INSTITIÚID TEICNEOLAÍOCHTA, SLIGEACH
INSTITUTE OF TECHNOLOGY, SLIGO

School of Business & Social Sciences

Head of School: Dr. Michael Barrett

Exam Series: Entrance Exam	Year 2018

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 $2x^2 + 15x - 5 = 0$. Give your answers correct to two decimal places. **(4 marks)**

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

$$3x + 5y = 7$$
$$4x + 3y = 2$$

(4 marks)

(c) Solve the following equation for x:

$$\frac{x}{3} = \frac{2(x + 2)}{5} - 4$$

(4 marks)

(d) Write the following as a single fraction:

$$\frac{3}{x+1} + \frac{1}{x-1} \qquad\qquad x \neq \pm 1$$

(4 marks)

(e)

(i) Solve the following equation for x: $2^{3x} = 64$ **(2 marks)**

(ii) Calculate the value of $(2\sqrt{16})^{\frac{1}{3}}$ **(2 marks)**

Total (20 marks)

Question 2

(a)   A sum of €15,000 is invested at 2% per annum. Calculate the value of the investment after 4 years' time if interest is compounded annually. (Give your answer to the nearest euro) **(4 marks)**

(b)   Calculate the annual interest rate necessary if an investment of €10,000 is to double itself over a 5-year period given that interest is compounded annually. (Give your answer correct to two decimal places) **(6 marks)**

(c)   Joe is going to the UK for a work meeting and changes €455 to pounds. How many pounds does he get?   (EUR/GBP = 0.893) Give your answer correct to two decimal places) **(3 marks)**

(d)   Let $z_1 = -5 + 2i$ and $z_2 = 3 - i$, where $i^2 = -1$. Plot each of the following numbers on an Argand diagram:

(i) z_1 **(2 marks)**

(ii) $z_1 + 3z_2$ **(2 marks)**

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

Total (20 marks)

Question 3

(a)

    (i) A team of 4 students is to be formed out of 7 students. In how many ways can the team be formed? **(3 marks)**

    (ii) How many 2-digit arrangements 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 S from the word BUSINESS? **(3 marks)**

    (ii) A box contains discs numbered 1 to 19. If a disc is selected at random, what is the probability that it is an even number or a multiple of 3? **(3 marks)**

    (iii) A jar contains 8 red balls, 4 green balls, 5 white balls and 7 yellow balls. Two balls are chosen from the jar, with replacement. What is the probability that both balls chosen are green? (Give your answer correct to two decimal places) **(3 marks)**

(c) The earnings in euros in a certain week of 10 employees in a local manufacturing plant are as follows:

$$470, 350, 600, 500, 280, 485, 460, 520, 495, 710$$

    (i) Calculate the mean earnings of the above data. **(3 marks)**

    (ii) Calculate the median earnings of the above data. **(2 marks)**

Total (20 marks)

Question 4

(a) Let $(x) = x^2 + 6x + 8$, 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) A car, starting at t = 0 seconds, travels a distance of s metres in t seconds where

$$s = 15t - \frac{3}{2}t^2.$$

    (i)   Find the speed of the car after 3 seconds.   **(2 marks)**

    (ii)   After how many seconds is the speed of the car equal to zero?

                                                                      (2 marks)

    (iii)   Find the distance travelled by the car up to the time its speed is zero.

                                                                       (2 marks)

(c) Let $(x) = x^3 - 2x^2 + 2$, where $x \in \mathbb{R}$.

   Find the equation of the tangent to the curve of $f(x)$ at the point where $x = 2$

                                                                         (4 marks)

Total (20 marks)

Question 5

(a)
    (i) The circle c has centre (5, -2) and a radius of 5cm. Write down the equation of circle c. **(3 marks)**

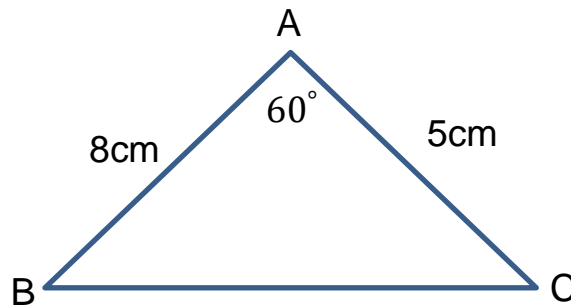   (ii) Verify if the point (4,-1) lies on circle c. **(3 marks)**

(b) A (4, -3), B (2, 0), C (1, -5) and D (0, -4) are four points.

    (i)   Show all points on a co-ordinate diagram. **(2 marks)**

    (ii)   Find the slope of the line CD. **(2 marks)**

    (iii)   Find the equation of the line AB. **(3 marks)**

(c)   In the triangle ABC below,

$$|AB| = 8cm, |AC| = 5cm, |< BAC| = 60°$$

    (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)

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              A
             /60°\
      8cm   /     \  5cm
           /       \
          /         \
         B_____C
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Total (20 marks)