calculate the value of

$$\sum_{r=0}^{4}(3r+2)$$

[2]

(b) Write the following sum using Sigma notation:

$$\frac{1}{2}+\frac{2}{3}+\frac{3}{4}+...+\frac{9}{10}$$

[2]

(c) This formula gives the sum of a geometric progression with $n$ terms, first term $a$ and common ratio $r$.

$$\frac{a(1-r^n)}{1-r}$$

i. Find the sum of the geometric progression with:

$$a=100, r=1.025, n=15$$

ii. Give the values of $a, r$ and $n$ in the geometric progression:

$$5, 10, 20, 40, ...1280$$

[4]

(d) Alex saves \$100 a year at a rate of 6% compounded annually. What will this investment be worth at the end of ten years? [2]

**END OF PAPER**

**Candidates using this paper must tie it into their Answer-Books so as to face the answer to the question to which it relates. They must write their number and name and the subject of the paper on every sheet used.**

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