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

Date and Time: Tuesday 16 May 2017, 10:00 – 13:00

Duration: 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.

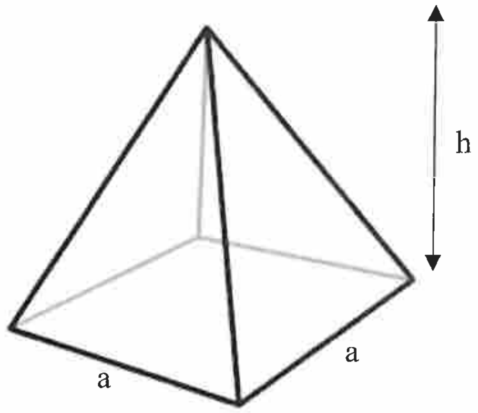
Graph Paper is provided at the end of this question paper. If used, it must be detached and fastened securely inside the answer booklet.

UL17/0463

1. The volume of a square based pyramid is given by the formula

$$V = \frac{a^2 h}{3}$$

where a is the length of the side of the square base and h is the height of the pyramid.



(a) Find the volume of a pyramid with square base length 5cm and height 8cm. [2]

(b) What is the height of a square based pyramid if its base has area $49cm^2$ and its volume is $245cm^3$? [2]

(c) Re-arrange the formula to make a the subject. [2]

(d) A funnel in the shape of such an upside-down square based pyramid is part of a builders mixing machine.

(i) What is the side length of the opening of the funnel (the square) if its height is $2m$ and its capacity is $2.16m^3$? [2]

(ii) How many litres of water can the funnel hold? $(1l = 1000cm^3)$ [2]

2. (a) A car which was worth $32,000 when new is worth $13,059.08 after 6 years. Assuming that the depreciation is linear:

(i) Find the value of the car when it is 2 years old. [2]

(ii) Using y to represent the value of the car, and x to represent the time in years, model the value of the car as a linear equation. [2]

(b) School minibuses can take either 12 or 18 pupils. A particular school has 7 minibuses, and when they are all full the school can take 108 pupils on a trip.

If $\boldsymbol{x}$ is the number of 12 seater minibuses, and $\boldsymbol{y}$ is the number of 18 seater minibuses, then

$$\boldsymbol{x + y = 7}$$

(i) Use the information given to write a second equation involving x and y. [2]

(ii) Hence, by solving the equations simultaneously find the number of 12 seater and the number of 18 seater minibuses owned by the school. [4]

3. (a) On the **same graph** sketch the line and curve with equations:

(i) $\boldsymbol{y = 3x + 8}$ [2]

(ii) $\boldsymbol{y = 15x - 3x^2}$ [3]

You should show all points of intersection with the axes.

(b) A company has profit function $\boldsymbol{P(x) = 15x - 3x^2}$ and cost function $\boldsymbol{C(x) = 3x + 8}$.

Show that the Revenue function is given by

$$\boldsymbol{R(x) = -3x^2 + 12x - 8} \quad [1]$$

(c) Use the quadratic formula to find the break-even points of the revenue function. Give your answers correct to 2 decimal places. [3]

(d) Explain how the break-even points that you have found in part (b) relate to your graph in part (a). [1]

4. Two functions are defined by

$$f(x) = 8 - x^2 \text{ and } g(x) = \sqrt{x+1}$$

(a) Find the range of $f(x)$ given that:

(i) The domain is the set of all real numbers.

(ii) The domain is the set of integers $\{-2, -1, 0, 1, 2\}$. [2]

(b) Find $fg(x)$ simplifying your answer. [2]

(c) Find $gf(x)$ and hence state the largest domain possible for $gf(x)$. [3]

(d) Differentiate $\frac{f(x)}{g(x)}$. There is no need to simplify your answer. [3]

5. (a) Find the co-ordinates of the stationary points of the function [5]

$$f(x) = x^3 - 7.5x^2 + 12x$$

(b) Determine whether each of the points found in part (a) is a maximum or a minimum point. [2]

(c) Sketch the function $y = f(x)$ for $-1 \leq x \leq 6$ showing the turning points. (You do not need to find the exact points of interception with the axes) [3]

6. (a) Given the matrices:

$$A = \begin{pmatrix} 2 & -3 \\ 1 & 5 \end{pmatrix}, \quad B = \begin{pmatrix} -1 & 4 & 2 \\ 3 & -3 & 7 \end{pmatrix}, \quad C = \begin{pmatrix} 3 & 0 \\ 2 & -4 \end{pmatrix}$$

(i) Calculate $2A + C$. [2]

(ii) Calculate AB. [3]

(iii) Explain why matrix BA is non-conformable. [1]

(b) Mr Brown owns three shops. Each of these shops employs some staff on grade A and some on grade B. The number of staff of each grade are shown in the table below.

	Grade A	Grade B
Shop 1	2	5
Shop 2	1	3
Shop 3	3	7

Staff on grade A are paid \$250 per week, staff on grade B are paid \$180 per week.

By performing an appropriate matrix multiplication, calculate the weekly wage bill for each shop.

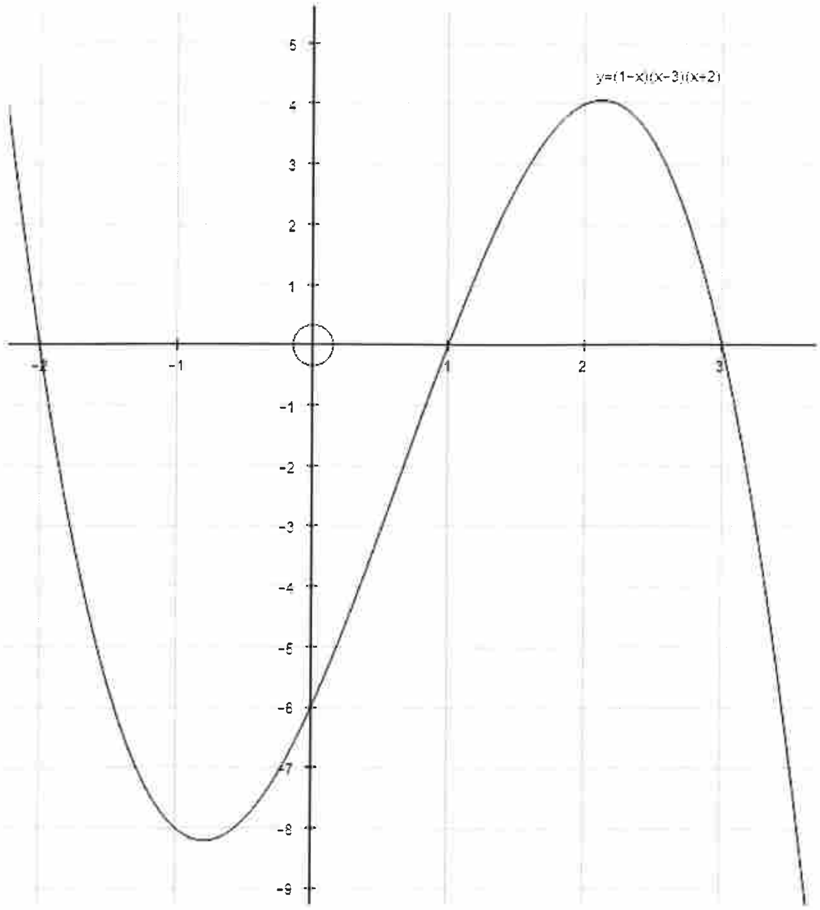
[4]

Hence find Mr Brown's total weekly wage bill.

7. The graph below shows the equation

$$y = (1 - x)(x - 3)(x + 2)$$

for values of x between -2.5 and 3.5.



(a) Show that the equation can be re-written as

$$y = -x^3 + 2x^2 + 5x - 6$$ [3]

(b) Use integration to find the area between the curve and the x-axis between $x = 1$ and $x = 3$. You must show all your working. [5]

(c) Explain why $\int_{-2}^{3}(-x^3 + 2x^2 + 5x - 6).dx$ does not give the total area enclosed by the curve and the x-axis. [2]

8. (a) Simplify

(i) $\log_5(25)^x$ [2]

(ii) $\left(\frac{2}{\sqrt{x}}\right)^4$ [2]

(b) Differentiate with respect to x

$$y = x^2 \ln 3x$$ [3]

(c) Solve the equation

$$300 = 60e^{-8x}$$

Giving your answer correct to 3 decimal places. [3]

9. (a) (i) Showing all your working, evaluate [3]

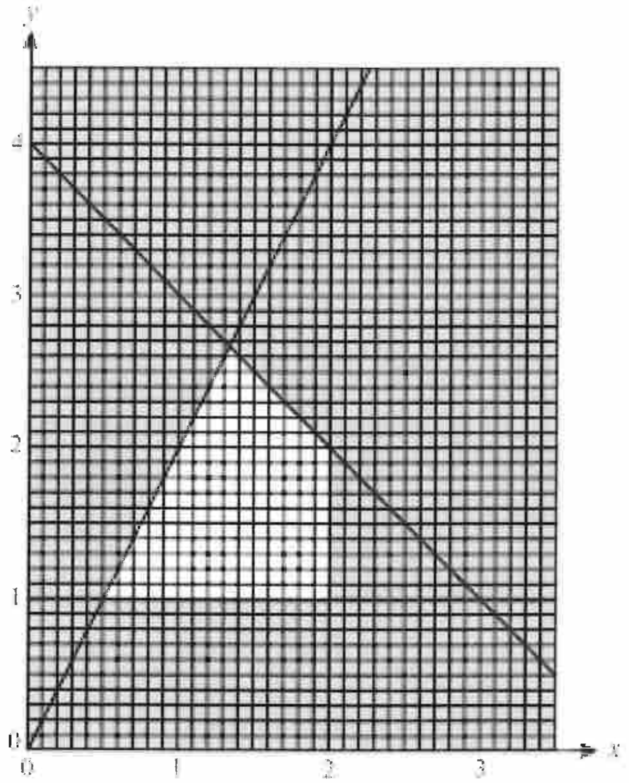
$$\sum_{k=-2}^{3} 2^k$$

(ii) Write the following series using Σ notation. [3]

$$5 + 8 + 11 + 14 + \cdots + 62$$

(b) Tom invests $3000 in a bank account at the **start of every year** for 6 years. He receives interest of 2% which is compounded annually. How much money does Tom have in the account at the end of the 6th year? [4]

10. The constraints of a linear programming problem are represented in the graph shown below. The feasible region is the unshaded region, including its boundaries.



(a) Two of the inequalities that define the feasible region are $y \leq 4 - x$ and $y \leq 2x$.
Write down the other two inequalities that define the feasible region. [2]

(b) Find the co-ordinates of the four corners of the feasible region. [5]

(c) The objective is to maximise the profit function

$$P = 3x + 2y.$$

By evaluating the profit function at the four corners of the feasible region, or otherwise, find the values of x and y that maximise P and state the maximum profit. [3]

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