

# 

### Semester Two Examination, 2020

### Question/Answer booklet

# MATHEMATICS

**SOLUTIONS**

**METHODS**

**UNITS 1&2**

## Section Two:

## Calculator-assumed

(Booklet 2 of 3)

## Time allowed for this section

Reading time before commencing work: ten minutes

Working time: one hundred minutes

## Materials required/recommended for this section

***To be provided by the supervisor***

This Question/Answer booklet

Formula sheet (retained from Section One)

***To be provided by the candidate***

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,  
correction fluid/tape, eraser, ruler, highlighters

Special items: drawing instruments, templates, notes on two unfolded sheets of A4 paper, and up to three calculators approved for use in this examination

## Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

## Structure of this paper

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Section | Number of questions available | Number of questions to be answered | Working time (minutes) | Marks available | Percentage of examination |
| Section One: Calculator-free | 8 | 8 | 50 | 52 | 35 |
| Section Two: Calculator-assumed | 12 | 12 | 100 | 90 | 65 |
|  | | |  | **Total** | 100 |

## Instructions to candidates

1. The rules for the conduct of examinations are detailed in the school handbook. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer booklet preferably using a blue/black pen.  
Do not use erasable or gel pens.

3. You must be careful to confine your answers to the specific question asked and to follow any instructions that are specific to a particular question.

4. Show all your working clearly. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat any question, ensure that you cancel the answer you do not wish to have marked.

5. It is recommended that you do not use pencil, except in diagrams.

6. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

7. The Formula sheet is not to be handed in with your Question/Answer booklet.

Section Two: Calculator-assumed 65% (90 Marks)

This section has**twelve** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 100 minutes.

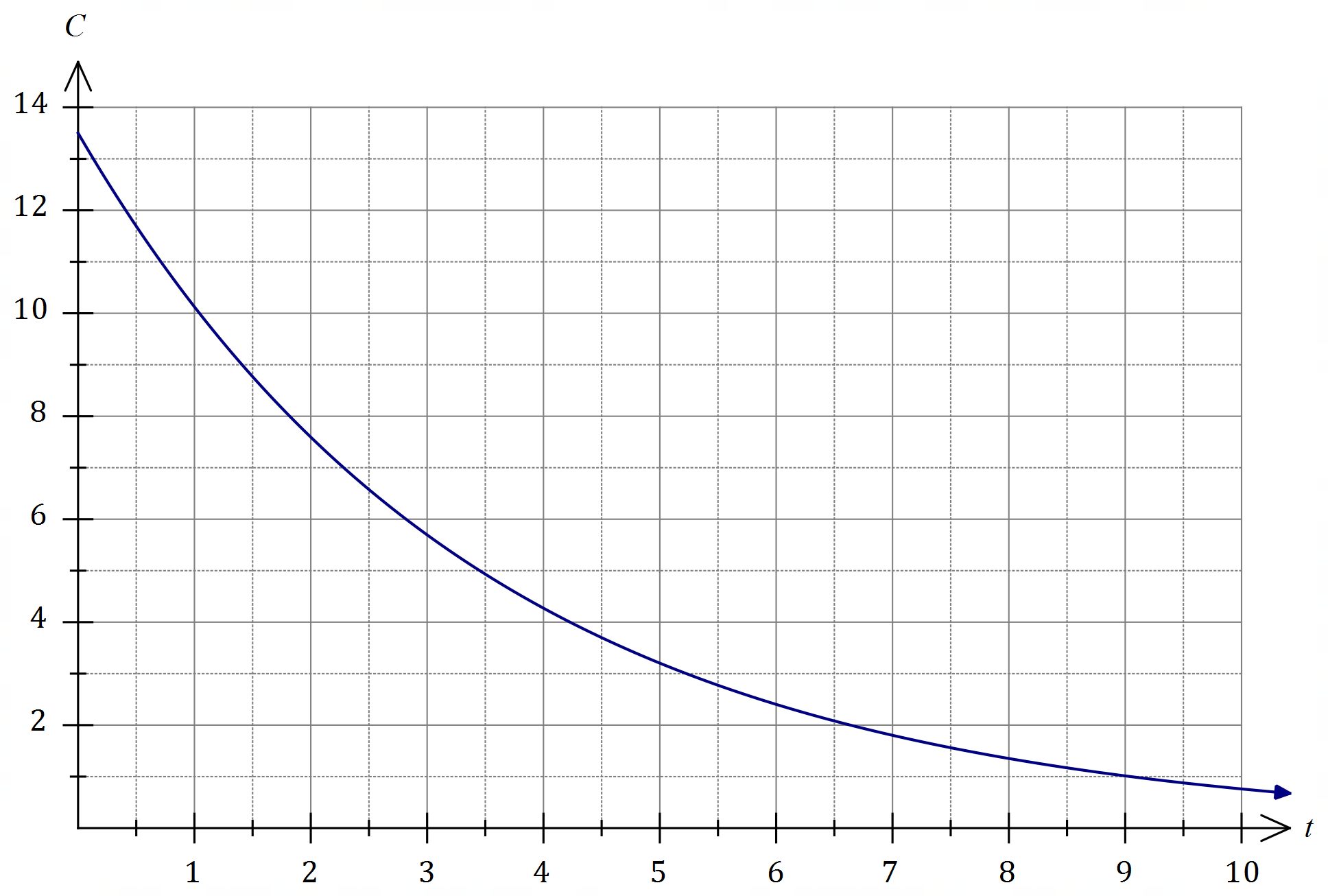
Question 9 (6 marks)

The cost, dollars, for a gigabyte of computer memory between the end of year 2008 ( and the end of year 2018 ( can be modelled by the equation .

(a) Calculate at the end of year 2013. (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct cost, to nearest cent |

(b) Draw the graph of against on the axes below. (3 marks)



|  |
| --- |
| **Solution** |
| See graph |
| **Specific behaviours** |
| ✓ through and  ü close to and  ü smooth curve throughout |

(c) Assuming that the model continues to be valid, during which year will the cost of computer memory fall below cents per gigabyte? (2 marks)

|  |
| --- |
| **Solution** |
| Hence during the year |
| **Specific behaviours** |
| ✓ correct value of  ü correct year |

Question 10 (6 marks)

For the events and , and .

Determine when

(a) and are mutually exclusive. (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct probability |

(b) . (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct probability |

(c) . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ valid method used  ✓ correct probability |

(d) and are independent. (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓  ✓ correct probability |

Question 11 (6 marks)

In flat rate depreciation, the value of an asset is depreciated by a fixed amount each year. Using the flat rate model, the recursive rule gives the value of a machine in dollars after years, where .

(a) Determine

(i) the value of the machine after years. (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct value |

(ii) the number of years until the machine has no value. (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct number |

Using flat rate depreciation, the value of another machine after years will be and after a further years it will become worthless. The value of this machine after years can be modelled using , where and are constants.

(b) Determine the value of and the value of . (2 marks)

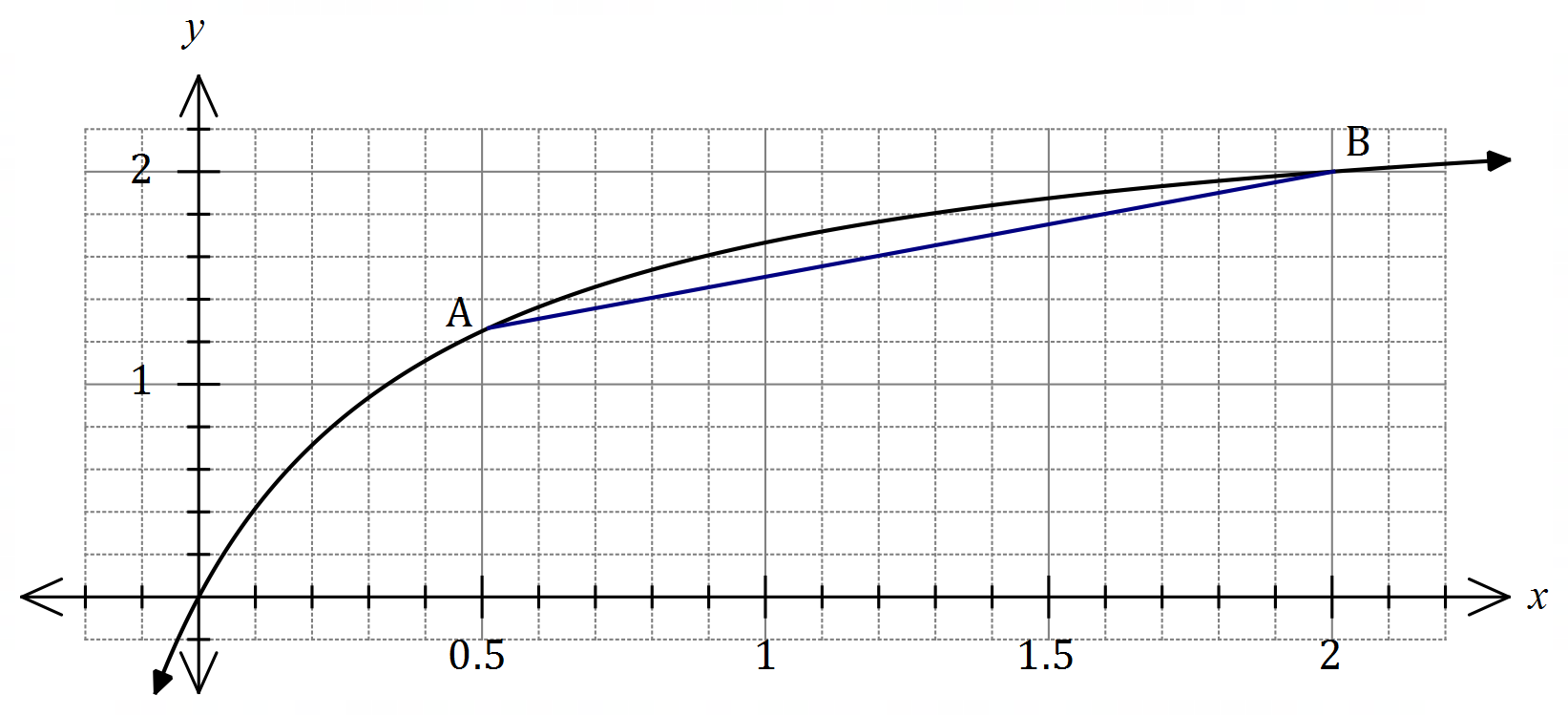
|  |
| --- |
| **Solution** |
| Hence and . |
| **Specific behaviours** |
| ✓ annual loss in value  ü initial value |

(c) Given that both machines begin to depreciate at the same time, determine the number of years until the machines have the same value. State this value. (2 marks)

|  |
| --- |
| **Solution** |
| Using a table, the values are both after years. |
| **Specific behaviours** |
| ✓ years  ü value |

Question 12 (7 marks)

Part of the graph of is shown below, where .



Points and lie on the curve and have -coordinates of and respectively.

(a) Draw the chord to the curve between and on the axes above and determine the gradient of this chord. (3 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ draws and labels chord on graph  ü correct -values  ü correct gradient |

Point , with an -coordinate of , lies on the curve between and . The gradient of the chord is .

(b) Calculate for the values of shown in the table below, recording the gradients in the table to decimal places. (2 marks)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

|  |
| --- |
| **Solution** |
| See table |
| **Specific behaviours** |
| ✓ one correct gradient  ü all correct gradients |

(c) Determine a limiting value for as becomes very close to and state what feature of the graph of this value represents. (2 marks)

|  |
| --- |
| **Solution** |
| As then . This is the gradient of at the point . |
| **Specific behaviours** |
| ✓ limiting value  ü states gradient at the point |

Question 13 (7 marks)

A set of undergraduates were asked to choose their electives for the following year.  
 chose Music (), chose Art () and chose neither Music nor Art.

(a) Determine how many of the undergraduates chose both Art and Music. (2 marks)

|  |
| --- |
| **Solution** |
| Hence chose both electives. |
| **Specific behaviours** |
| ✓ indicates union of sets  ü correct number |

(b) Determine the probability that a randomly chosen undergraduate from the set chose:

(i) Music. (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct probability |

(ii) Music but not Art. (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct probability |

(iii) Music given that they chose Art. (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct probability |

(c) Use your answers above to explain whether the choice of Music and Art electives is independent for these undergraduates. (2 marks)

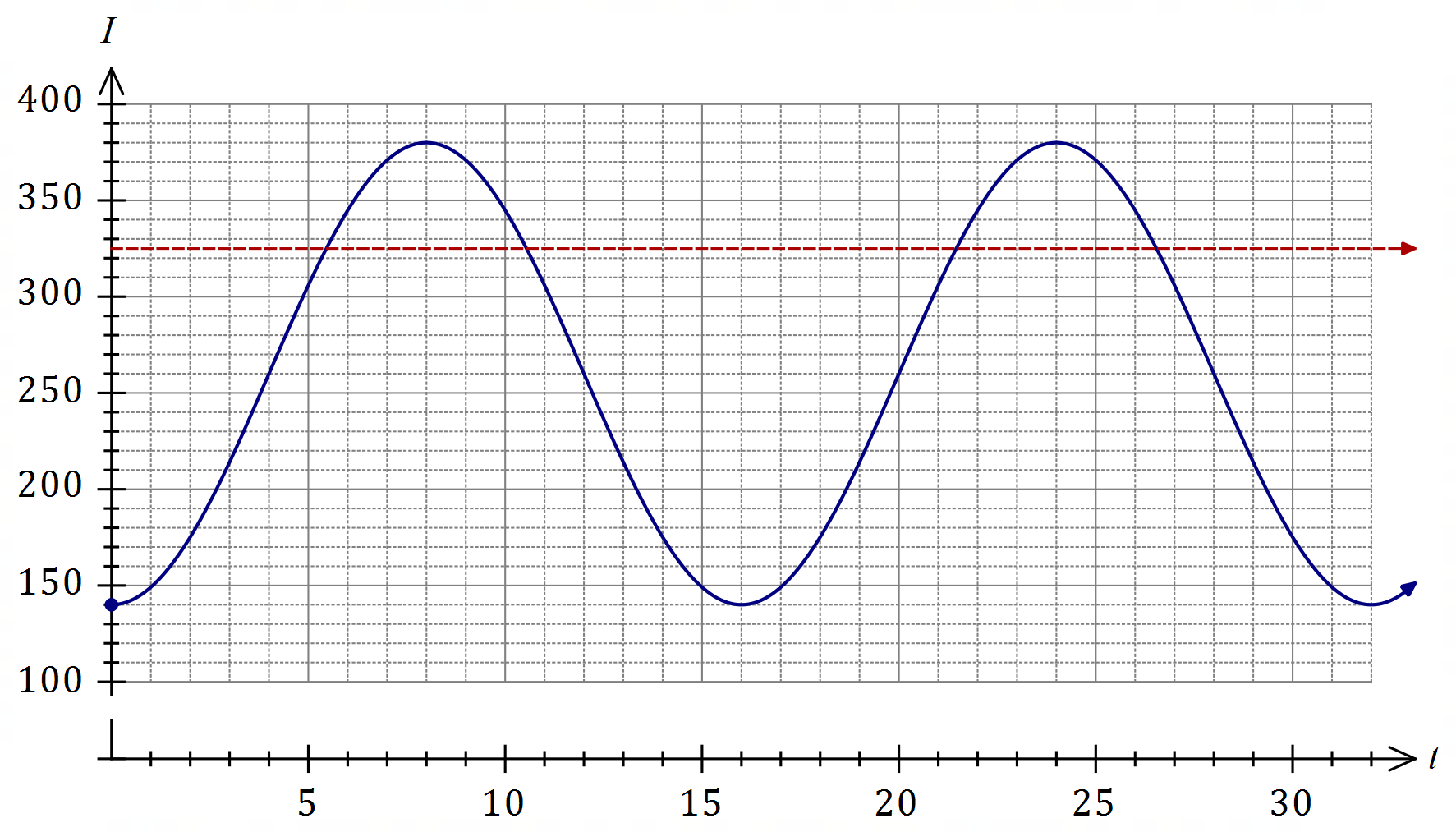
|  |
| --- |
| **Solution** |
| Choice is not independent, as .  (*Undergraduates are less likely to choose music if they have chosen art*.) |
| **Specific behaviours** |
| ✓ states not independent (or dependent)  ü explanation using existing probabilities in part (b) |

Question 14 (6 marks)

When an alternating current is used to power a light globe, the intensity of light emitted from the globe, lumens, varies with time milliseconds and can be modelled by the formula,

(a) Draw the graph of against on the axes below for . (3 marks)

|  |
| --- |
| **Solution** |
| See graph |
| **Specific behaviours** |
| ✓ complete cycles, ü locates all min and max, ü shape & smooth curve |



(b) State the period of . (1 mark)

|  |
| --- |
| **Solution** |
| Period is milliseconds |
| **Specific behaviours** |
| ✓ correct period |

(c) Determine the percentage (correct to the nearest whole number) of each cycle that the intensity of light is above lumen.

(2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ indicates interval in ms  ü correct percentage to nearest whole number |

Question 15 (7 marks)

A farmer was treating a large area of land for an invasive weed. The area treated on the first day was m2. Over the following months more resources were utilised so that the area treated each day was more than the previous day.

(a) Determine the area treated on the day. (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ indicates use of general term formula  ü correct area |

The cost of the treatment was cents per square metre.

(b) On which day did the cost of the days treatment first exceed ? (3 marks)

|  |
| --- |
| **Solution** |
| On day . |
| **Specific behaviours** |
| ü adjusts sequence  ✓ indicates equation/inequality to solve  ü correct day |

(c) Determine, to the nearest ten dollars, the total cost of the first days of treatment.

(2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ indicates use of sum formula  ü total cost, rounded as required |

Supplementary page

Question number: \_\_\_\_\_\_\_\_\_

Supplementary page

Question number: \_\_\_\_\_\_\_\_\_

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