# Instructions to Candidates

<table>
<thead>
<tr>
<th>Time Allowed:</th>
<th>$2 \frac{1}{2}$ hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Questions on Paper:</td>
<td>5</td>
</tr>
<tr>
<td>Number of Questions to be attempted:</td>
<td>5</td>
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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.) \((4 \text{ marks})\)

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

\[
\begin{align*}
2x + 3y &= 8 \\
3x + 2y &= 7
\end{align*}
\]

\((4 \text{ marks})\)

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

\[
\frac{1}{2}(x + 5) = \frac{1}{3}x + \frac{1}{4}
\]

\((4 \text{ marks})\)

(d) Write the following as a single fraction:

\[
\frac{2}{x+3} - \frac{5}{x-1} \quad x \neq 1 \text{ or } x \neq -3
\]

\((4 \text{ marks})\)

(e) \((i)\) Solve the following equation for \(x\):

\[5^{2x-1} = 125\]

\((2 \text{ marks})\)

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

\((2 \text{ marks})\)

Total \((20 \text{ marks})\)

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) \((4 \text{ marks})\)

(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. \((6 \text{ marks})\)

(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) \((3 \text{ marks})\)

(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:

\[(i) \quad z_2 \quad \text{(2 marks)}\]

\[(ii) \quad z_1 - 4z_2 \quad \text{(2 marks)}\]

\[(iii) \quad z_2z_1 \quad \text{(3 marks)}\]

Total \((20 \text{ marks})\)
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? \(\text{(3 marks)}\)

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

(b)

(i) What is the probability of choosing the letter P from the word PEOPLE? \(\text{(3 marks)}\)

(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) \(\text{(3 marks)}\)

(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) \(\text{(3 marks)}\)

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

(i) How many different arrangements are possible? \(\text{(2 marks)}\)

(ii) How many of these arrangements begin with the letter C? \(\text{(3 marks)}\)

Total (20 marks)
Question 4

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

(i) Find the value of \( f(-1) \) \hspace{2cm} (2 marks)

(ii) Solve the equation \( f(x) = 0 \) \hspace{2cm} (2 marks)

(iii) Find \( f'(x) \), the derivative of \( f(x) \) \hspace{2cm} (2 marks)

(iv) Hence find the coordinates of the local minimum point of the curve \( y = f(x) \) \hspace{2cm} (4 marks)

(b) The volume of water, \( V \), in m\(^3\) 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? \hspace{2cm} (3 marks)

(ii) Find the rate of change of volume with respect to \( t \), when \( t = 40 \) seconds. \hspace{2cm} (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 \hspace{2cm} (2 marks)

(d) 5, 13, 21, 29,… is an arithmetic sequence. Which term of the sequence is 77? \hspace{2cm} (2 marks)

Total (20 marks)
Question 5

(a)  
(i) The circle c has centre (4, 1) and a radius of 4\, \text{cm}. Write down the equation of circle c.  

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

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

(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.

(d) In the triangle ABC below,

\[|AB| = 10\, \text{cm}, |AC| = 6\, \text{cm}, |\angle BAC| = 55^\circ\]

(i) Find \(|BC|\), correct to one decimal place.

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