INSTITIÚID TEICNEOLAÍOCHTA, SLIGEACH
INSTITUTE OF TECHNOLOGY, SLIGO

School of Business & Social Sciences

Head of School: Dr. Michael Barrett

Exam Series: Entrance Exam	**Year 2020**

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 $4x^2 + 8x - 1 = 0$. (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*.

$$7x - y = 15$$
$$3x - 2y = 19$$

(4 marks)

(c) Solve the following equation for *x*:

$$\frac{1}{3}(x + 3) = \frac{1}{2}(x + 4)$$

(4 marks)

(d) Write the following as a single fraction:

$$\frac{2}{x+1} + \frac{5}{x+2} \qquad x \neq -1 \text{ or } x \neq -2$$

(4 marks)

(e)

(i) Solve the following equation for *x*: $3^{x+2} = 27$ **(2 marks)**

(ii) Calculate the value of $(2\sqrt{64})^{\frac{1}{2}}$ **(2 marks)**

Total (20 marks)

Question 2

(a) A sum of €22,000 is invested at 1.25% per annum. Calculate the value of the investment after 6 years' time if interest is compounded annually. (Give your answer to the nearest euro) **(4 marks)**

(b) A company budgets to manufacture 10,000 units of its product. The materials required are 50kg per unit @ €1.25 per kg. Each unit produced requires 5 hours of direct labour @ €12.50 per hour. Indirect costs are €16,000. Calculate the total cost to manufacture the 10,000 units. **(5 marks)**

(c) A salesperson makes sales of €450,000. They receive commission of 1% on the first €300,000 and 0.75% on the remainder. Calculate the total commission due to the salesperson. (Give your answer to the nearest euro) **(4 marks)**

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

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

(ii) $z_2 - 2z_1$ **(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 4-digit arrangements greater than 6,000 can be formed using the eight digits 0,1, 2, 3, 4, 5, 6, 7 exactly once? **(4 marks)**

(b)

(i) What is the probability of choosing the letter O from the word CORPORATION? (Give your answer correct to two decimal places) **(3 marks)**

(ii) In a box, there are 9 red, 7 blue and 8 green balls. One ball is picked up randomly. What is the probability that it is neither red nor green? (Give your answer correct to two decimal places) **(3 marks)**

(iii) Three unbiased coins are tossed. What is the probability of getting at most two tails? (Give your answer correct to two decimal places) **(4 marks)**

(c) A sales representative makes calls to three separate unrelated customers. The chance of making a sale at any one of them is 75 per cent. What is the probability that a sale is made on the third call only? (Give your answer correct to two decimal places) **(3 marks)**

Total (20 marks)

Question 4

(a) Let $f(x) = -2x^2 + 6x - 8$, 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 maximum point of the curve $y = f(x)$ **(4 marks)**

(b) A car begins to slow down at *p* in order to stop at a red traffic light at *q*. The distance of the car from *p*, after *t* seconds, is given by

$$s = 12t - 1.5t^2$$

where s is in metres

(i) Find the speed of the car as it passes p. **(4 marks)**

(ii) Find the time taken to stop. **(2 marks)**

(c) The first term of an arithmetic sequence is 80 and the common difference is – 4. Write down the first three terms of the sequence. **(2 marks)**

(d) In a geometric sequence of positive terms, the third term is $\frac{1}{4}$ and the fifth term is $\frac{1}{16}$ Find r, the common ratio. **(2 marks)**

Total (20 marks)

Question 5

(a)

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

(ii) The line $x - 2y + 5 = 0$ intersects the circle $x^2 + y^2 = 10$ at the points a and b. Find the co-ordinates of a and the co-ordinates of b. **(3 marks)**

(b) Find the distance between the two points (3, 2) and (8, 14). **(3 marks)**

(c) P is the line 3x + 2y +12 = 0. Lis the line that passes through the point (7, 3) and is perpendicular to P.

Find the equation of the line L. **(4 marks)**

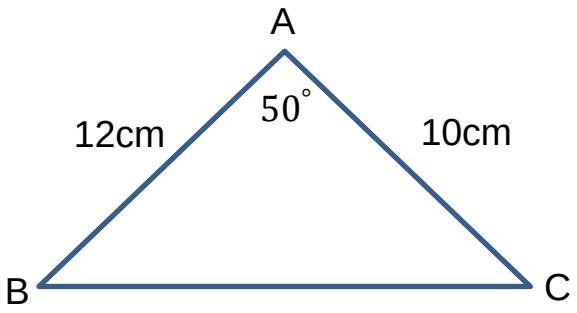
(d) In the triangle ABC below,

$$|\boldsymbol{AB}| = \mathbf{12}\ \boldsymbol{cm}, |\boldsymbol{AC}| = \mathbf{10}\boldsymbol{cm}, |< \boldsymbol{BAC}| = \mathbf{50}^\circ$$

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

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

(4 marks)



Total (20 marks)