



## Rossmoyne Senior High School

Semester One Examination, 2021

Question/Answer booklet

# MATHEMATICS METHODS UNIT 1

## Section One: Calculator-free

Circle your Teacher's Name:

Ms Bestall	Mr Buckland	Ms Fraser-Jones
Mr Gibbon	Ms Goh	Ms Leonard
Mr Luzuk	Mr Ng	Ms Murray

### Time allowed for this section

Reading time before commencing work: five minutes  
Working time: fifty minutes

Number of additional  
answer booklets used  
(if applicable):

### 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	54	35
Section Two: Calculator-assumed	13	13	100	95	65
<b>Total</b>					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% (54 Marks)**

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

Working time: 50 minutes.

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**Question 1****(6 marks)**

Solve the following equations for  $x$ .

(a)  $(2x + 5)(x - 4) = 0$ .

**(2 marks)**

(b)  $\frac{8x+3}{2} = \frac{9x-8}{4}$

**(2 marks)**

(c)  $(x - 8)^2 - 100 = 0$ .

**(2 marks)**

**Question 2****(7 marks)**

The straight line  $L$  has equation  $4x + 2y = 1$ .

- (a) Write the equation of  $L$  in the form  $y = mx + c$  to show that its gradient is  $-2$ . (1 mark)

Line  $L_1$  is perpendicular to  $L$  and passes through the point  $(2, 6)$ .

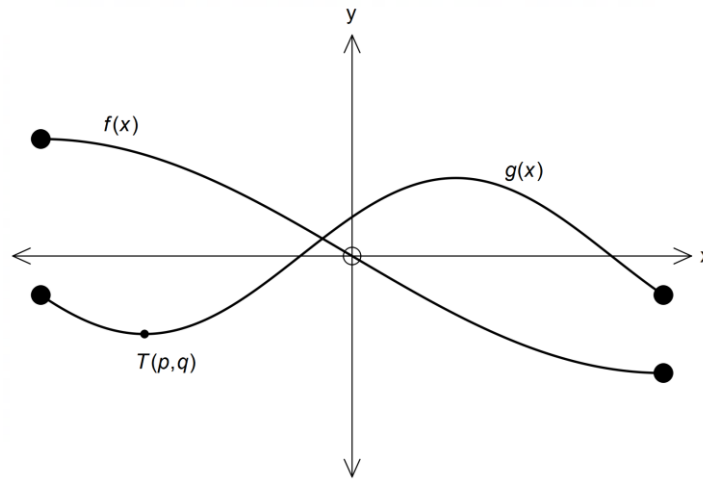
Line  $L_2$  is parallel to  $L$  and passes through the point  $(1, -7)$ .

- (b) Determine the point of intersection of  $L_1$  and  $L_2$ . (6 marks)

Question 3

(9 marks)

The graphs of  $f(x) = -3\sin\left(\frac{x}{2}\right)$  and  $g(x) = 2\cos(x - 60^\circ)$  are shown below on the interval  $-180^\circ \leq x \leq 180^\circ$ .  $T(p, q)$  is a turning point of  $g(x)$  with  $p < 0$ .



- (a) State the period of  $f(x)$ . (1 mark)
  
- (b) State the range of  $g(x)$ . (1 mark)
  
- (c) Determine the values of  $p$  and  $q$ . (2 marks)
  
- (d) Determine the value(s) of  $x$  in the interval  $-180^\circ \leq x \leq 180^\circ$  for which  $g(x) > 0$ . (2 marks)
  
- (e) State the transformations on  $f(x)$  to obtain the function  $h(x) = \sin(x)$ . (3 marks)

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## Question 4

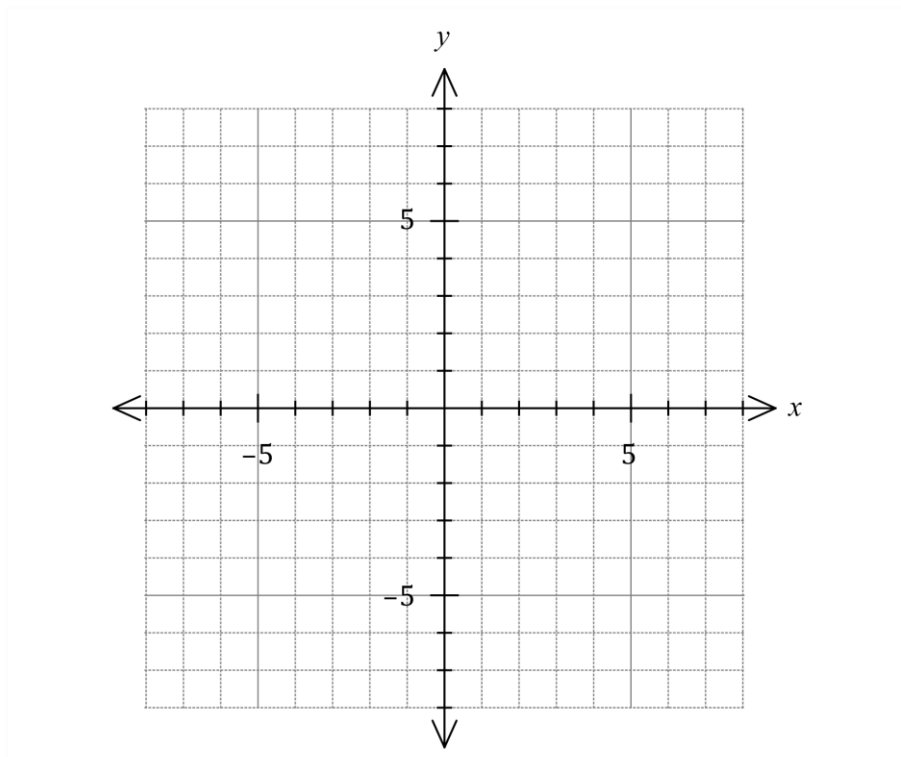
(7 marks)

Consider the function  $f(x) = \frac{a}{x+b}$ , where  $a$  and  $b$  are constants. The graph of  $y = f(x)$  has an asymptote with equation  $x = -1$  and passes through the point  $(-4, 1)$ .

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

(b) State the equation of the other asymptote of the graph of  $y = f(x)$ . (1 mark)

(c) Sketch the graph of  $y = f(x)$  on the axes below. (3 marks)



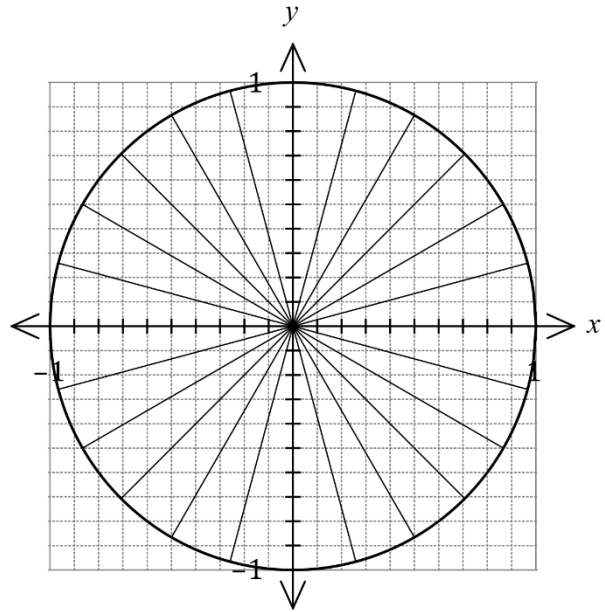
Question 5

(6 marks)

(a) 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 anti-clockwise angles of  $165^\circ$  and  $\frac{13\pi}{12}$  from the positive  $x$ -axis respectively.

Hence estimate the value of  $\cos 165^\circ$  and the value of  $\sin\left(\frac{13\pi}{12}\right)$ .



(3 marks)

(b) Solve the equation  $3 \tan(2x - 10^\circ) = \sqrt{3}$  for  $0^\circ \leq x \leq 180^\circ$ .

(3 marks)

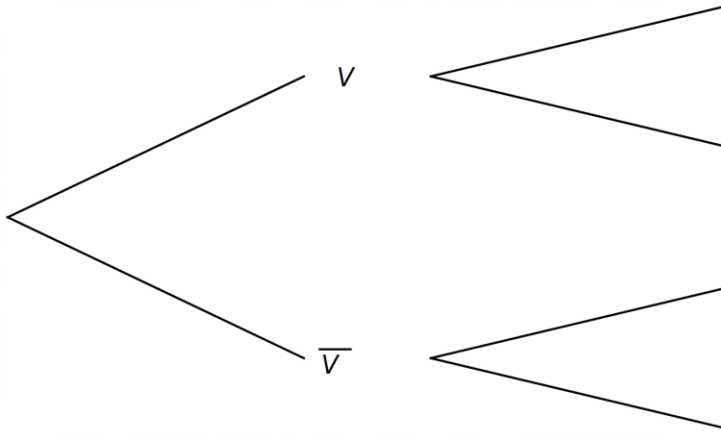
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## Question 6

(6 marks)

The following probabilities are given for events  $V$  and  $W$ .

- $P(V) = 0.6$
- $P(W|V) = 0.3$
- $P(W|\bar{V}) = 0.5$



- (a) Complete the tree diagram above. (2 marks)
- (b) Determine the following:
- (i)  $P(W)$  (1 mark)
- (ii)  $P(V \cap W)$  (1 mark)
- (iii)  $P(\bar{V} \cap W)$  (1 mark)
- (iv)  $P(V \cup W)$  (1 mark)



**Question 7****(6 marks)**

Two polynomial functions are defined by  $f(x) = (2x - 3)(x + 2)$  and  $g(x) = x^3 + 4x^2 - 4x - 12$ .

There is a point of intersection of  $f(x)$  and  $g(x)$  at  $(2, 4)$ . Find the coordinates of the other point(s) of intersection.

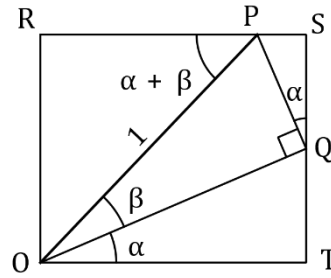
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## Question 8

(7 marks)

Consider rectangle  $ORST$  that contains the right triangle  $OPQ$  as shown.

Let the length of  $OP = 1$ ,  
 $\angle QOT = \angle SQP = \alpha$ ,  
 $\angle POQ = \beta$  and  
 $\angle OPR = \alpha + \beta$ .



(a) Explain why  $QT = \sin \alpha \cos \beta$ .

(2 marks)

(b) Determine expressions for the lengths of  $QS$  and  $OR$  and hence prove the angle sum identity  $\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$ .

(3 marks)

(c) Use the identity from part (b) to show that  $\sin\left(x + \frac{3\pi}{2}\right) = -\cos x$ .

(2 marks)

Supplementary page

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

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