

before reading any further.  
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.

### Important note to candidates

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

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

To be provided by the supervisor  
Materials required/recommended for this section

Time allowed for this section  
Working time for sections: one hundred minutes  
Reading time before commencing work: ten minutes

Your name  
In words

Student Number: in figures  
Calculator-assumed  
Section Two:  
UNIT 1  
METHODS  
MATHEMATICS  
Question/Answer Booklet

If required by your examination administrator, please place your student identification label in this box

Semester One Examination, 2016

Rossmyne Senior High School



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**Structure of this paper**

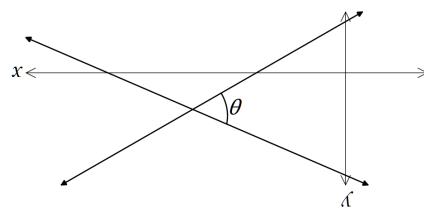
Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
Section One: Calculator-free	7	7	50	51	35
Section Two: Calculator-assumed	13	13	100	98	65
<b>Total</b>			149	100	

**Additional working space**

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

**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.
3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specified to a particular question.
4. 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.
5. **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.
6. It is recommended that you **do not use pencil**, except in diagrams.
7. The Formula Sheet is **not** to be handed in with your Question/Answer Booklet.



- (b) The graphs of  $x + 2y = 4$  and  $2x - 3y = 3$  are shown below. Determine, to the nearest degree, the size of the angle  $\theta$ . (3 marks)

(6 marks)

**Question 8**

(3 marks)

- (a) Show how to establish that the exact value of  $\cos 135^\circ$  is  $-\frac{\sqrt{2}}{2}$ .

Working time for this section is 100 minutes.

This section has **thirteen (13)** questions. Answer all questions. Write your answers in the spaces provided.

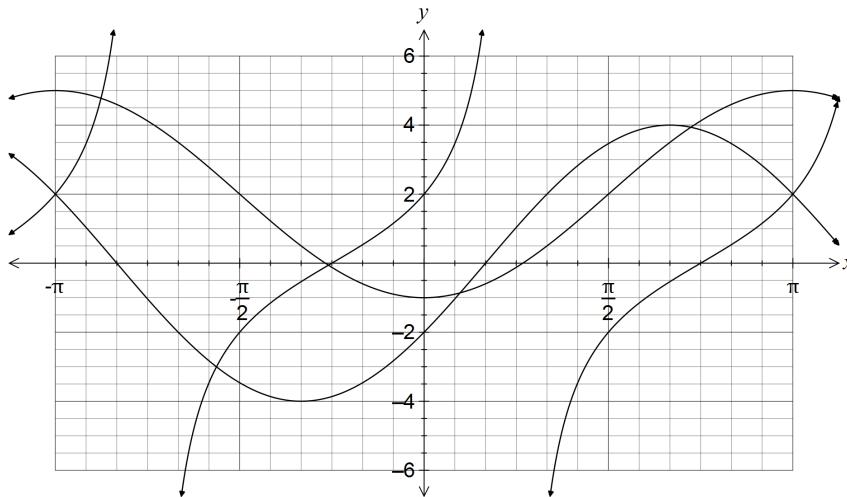
Question number: \_\_\_\_\_

Additional working space

(7 marks)

**Question 9**

The graphs of the functions  $f(x) = a - b \cos(x)$ ,  $g(x) = c \sin(x - d)$  and  $h(x) = m \tan(x + n)$  are shown below, where  $a, b, c, d, m$  and  $n$  are positive constants.



- (a) Clearly label each of the functions  $f$ ,  $g$  and  $h$  on the graph. (1 mark)
- (b) Determine the values of the positive constants  $a$ ,  $b$ ,  $c$ ,  $d$ ,  $m$  and  $n$ . (6 marks)

**Additional working space**

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

- (a) The extension,  $e$ , of a spring is directly proportional to the mass,  $m$ , hung on the end of it. When a mass of 100 g was hung on the spring, its extension was 25 mm.
- (i) Write an equation that relates the variables  $e$  and  $m$ . (2 marks)
- (ii) Determine  $m$  when  $e = 125$  mm. (1 mark)
- (iii) Determine  $m$  when  $e = 125$  mm. (4 marks)

- (a) A full water tank can be emptied in 40 minutes using a small pump and in 10 minutes using a large pump. Assuming that the pumps do not affect each other when used together, determine the time required to empty the tank using both pumps. (4 marks)
- (b) A full water tank can be emptied in 40 minutes using a small pump and in 10 minutes

Additional working space  
Question number: \_\_\_\_\_

(7 marks)

**Question 11**

$$f(x) = \frac{6}{x-3}$$

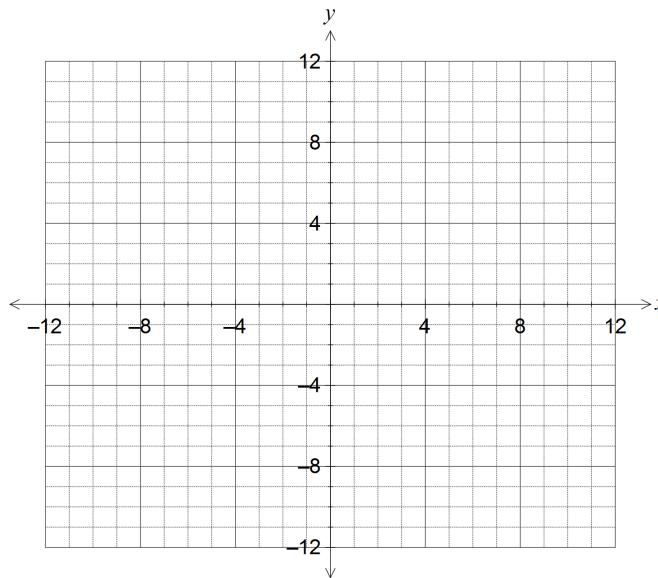
A function is defined by

- (a) State the domain of this function.

(1 mark)

- (b) Draw the graph of  $y = f(x)$  on the axes below, clearly showing the coordinates of all axis-intercepts and equations of any asymptotes.

(4 marks)



- (c) The graph of  $y = f(x)$  is dilated vertically by a scale factor of 4 followed by a translation of three units to the right. Determine the coordinates of the  $y$ -intercept of the transformed graph.

(2 marks)

(7 marks)

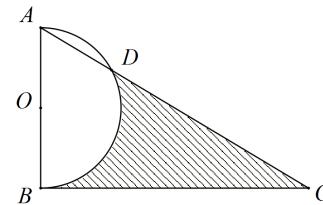
**Question 20**

- (a) Determine the exact area of a sector enclosed by an arc of length 42 cm in a circle of radius 12 cm.

(2 marks)

- (b) In the diagram below,  $BC$  is a tangent to the circle with diameter  $AB$  and centre  $O$ . Given that  $AB = 20$  cm and  $BC = 30$  cm, determine the shaded area.

(5 marks)



(2 marks)

(b) A thin metal plate in the shape of an equilateral triangle has an area of 330 cm<sup>2</sup>. Determine the side length of the triangle.

(2 marks)

$$6\sin\left(\frac{5}{x} - 50^\circ\right) = 3 \quad \text{for } x \geq 0^\circ$$

(b)

Determine the two smallest solutions to the equation

(iii) the distance DC.

(2 marks)

(2 marks)

(ii) the distance AB.

(2 marks)

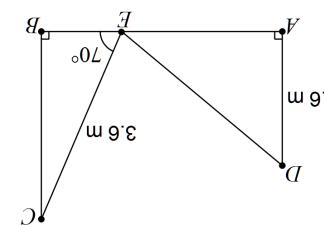
(iii)  $\sin 2\theta$ .

(2 marks)

(i) the angle through which the ladder was rotated.

(2 marks)

(iii)  $\cos \theta$ .



(8 marks)

(a) A 3.6 m long ladder first rests against a vertical wall BC, making an angle of 70° with the horizontal ground. The ladder is rotated in a vertical plane about E to rest against wall AD, reaching a point 2.6 m above the ground.

(2 marks)

(i)  $\sin \theta$ .

Question 12  
CALCULATOR-ASSUMED  
(8 marks)

Given that  $\tan \theta = -\frac{1}{3}$ , where  $\frac{\pi}{2} < \theta < \pi$ , show how to determine the exact value of

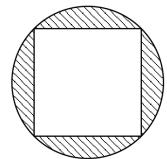
(2 marks)

(i)  $\sin \theta$ .

Question 19  
CALCULATOR-ASSUMED  
(8 marks)

**Question 13**

- (a) A square is inscribed in a circle of radius 16 cm, as shown below. Determine the area enclosed between the square and the circle. (3 marks)



- (b) The perimeter of a sector, with central angle  $\theta$  radians in a circle of radius  $r$ , is 12 cm.

- (i) Express  $\theta$  in terms of  $r$ . (2 marks)

- (ii) Show that the area of the sector is  $6r - r^2$ . (2 marks)

- (iii) Determine the area of the sector if  $\theta = 1$ . (2 marks)

**Question 18**

In triangle ABC,  $\angle BAC = 50^\circ$ ,  $AC = 18.4$  cm and  $BC = 15$  cm.

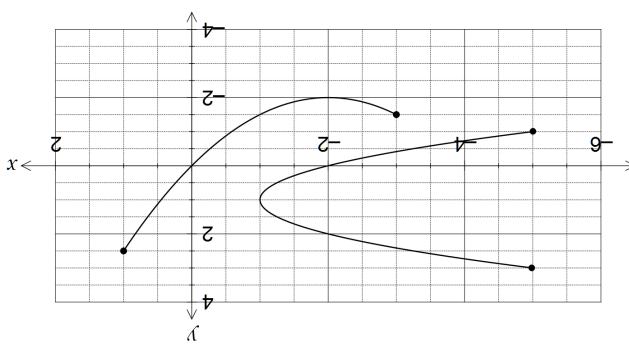
Determine the largest possible area and smallest possible perimeter of this triangle.

METHODS UNIT 1

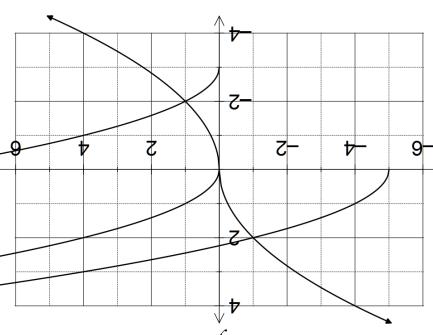
CALCULATOR-ASSUMED

9

Question 17 (7 marks)



A function and a relation have been graphed on the axes below.

(a) The diagram below shows the five graphs  $y = f(x)$ , where  $a$ ,  $b$ ,  $c$  and  $d$  are constants.(b) The diagram below shows the five graphs  $y = f(x)$ ,  $y = f(x) + a$ ,  $y = f(x + b)$ ,(c) Determine  $f(4)$ .

METHODS UNIT 1

CALCULATOR-ASSUMED

12

Question 14 (9 marks)

(a) State the domain and range of the function.

(b) (2 marks)

(i) Determine the values of the constants  $a$ ,  $b$ ,  $c$  and  $d$ .(a) Draw the line  $x = -2$  on the graph and explain how it can be used to identify the relation.

(b) (2 marks)

(i)  $y = g(x - 1) - 2$ (ii)  $y = -\frac{1}{2}g(x)$ (b) Describe two transformations that will transform the graph of  $y = g(x)$  to:(c) The relation can be expressed in the form  $y^2 = ax + by - 2$ . Determine the values of the constants  $a$  and  $b$ .

(c) (3 marks)

(ii)  $y = -\frac{1}{2}g(x)$ (iii)  $y = g(x - 1) - 2$

(9 marks)

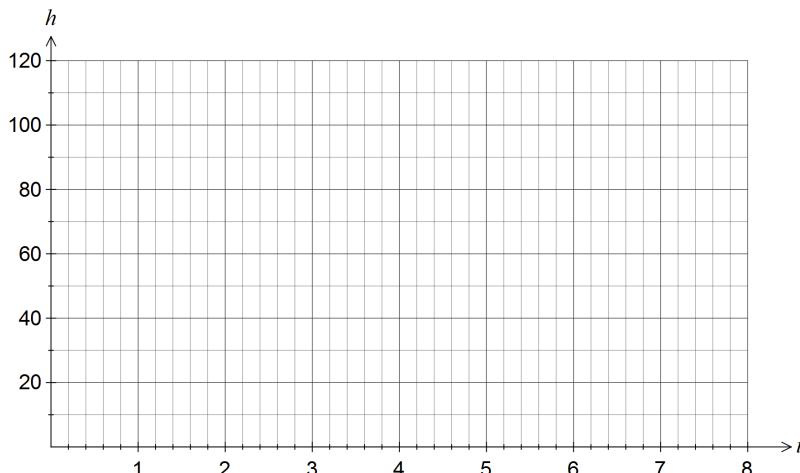
**Question 15**

A sensor was fitted to the tip of a blade on a wind turbine to measure the height,  $h$  metres, of the blade above the ground. The height was observed to vary according to the function

$$h(t) = 72 - 38 \sin\left(\frac{\pi t}{2}\right), \text{ where } t \text{ is the time in seconds since measurements began.}$$

- (a) Determine the height of the blade tip above the ground when  $t = 3$ . (1 mark)

- (b) Sketch the graph of  $h(t)$  on the axes below for  $0 \leq t \leq 8$ . (4 marks)



- (c) How long does the blade take to rotate once? (1 mark)

- (d) Assuming the blade continues to rotate in this manner, determine the percentage of time during which the blade tip is at least 90 m above the ground. (3 marks)

**Question 16**

(7 marks)

The graphs of  $ax + by = 6$ ,  $y = \frac{c}{x} + d$  and  $y = n(x - p)^2 + q$  are shown below. Determine the values of the constants  $a$ ,  $b$ ,  $c$ ,  $d$ ,  $n$ ,  $p$  and  $q$ .

