**Year 12 Examination, 2017**

**Question/Answer Booklet**

**MATHEMATICS SPECIALIST**

**Section One: Calculator-free**

Student Name/Number: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Teacher Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Time allowed for this section**

Reading time before commencing work: five minutes

Working time for this section: fifty minutes

**Materials required/recommended for this section**

**To be provided by the supervisor:** This Question/Answer Booklet

Formula Sheet

**To be provided by the candidate:**

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,

correction fluid/tape, eraser, ruler, highlighters

Special items: nil

**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 notes or other items of a non-personal nature in the examination room. 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 exam |
| Section One: Calculator-free | 7 | 7 | 50 | 54 | 35 |
| Section Two: Calculator-assumed | 11 | 11 | 100 | 100 | 65 |
|  | | | | | 100 |

**Instructions to candidates**

1. The rules for the conduct of School exams are detailed in the *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_School/College assessment policy*. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in this Question/Answer Booklet.

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

1. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
   * Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
   * Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.
2. **Show all 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.
3. It is recommended that you **do not use pencil**, except in diagrams.
4. The Formula Sheet is **not** to be handed in with your Question/Answer Booklet.

**Section One: Calculator-free 35% (54 Marks)**

This section has **seven (7)** questions. Answer **all** questions. Write your answers in the spaces provided.

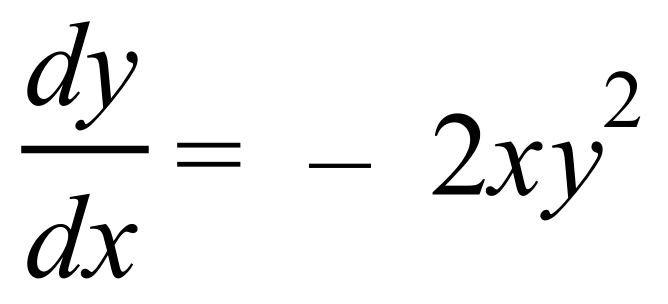
Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

* Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
* Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 50 minutes.

**Question 1 (4 marks)**

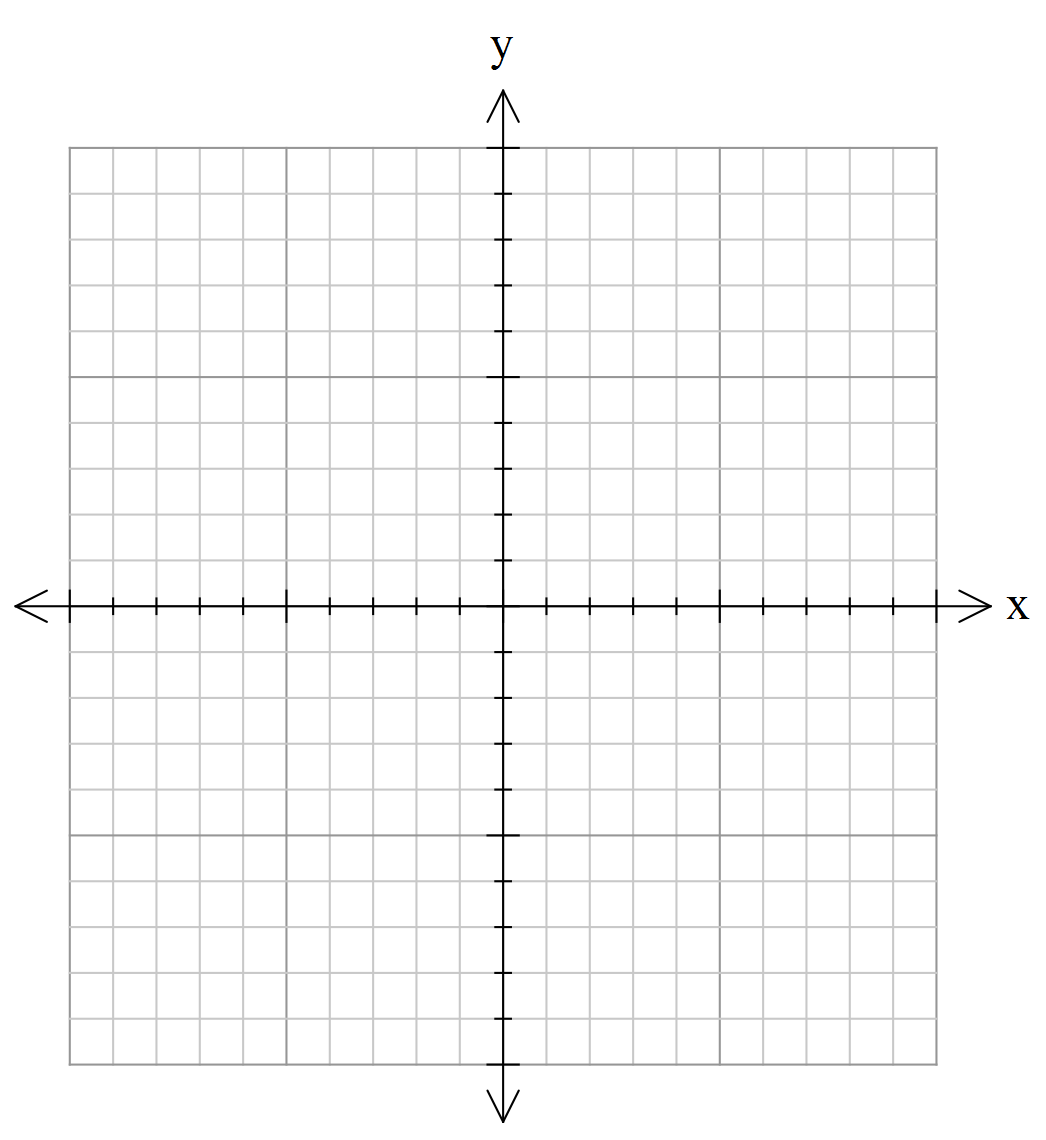
Solve the differential equation



given that 

**Question 2 (6 marks)**

Sketch the function  paying particular attention to the location of its turning point(s) and the behaviour as.



**Question 3 (8 marks)**

1. Determine the two points P and Q where the curve

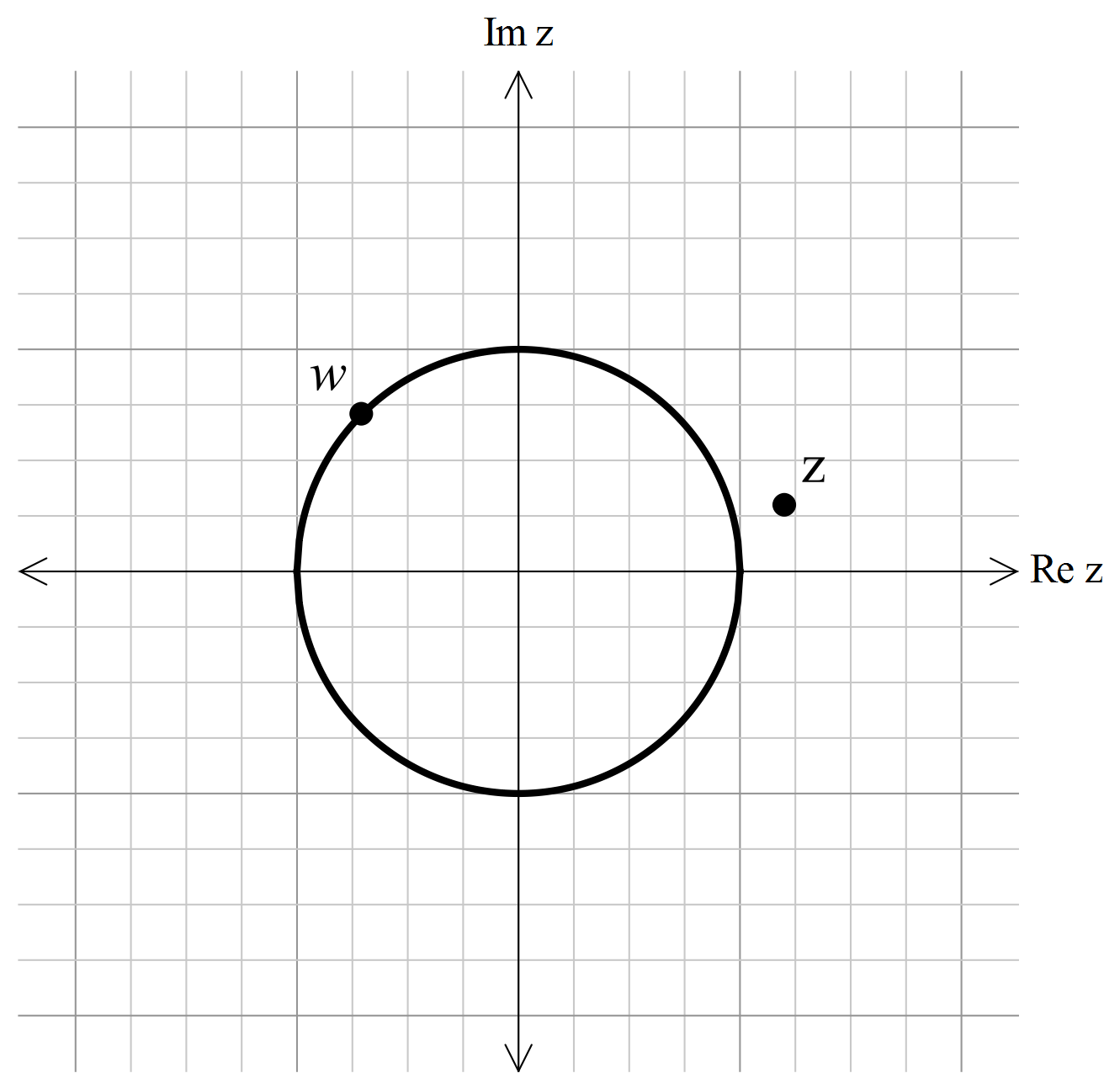


cuts the-axis. (2 marks)

1. Show that the tangents to the curve at P and Q are parallel. (4 marks)
2. The point R on the curve has  co-ordinate 2.99. Use increments to deduce an approximation for the  co-ordinate of R. (2 marks)

**Question 4 (7 marks)**

The positions in the complex plane of the numbersandtogether with the unit circle are shown below.



1. Indicate, as accurately as possible, the positions in the complex plane of the numbers:
2.  (1 mark)
3.  (1 mark)
4.  (1 mark)
5.  (1 mark)
6.  (1 mark)
7. Sketch on the diagram the set of complex numbers  which satisfy both the inequalities

 and  . (2 marks)

**Question 5 (12 marks)**

Determine the following integrals:

1.  (3 marks)
2. . (3 marks)
3. Use the substitution to evaluate (3 marks)  .
4. Use the substitution  to determine the value of  if

. (3 marks)

**Question 6 (8 marks)**

1. The formula for a confidence interval for the mean  of a population is often expressed in the form



where  is the sample mean and  is called the ‘margin of error’.

Write down a formula for  assuming that the sample mean  is normally distributed and the standard deviation of the population is known. (1 mark)

1. Describe the effect on the margin of error if
2. the sample size doubles. (1 mark)
3. the level of confidence increases. (1 mark)
4. the standard deviation of the underlying population doubles. (1 mark)
5. State whether the following statements about confidence intervals for  are true or false. Justify your answers.
6. If there are 10 independent samples from the same population, then exactly 9 of the corresponding 90% confidence intervals will contain. (2 marks)
7. Each 95% confidence interval for contains 95% of the underlying population.

(2 marks)

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**Question 7 (9 marks)**

Two vectors are defined to be 

For some scalar value , the vector is orthogonal to .

1. Determine the value of. (3 marks)
2. Determine the equation of the line parallel to **c** that passes through the origin. Express the equation of the line in both vector and parametric forms. (2 marks)
3. Determine the vector product of and . (2 marks)
4. Write down the equation of the plane that is perpendicular to both and  and that contains the origin. (2 marks)

**Additional working space**

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

**Additional working space**

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

**Acknowledgements**

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