PENINSULA COLLEGE GEORGETOWN

FINAL SEMESTER EXAMINATION

Programme	:	**DIPLOMA IN COMPUTER SCIENCE**
Course	:	**CALCULUS AND ALGEBRA**
Course Code	:	**DCS1224**
Duration	:	**3 Hours**

INSTRUCTIONS TO CANDIDATES:

1. Please read the instructions given in the question paper **CAREFULLY.**
2. The question paper consists of **FOUR (4)** questions.
3. Answer **ALL** questions in the question paper.
4. Answers to the questions are to be written into the examination booklet.
5. Electronic dictionaries, lecture notes, files or any unauthorised materials except writing equipment are strictly prohibited.

WARNING:

The Examination Board of Peninsula College Georgetown regards cheating as a most serious offence and will not hesitate to mete out the appropriate punitive actions according to the severity of the offence committed, and in the accordance with the clauses stipulated in the Students' Handbook, up to and including expulsion from Peninsula College Georgetown.

(*This booklet contains 6 printed pages including this page*)

For examiner's use only

QUESTION NO.	MARKS
1	/ 25
2	/ 25
3	/ 25
4	/ 25
Total	**/ 100**

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Answer **ALL FOUR (4)** questions on the separate sheet provided. **[100 marks]**

1. a) An average of 3.2 students were absent per day in a certain school. By using **Poisson Distribution**, compute the probability that:

i) at most one student will be absent on a given day.

(2 marks)

ii) between 1 to 3 students will be absent.

(5 marks)

iii) at least 4 students will be absent.

(3 marks)

b) A bus company has 12 buses. On average, one bus will break down at any one time. On a certain day, 10 buses are on the road. Using **Binomial Distributions**, find the probability of:

i) 2 buses broke down.

(3 marks)

ii) less than 2 buses break down.

(4 marks)

c) Find the inverse of matrix $A = \begin{bmatrix} 4 & 7 \\ 2 & 6 \end{bmatrix}$.

(4 marks)

d) Given that $\mathrm{A} = \begin{bmatrix} 6 & -2 \\ -4 & 1 \end{bmatrix}$ and I is the 2×2 identity matrix. Prove that $A^2 = 7A + 2\mathrm{I}$.

(4 marks)

Total: [25 marks]

2. a) A patient has a covid-19 disease. She has 4^3 body cells that had been affected on the first day. The number of affected cells doubles every day. The patient must be admitted to the hospital when 2^{10} body cells are affected. Determine on which day the patient be admitted to the hospital using the **law of indices**.

(3 marks)

b) Using the rules of indices,

i) Simplify $\dfrac{\left(2x^{\frac{1}{2}}\right)^3}{4x^2}$ fully.

(3 marks)

ii) Calculate the expression, $10^{-2} \times 64^{\frac{1}{2}}$.

(3 marks)

iii) Prove $(16x^{12})^{\frac{3}{4}} = 8x^9$.

(3 marks)

c) Using the rules of logarithms,

i) Identify the value of $\frac{\log_5 8 \times \log_3 25}{\log_{\sqrt{3}} 4}$ by using the simplication method.

(4 marks)

ii) Find out the value of x by solving the logarithmic equation $2\log_3 x - \log_3 7x = 1$.

(5 marks)

d) Given that $x = 2^p$ and $y = 4^q$. Prove that $log_2(x^3y^2) = 4\text{p} + 6\text{q}$.

(4 marks)

Total: [25 marks]

3. a) Identify:

i) the expression, X, that $(3d^2 - 5e + 3f)$ subtracted from to get $(d^2 + 6f)$ as the answer. (3 marks)

ii) the length of the third edge of the triangle, Y, if its perimeter is $(4g^2 + 10gh + 5)\ cm$ and the length of the other two sides are $(5gh - 3g^2)\ cm$ and $(g^2 + 5gh - 2)\ cm$, respectively. (3 marks)

b) Solve the following equations by using **Row Reduction**. Compute the final answer in 2 decimal places.

(6 marks)

$$2x^1 + 5x^2 = 4$$
$$3x^1 + x^2 = 8$$

c) A curve line, $f(x) = x^2 + 5x$, is drawn on the graph. Determine:

i) a point on the curve line if $x = 5$. (2 marks)

ii) the slope of the tangent line passes through a point in **Question 3c (i)**.

(3 marks)

iii) a tangent line equation passes through a point in **Question 3c (i)**.

(2 marks)

d) If $\frac{d}{dx} f(x) = 2x^3 - \frac{2}{x^4}$ and $f(1) = 0$.

i) Integrate the derivative of the function.

(3 marks)

ii) Compute the value of C found in the **Question 3d (ii)** answer.

(2 marks)

iii) According to **Question 3d (i)** and **Question 3d (ii)**, provide the function $f(x)$.

(1 mark)

Total: [25 marks]

4. a) Find the measures of central tendency and dispersion below for the following distribution.

$$6, 6, 7, 8, 5, 10, 6, 4, 4$$

i) Calculate the mean.

(2 marks)

ii) Calculate the median.

(3 marks)

iii) Calculate the mode.

(2 marks)

iv) Calculate the Range.

(2 marks)

v) Calculate the Standard Deviation in 2 decimal places.

(4 marks)

vi) Calculate the Variance in 2 decimal places.

(2 marks)

b) Provide the solution of $\frac{p+2x}{p-2x} + \frac{p+2y}{p-2y}$ if $p = \frac{4xy}{x+y}$.

(10 marks)

Total: [25 marks]

- END OF QUESTIONS -

Formula

Law of Indices	Law of Logarithms	
$a^m \times a^n = a^{m+n}$ $a^m \div a^n = a^{m-n}$ $(a^m)^n = a^{m\times n} = a^{mn}$ $a^{-m} = \frac{1}{a^m}$ $a^0 = 1$ $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$ $a^{\frac{m}{n}} = \sqrt[n]{a^m}$	$\log_a xy = \log_a x + \log_a y$ $\log_a \frac{x}{y} = \log_a x - \log_a y$ $\log_a x^n = n log_a x$ $\log_a b = \frac{\log_c b}{\log_c a}$ $\log_a b = \frac{1}{\log_b a}$ $a^{\log_a x} = x$	$\log_a 1 = 0$ $\log_a a = 1$ $\log_a a^r = r$ $\log_a b \, log_b c = \log_a c$

Matrix

Determinant	$a_{11}\begin{vmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{vmatrix} - a_{12}\begin{vmatrix} a_{21} & a_{23} \\ a_{31} & a_{33} \end{vmatrix} + a_{13}\begin{vmatrix} a_{21} & a_{22} \\ a_{31} & a_{32} \end{vmatrix}$ $= a_{11}(a_{22} \times a_{33} - a_{32} \times a_{23}) - a_{12}(a_{21} \times a_{33} - a_{31} \times a_{23}) + a_{13}(a_{21} \times a_{32} - a_{31} \times a_{22})$
Minor	$\begin{bmatrix} M_{11} & M_{12} & M_{13} \\ M_{21} & M_{22} & M_{23} \\ M_{31} & M_{32} & M_{33} \end{bmatrix}$ $M_{11} = \begin{vmatrix} a_{22} & a_{23} \\ a_{32} & a_{33} \end{vmatrix}$ $M_{21} = \begin{vmatrix} a_{12} & a_{13} \\ a_{32} & a_{33} \end{vmatrix}$ $M_{31} = \begin{vmatrix} a_{12} & a_{13} \\ a_{22} & a_{23} \end{vmatrix}$ $M_{12} = \begin{vmatrix} a_{21} & a_{23} \\ a_{31} & a_{33} \end{vmatrix}$ $M_{22} = \begin{vmatrix} a_{11} & a_{13} \\ a_{31} & a_{33} \end{vmatrix}$ $M_{32} = \begin{vmatrix} a_{11} & a_{13} \\ a_{21} & a_{23} \end{vmatrix}$ $M_{13} = \begin{vmatrix} a_{21} & a_{22} \\ a_{31} & a_{32} \end{vmatrix}$ $M_{23} = \begin{vmatrix} a_{11} & a_{12} \\ a_{31} & a_{32} \end{vmatrix}$ $M_{33} = \begin{vmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{vmatrix}$
Cofactor	$\begin{bmatrix} M_{11} & M_{12} & M_{13} \\ M_{21} & M_{22} & M_{23} \\ M_{31} & M_{32} & M_{33} \end{bmatrix}\begin{bmatrix} + & - & + \\ - & + & - \\ + & - & + \end{bmatrix}$
Adjoint	C^T
Inverse	$\frac{1}{\lvert A \rvert}\,\mathrm{adj}(A)$
Inverse of 2×2 *Matrix*	$A^{-1} = \frac{1}{ad - bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$

Poisson Distribution		Binomial Distribution
$P(X) = \frac{\lambda^x e^{-\lambda}}{x!}$		$P(x) = \frac{n!}{x!\,(n-x)!}\, p^x\, q^{n-x}$
Measures of Location and Dispersion		
Raw Data		Grouped Data
Mean	$\frac{\sum x}{n}$	$\frac{\sum fx}{\sum f}$
Median	value of $\frac{n+1}{2}$ th item	value of $\left(\frac{n}{2}\right)^{\text{th}}$ item $L_m + \frac{c_m}{f_m}\left(\frac{n}{2} - \sum f_b\right)$
Mode	-	$L_m + \frac{f_m - f_b}{2f_m - (f_b + f_a)} c_m$
Range	largest value – smallest value	-
Standard Deviation	$\sigma = \sqrt{\frac{\sum x^2}{N} - \left(\frac{\sum x}{N}\right)^2}$	$\sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$
Variance	σ^2	

Calculus	
The Slope of the Tangent Line	$f'(x) = \frac{d}{dx}(f(x))$
Tangent Line Equation	$y - y_1 = m(x - x_1)$
Derivative of Function	$\int \frac{d}{dx} f(x)dx, f(x)$