**Mathematics S7MA3**

**Part A: Examination without technological tool**

Date: Tuesday 31st January 2023

Duration: 2 hours (120 minutes)

Course: S7-MA3 EN

Teacher: K. Osborne

**Authorised material:**

- Formula booklet

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*Exam without* *calculator*

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| **PART A** | | |
|  | | **Marks** |
| **1** | Consider the function .  **Determine** the equation of the tangent to the curve at . | **5** |
| **2** | The population of a small town increases linearly. In 2012 the population was 5000. Five years later it was found to be 6250.   1. **Determine** a model for the population as a function of where is the time in years after 2012. 2. **Investigate** in which year the population exceeds 7000. | **3**  **2** |
| **3** | A student kicks a ball up into the air. The height of the ball, , in metres, can be modelled by the function  where is the height in metres and is the time in seconds after it is kicked.  **Determine** the maximum height reached by the ball. | **5** |
| **4** | The function is a primitive function of .  Consider the graph of the function shown below.  **Show** that the shaded area bounded by the graph of , the lines and and the x-axis is equal to square units. | **5** |
| **5** | Scientists observe the population of ladybirds in a field. The population can be modelled by the function where is the number of ladybirds and is the time in weeks after the observation starts.   1. How many ladybirds are there at the start of the observation? 2. **Calculate** the number of ladybirds after one week. 3. **Determine** the weekly percentage increase. | **1**  **2**  **2** |
| **6** | An exponential function is of the form . The graph of passes through the co-ordinates and . **Determine** the parameters and , and give the function | **5** |
| **7** | The graph below is the graph of the derivative  For each of the statements below indicate if it is true or false and give a reason for your answer. Marks will only be given if both the answer and the reason are correct.   1. The function has a minimum at . 2. The function is decreasing over the interval . 3. The function has two turning points. 4. The -intercept of the graph of cannot be determined from the graph of . 5. The graph of must have two -intercepts. | **5** |
| **8** | The graph of a sine function is shown below.  Chart, line chart  Description automatically generated   1. **Determine** the period. 2. **Determine** the parameters a, b, c and d in the function | **1**  **4** |
| **9** | Consider the graph of shown below.  Given that and , **find** . | **5** |
| **10** | *The acceleration function is defined as ,*  *where is the velocity function.*  The acceleration (in ) of an object at a time (in seconds) can be modelled by the function . The graph of is shown below.    The velocity of the object at is equal to .  **Calculate** the velocity after 2 seconds. | **5** |