IT Sligo

INSTITIÚID TEICNEOLAÍOCHTA, SLIGEACH
INSTITUTE OF TECHNOLOGY, SLIGO

School of Business & Social Sciences

Head of School: Dr. Michael Barrett

Exam Series: Entrance Exam	**Year 2019**

Module Title:
Maths Entrance Examination

Internal
Examiner(s): Cillian O Murchú

Instructions to Candidates

Time Allowed:	$2\frac{1}{2}$ hours
Number of Questions on Paper:	5
Number of Questions to be attempted:	5

Any Other Special Instructions:

Answer ALL five questions.
Show all necessary work clearly.
Answer should show the appropriate units of measurement, where relevant.
The standard Formulae and Tables booklet is available.

All questions carry equal marks.

Question 1

(a) Solve the equation $-3x^2 + 6x + 8 = 0$. (Give your answers correct to one decimal place.) **(4 marks)**

(b) Solve the simultaneous equations below to find the value of x and the value of y.

$$2x + 3y = 8$$
$$3x + 2y = 7$$

(4 marks)

(c) Solve the following equation for x:
$$\frac{1}{2}(x + 5) = \frac{1}{3}x + \frac{1}{4}$$

(4 marks)

(d) Write the following as a single fraction:
$$\frac{2}{x+3} - \frac{5}{x-1} \qquad x \neq 1 \text{ or } x \neq \text{-}3$$

(4 marks)

(e)

(i) Solve the following equation for x: $\quad 5^{2x-1} = 125$ **(2 marks)**

(ii) Calculate the value of $(4\sqrt{16})^{\frac{1}{2}}$ **(2 marks)**

Total (20 marks)

Question 2

(a) A sum of €18,000 is invested at 1.5% per annum. Calculate the value of the investment after 5 years' time if interest is compounded annually. (Give your answer to the nearest euro) **(4 marks)**

(b) Six years after purchase a computer has a scrap value of €800. If the depreciation rate is 12% per annum, calculate the value of the computer when it was bought 6 years ago. **(6 marks)**

(c) Tom is a financial analyst. In December, he received a €800 bonus, which equalled 20% of his monthly salary. What was his monthly salary? (Give your answer correct to nearest euro) **(3 marks)**

(d) Let $z_1 = -4 - 3i$ and $z_2 = 1 - i$, where $i^2 = -1$. Plot each of the following numbers on an Argand diagram:

(i) z_2 **(2 marks)**

(ii) $z_1 - 4z_2$ **(2 marks)**

(iii) $z_2 z_1$ **(3 marks)**

Total (20 marks)

Question 3

(a)

    (i) A team of 3 students is to be formed out of 8 students. In how many ways can the team be formed? **(3 marks)**

    (ii) How many 3-digit arrangements greater than 500 can be formed using the six digits 0,1, 2, 3, 4, 5 exactly once? **(3 marks)**

(b)

    (i) What is the probability of choosing the letter P from the word PEOPLE? **(3 marks)**

    (ii) In a shipment of 100 televisions, 8 are defective. If a person buys two televisions from that shipment, what is the probability that both are defective? (Give your answer correct to two decimal places) **(3 marks)**

    (iii) A fair dice is thrown 2 times. Find the probability that there will be no sixes thrown. (Give your answer correct to two decimal places) **(3 marks)**

(c) The letters of the word CUSTOMERS are arranged at random.

    (i) How many different arrangements are possible? **(2 marks)**

    (ii) How many of these arrangements begin with the letter C? **(3 marks)**

Total (20 marks)

Question 4

(a) Let $f(x) = x^2 - 5x - 24$, where $x \in \mathbb{R}$.

      (i)   Find the value of $f(-1)$ **(2 marks)**

      (ii)   Solve the equation $f(x) = 0$ **(2 marks)**

      (iii)   Find $f'(x)$, the derivative of $f(x)$ **(2 marks)**

      (iv)   Hence find the coordinates of the local minimum point of the curve $y = f(x)$

                                                   (4 marks)

(b) The volume of water, V, in m³ that remains in a leaking tank after t seconds is given by

$$V = 45000 - 300t + 0.5t^2$$

      (i)   After how many seconds will the tank be empty?   **(3 marks)**

      (ii)   Find the rate of change of volume with respect to t, when t = 40

            seconds.   **(3 marks)**

(c) The first term of a geometric sequence is 3 and the common ratio is 2. Write down the next two terms of the sequence   **(2 marks)**

(d) 5, 13, 21, 29,…. is an arithmetic sequence. Which term of the sequence is 77?

                                                        (2 marks)

Total (20 marks)

Question 5

(a)

    (i) The circle *c* has centre (4, 1) and a radius of 4cm. Write down the equation of circle c. **(3 marks)**

    (ii) Verify if the point (2, 6) lies on circle *c*. **(3 marks)**

(b)   The point (-3,4) is on the line whose equation is $5x + y + k = 0$. Find the value of *k*.

(3 marks)

(c)   The equation of the line L is $x - 2y + 10 = 0$. L contains the point r(2, 6).

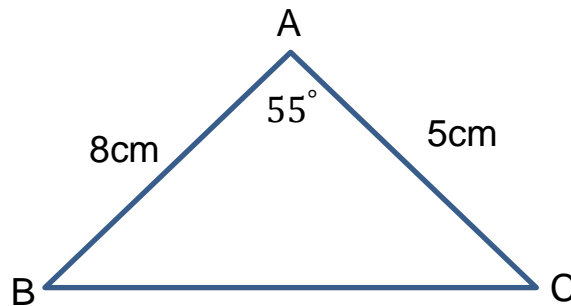Find the equation of the line T which passes through r and which is perpendicular to L.

(4 marks)

(d)   In the triangle ABC below,

$$|AB| = 10 \; cm, |AC| = 6cm, |< BAC| = 55°$$

    (i) Find $|BC|$, correct to one decimal place. **(3 marks)**

    (ii) Hence or otherwise, find $|< ABC|$ and $|< ACB|$, correct to the nearest degree.

(4 marks)

Total (20 marks)