FINAL
Examination Paper

(COVER PAGE)

Session : January 2015

Programme : Diploma In Information And Communication Technology (DICTN)

Course : MAT1103 : Fundamentals Of Mathematics

Date of Examination : March 17, 2015

Time : 2:00pm – 4:00pm Reading Time: 

Duration : 2 Hours

Special Instructions :

Answer any FOUR (4) structured-type questions.

Materials permitted : Non-Programmable Calculator

Materials provided : Nil

Examiner (s) : Ms. S.M. Elizabethrani, Fang Yen Yen.

Moderator : Dr. Ng Set Foong

This paper consists of 7 printed pages, including the cover page.
Answer any **FOUR (4)** questions in the answer booklet provided. All questions carry equal marks.

**Question 1**

(a) Simplify \( \left(125x^{-6}y^{13}\right)^{\frac{1}{3}} \) and express your final answer only in **POSITIVE** exponents.  

(2 marks)

(b) Find the following products in simplest form:

(i) \( (36)^{\frac{3}{2}} \times (625)^{\frac{1}{2}} \).  

(2 marks)

(ii) \( (2x - 6)(5x + 11) \).  

(2 marks)

(c) Simplify \( 2\sqrt{20} + \sqrt{45} - \sqrt{80} \).  

(2 marks)

(d) Solve the following equations for \( x \):

(i) \( \left| \frac{2 + x}{5} \right| + 1 = 7 \).  

(5 marks)

(ii) \( 2x(2x - 9) = 0 \).  

(4 marks)

(e) Rationalize the denominator: \( \frac{2}{\sqrt{2} - 3} \).  

(3 marks)

(f) The sum of two numbers is 7 and the sum of their squares is 29. Find the two numbers.  

(5 marks)
Question 2

(a) Solve \( 2^{x-1} = 11 \) for \( x \) and give the answer correct to 3 decimal places.  

(b) Solve \( \log_7(2x) - \log_7(5-x) + \log_7(x-2) = 0 \) for \( x \).  

(c) Find the value of \( a \) :

(i) \( 8(2^{a-1}) = 64^a \)  

(ii) \( \log_a 512 = 3 \)

(d) Solve the following system of equations:

\[
\begin{align*}
x - y + z &= 8 \\
2x + 3y - z &= -2 \\
3x - 2y - 9z &= 9
\end{align*}
\]

(e) Solve the following simultaneous equation:

\[
\begin{align*}
x + y &= 2 \\
2x^2 - 5x - y &= 4
\end{align*}
\]

Question 3

(a) Find the slope and the \( y \)-intercept of the line determined by the equation \( \frac{4x}{-3} = \frac{3y + 5}{-2} \).  

(b) Write an equation of the line passing through \((3, -2)\) and perpendicular to \(3x + 4y = 5\).  

(c) Given that \( f(x) = 2 + \frac{1}{x} \) and \( g(x) = x^2 - 1 \), find

(i) \( f^2(l) \)  

(ii) \( g^{-1}(l) \)  

(iii) \( gf(-l) \)
(d) Sketch the graph of the function given below:

\[ f(x) = x^2 - 6x - 7 \]

show its vertex (maximum or minimum), x and y-intercepts clearly on the graph. (6 marks)

(e) The sum of three consecutive odd numbers is 99. Find the numbers. (4 marks)

Question 4

(a) Solve the following inequalities:

(i) \[-5x - 2 > -3(x + 2) + 17\]. (3 marks)

(ii) \[2x^2 + 9x > 5\]. (4 marks)

(iii) \[-2 \leq \frac{3(x + 7)}{5} \leq 6\]. (3 marks)

(iv) \[2|5x - 4| \leq 8\]. (3 marks)

(b) Sketch the graphical solution of the following system of inequalities:

\[
\begin{align*}
x + 2y & \leq 4 \\
y - 2x & > -6 \\
y & \geq -1
\end{align*}
\]

(5 marks)

(c) Find the distance between the points \((-2, 4)\) and \((-3, 2)\). (3 marks)

(d) Graph \(3x - y = 6\) for \(x \leq 1\). Hence, find the range of the function. (4 marks)
Question 5

(a) Solve the following equations. Give your answers up to 3 decimal places where necessary.
   
   (i) \(9e^{5x} = 1269\) \hspace{1cm} (2 marks)
   
   (ii) \(2 + 4 \ln x = 16\) \hspace{1cm} (2 marks)

(b) Find the sum of all the terms in the arithmetic progression:
   
   \(-9, -2, 5, 12, \ldots, 75.\) \hspace{1cm} (6 marks)

(c) Find the sum of the first 10 terms of the geometric progression:
   
   \(7, -14, 28, -56, \ldots\) \hspace{1cm} (4 marks)

(d) The sum of the first 7 terms of an arithmetic progression is 84, find the common difference if the 7th term is 45. \hspace{1cm} (4 marks)

(e) Find the 16th term of a geometric progression whose first term is \(-2\) and whose fourth term is \(-54.\) \hspace{1cm} (4 marks)

(f) The sum of a number and 9 is multiplied by \(-2\), and the answer is \(-8.\) Find the number. \hspace{1cm} (3 marks)
Question 6

(a) Simplify $5\sqrt{24} - 3\sqrt{96} + 9\sqrt{6}$.  

(b) The length of a rectangle is 8 cm more than its width. Find the dimension of the rectangle if its area is 84 cm$^2$.  

(c) If the price a computer is RM1500 after 40% discount, find the original price of the computer.  

(d) Simplify the following  

(i) $2(10xy - 4x^2y^2 - 3y^3) + (-9x^2y^2 + 4y^3 - 7xy)$  
(ii) $\left(\frac{2x^3y^{-6}}{-4y^{-2}}\right)^2$  

(e) Given A(-2, 3) and B(7, -5), find  

(i) the distance of AB,  
(ii) equation of the line AB in standard form.  

(f) Expand $(2x + 1)^2$ using Binomial theorem.  

(g) Find the fourth term of the expansion of $(2x - 3)^6$.  

-THE END-
Formulae:

**Quadratic Formula**

\[ ax^2 + bx + c = 0 \quad a \neq 0 \]

\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

**Arithmetic Progression**

\[ T_n = a + (n-1)d, \]

\[ S_n = \frac{n}{2} [2a + (n-1)d] ; \quad S_n = \frac{n}{2} [a+l] \]

**Geometric Progression**

\[ T_n = ar^{n-1}, \]

\[ S_n = \frac{a(r^n - 1)}{r - 1}, \quad r \neq 1 ; \quad S_n = \frac{a(1-r^n)}{1-r}, \quad r \neq 1 \]

**Binomial Theorem**

\((k+1)th\ term\ for\ (a+b)^n:\)

\[ ^nC_k a^{n-k} b^k \]