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Semester One Examination, 2021

Question/Answer booklet

MATHEMATICS  
METHODS  
UNIT 1

**SOLUTIONS**

Section One:  
Calculator-free

Student’s name

|  |  |
| --- | --- |
| Number of additional answer booklets used (if applicable): |  |

## Time allowed for this section

Reading time before commencing work: five minutes

Working time: 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 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 | 15 | 15 | 100 | 98 | 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 One: Calculator-free 35% (52 Marks)

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

Working time: 50 minutes.

Question 1 (6 marks)

Solve the following equations for .

(a) . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ first correct solution  ü second correct solution |

(b) . (2 marks)

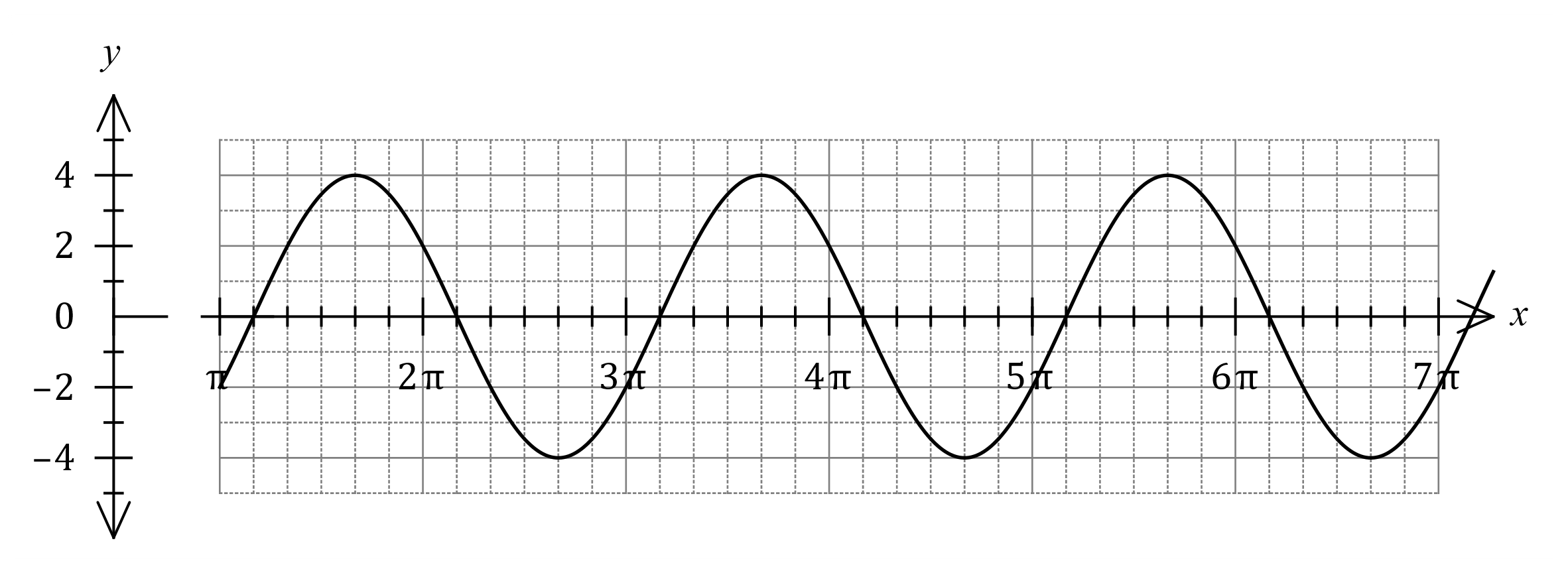
|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ indicates correct method  ü both correct solutions |

(c) . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ indicates correct method  ü both correct solutions |

Question 2 (6 marks)

(a) The graph of is shown below, where and are positive constants.



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

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ amplitude  ü least value of phase shift |

(b) Let .  
  
Determine the zeros of the graph of for . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ locates one zero  ü locates second zero |

(c) Let .

Determine the coordinates of the maximum of the graph of for .

(2 marks)

|  |
| --- |
| **Solution** |
| Maximum of when , but period trebled and so now when .  Hence maximum at . |
| **Specific behaviours** |
| ✓ correct -coordinate  ✓ correct -coordinate |

Question 3 (7 marks)

Consider the function , where and are constants. The graph of has an asymptote with equation and passes through the point .

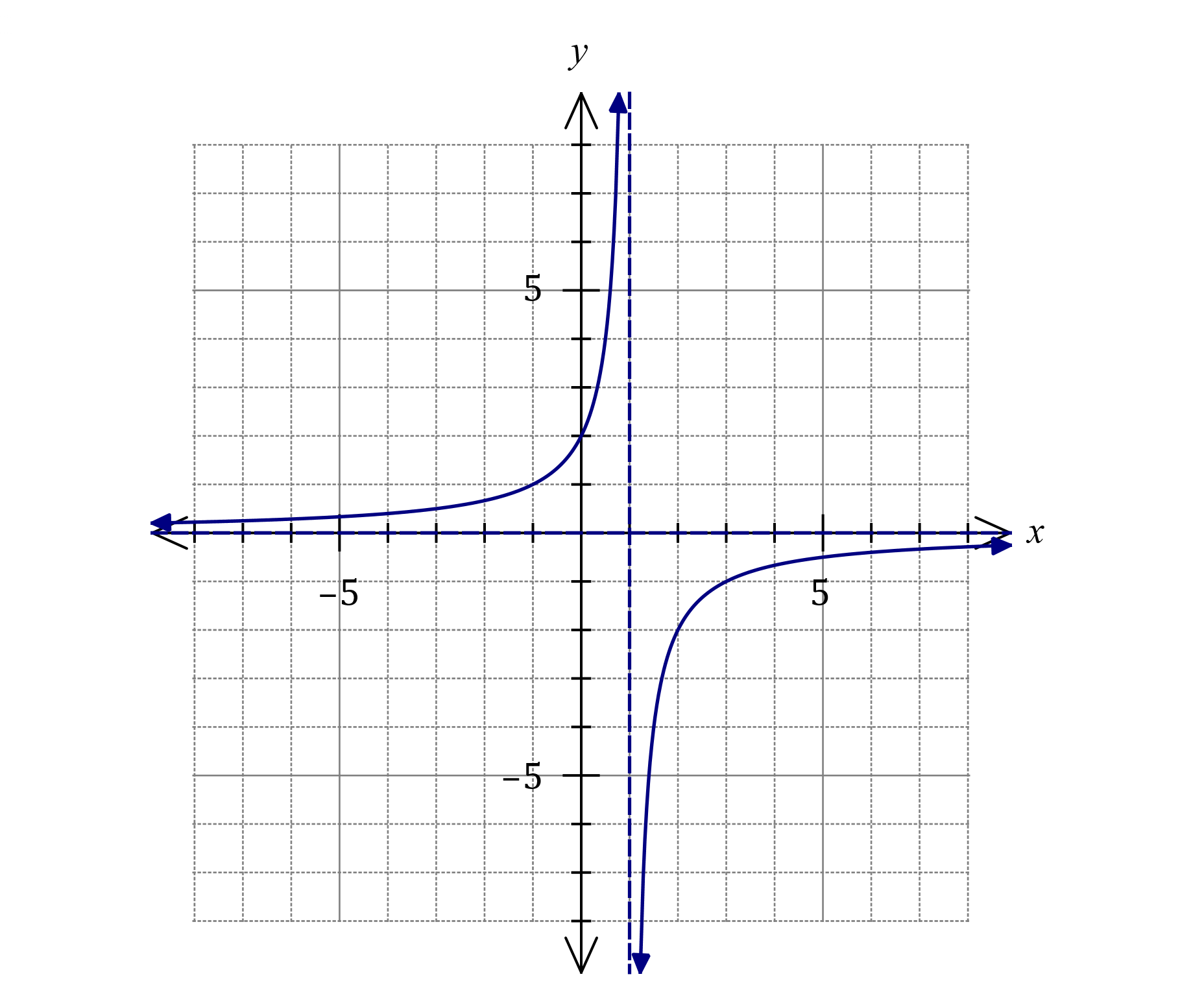
(a) Determine the value of and the value of . (3 marks)

|  |
| --- |
| **Solution** |
| Using asymptote, .  Using point: |
| **Specific behaviours** |
| ✓ value of  ü forms equation using point  ü calculates value of |

(b) State the equation of the other asymptote of the graph of . (1 mark)

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

(c) Sketch the graph of on the axes below. (3 marks)



|  |
| --- |
| **Solution** |
| See graph |
| **Specific behaviours** |
| ✓ thru' and  ü asymptotic behaviour  ü smooth hyperbolic curves |

Question 4 (7 marks)

The straight line has equation .

(a) Write the equation of in the form to show that its gradient is . (1 mark)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ correct values of and |

Line is parallel to and passes through the point .

Line is perpendicular to and passes through the point .

(b) Determine the point of intersection of and . (6 marks)

|  |
| --- |
| **Solution** |
| Lines intersect at . |
| **Specific behaviours** |
| ✓ equation of  ü gradient of  ü equation of  ü equates lines and groups like terms  ü solves for  ü solves for and states point of intersection |

Question 5 (7 marks)

(a) Determine the number of possible combinations when four students must be chosen from a small class of six. (2 marks)

|  |
| --- |
| **Solution** |
| There are combinations. |
| **Specific behaviours** |
| ✓ indicates use of formula or Pascal’s triangle  ü correct number |

(b) Determine the coefficient of the term in the expansion of

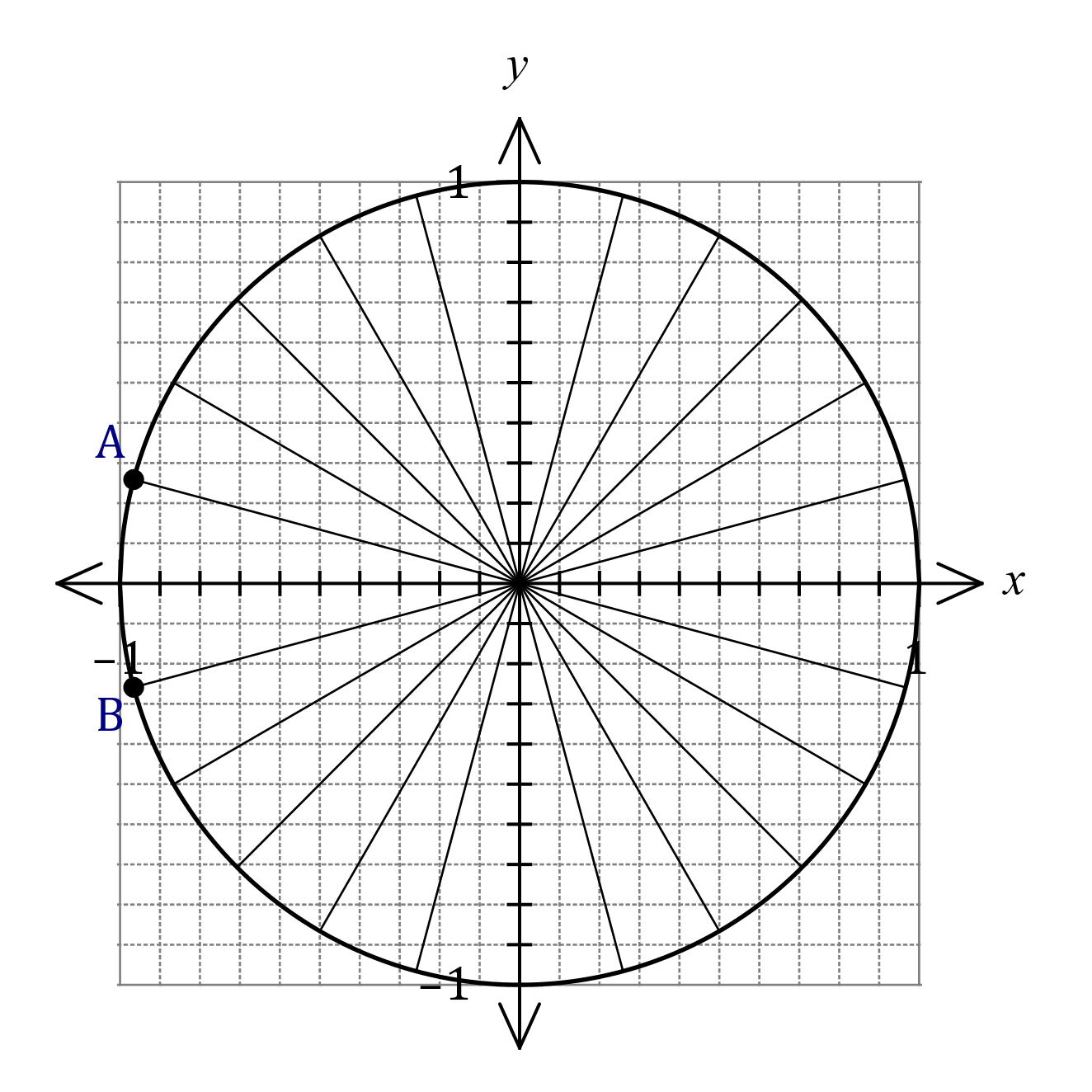
(i) . (2 marks)

|  |
| --- |
| **Solution** |
| Coefficient is . |
| **Specific behaviours** |
| ✓ indicates method  ü clearly states coefficient |

(ii) . (3 marks)

|  |
| --- |
| **Solution** |
| Coefficient is . |
| **Specific behaviours** |
| ✓ indicates use of combination from (a) as part of expansion   indicates two other parts for required expansion  ✓ expands factors, showing correct coefficient |

Question 6 (6 marks)

1. A unit circle is shown.  
     
     
   Mark on the circumference of the  
   circle the points A and B so that  
   rays drawn from the origin to each point make anticlockwise angles

of and from the positive

-axis respectively.  
  
  
Hence estimate the value of

and the value of .

|  |
| --- |
| **Solution** |
| See graph for points. |
| **Specific behaviours** |
| ✓ both points located correctly  ü value of cosine within the range given  ü value of sine within the range given |

(3 marks)

(b) Solve the equation for . (3 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ eliminates tan from equation  ü one correct solution  ü second correct solution |

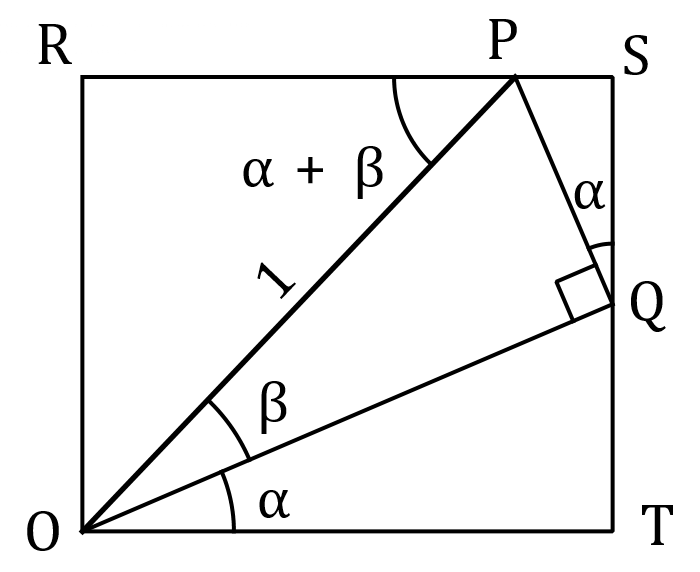
Question 7 (6 marks)

Two polynomial functions are defined by and .

Determine the coordinates of the point(s) of intersection of and .

|  |
| --- |
| **Solution** |
| Expand  Equate functions:  Equate to zero:  Find root:  Start factorising:  Complete factorising:  Coordinates:  Intersect at and . |
| **Specific behaviours** |
| ✓ expands quadratic  ü equate functions and then to zero  ü finds first root  ü factors into linear and quadratic  ü completes factorisation  ü determines -coordinates and states coordinates of all points |

Question 8 (7 marks)

Consider rectangle that  
contains the right triangle   
as shown.

Let the length of and  
.

(a) Show that . (2 marks)

|  |
| --- |
| **Solution** |
| In triangle , .  Hence, in triangle , |
| **Specific behaviours** |
| ✓ uses for length of  ü uses to obtain result |

(b) Determine expressions for the lengths of and and hence prove the angle sum identity . (3 marks)

|  |
| --- |
| **Solution** |
| Because is a rectangle then |
| **Specific behaviours** |
| ✓ length of  ü length of  ü uses congruent sides of rectangle to complete proof |

(c) Use the identity from part (b) to show that . (2 marks)

|  |
| --- |
| **Solution** |
|  |
| **Specific behaviours** |
| ✓ expands using identity  ü clearly shows both known values and simplifies |

Supplementary page

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

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