



Semester One Examination, 2019

Question/Answer booklet

**MATHEMATICS  
METHODS  
UNIT 1**

**Section Two:**

**Calculator-assumed**

**Student Name:** \_\_\_\_\_

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

**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	13	13	100	98	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 answer to the specific question asked and to follow any instructions that are specified 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% (98 Marks)**

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

Working time: 100 minutes.

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**Question 9****(6 marks)**

- (a) The points  $A$  and  $B$  have coordinates  $(4, -6)$  and  $(5, 8)$  respectively. If  $B$  is the midpoint of  $A$  and  $C$ , determine the coordinates of  $C$ . (3 marks)

- (b) The points  $D$  and  $E$  have coordinates  $(5p, -q)$  and  $(2q, 3p)$  respectively, where  $p$  and  $q$  are constants. Determine the value of  $p$  and the value of  $q$  if the midpoint of  $D$  and  $E$  is at  $(21, 17)$ . (3 marks)

**Question 10****(8 marks)**

(a) The variables  $C$  and  $x$  are directly proportional and when  $x = 5$ ,  $C = 60$ .

(i) Determine an equation for the relationship between  $C$  and  $x$ . (2 marks)

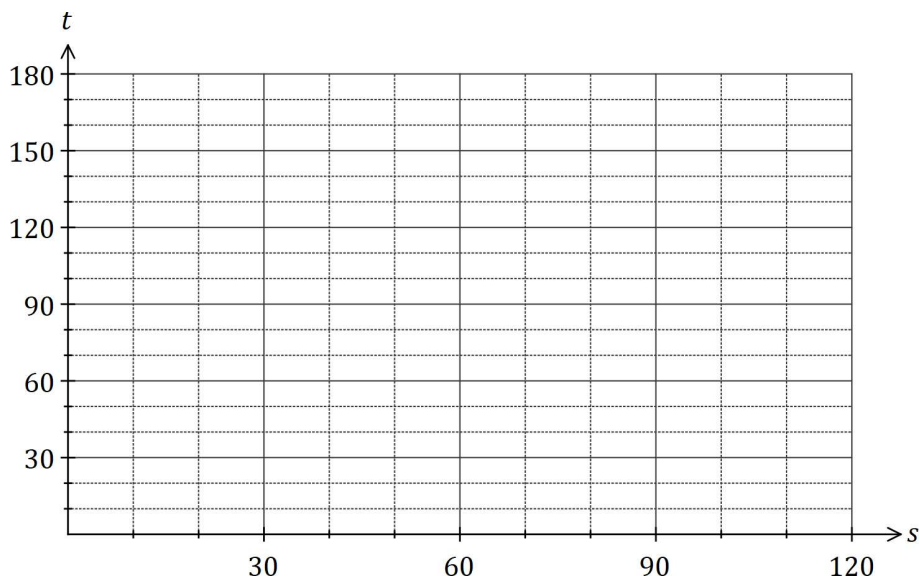
(ii) State the value of  $C$  when  $x = 15$ . (1 mark)

(b) The time,  $t$  minutes, that a car takes to travel one kilometre at a constant speed of  $s \text{ kmh}^{-1}$  is given by the formula  $t = \frac{k}{s}$ .

(i) Determine the value of the constant  $k$ , given that when  $s = 40$ ,  $t = 90$ . (1 mark)

(ii) Determine the value of  $t$  when  $s = 30$ . (1 mark)

(iii) On the axes below, draw a graph to show how  $s$  varies with  $t$ . (3 marks)



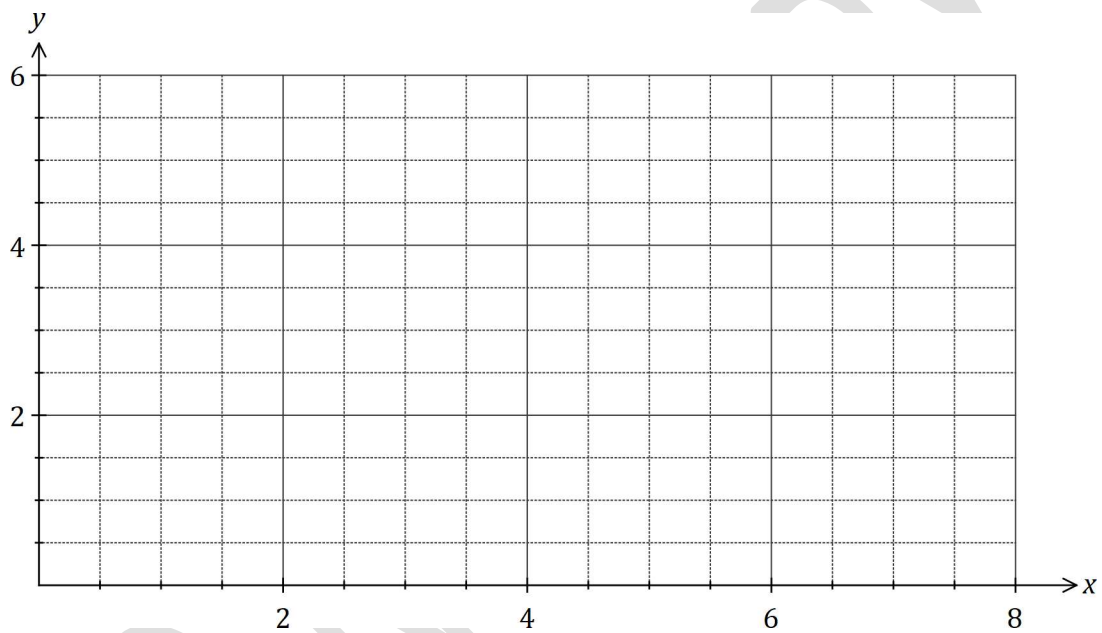
## Question 11

(8 marks)

The distortion of a signal,  $S$ , can be modelled by  $S(x) = 4.55 - 4.5x + 1.95x^2 - 0.2x^3$ , where  $x$  is the distance from the signal source in metres and  $0 \leq x \leq 7$ .

- (a) Determine  $S$  when  $x = 1$ . (1 mark)

- (b) Draw the graph of  $y = S(x)$  on the axes below. (4 marks)



- (c) Determine the equation of the straight line  $L$  that passes through the  $x$ -intercept and the  $y$ -intercept of the graph of  $y = S(x)$ . (2 marks)
- (d) Determine the coordinates of the point of intersection of  $L$  with the graph of  $y = S(x)$  where  $x > 0$  and  $y > 0$ . (1 mark)

## Question 12

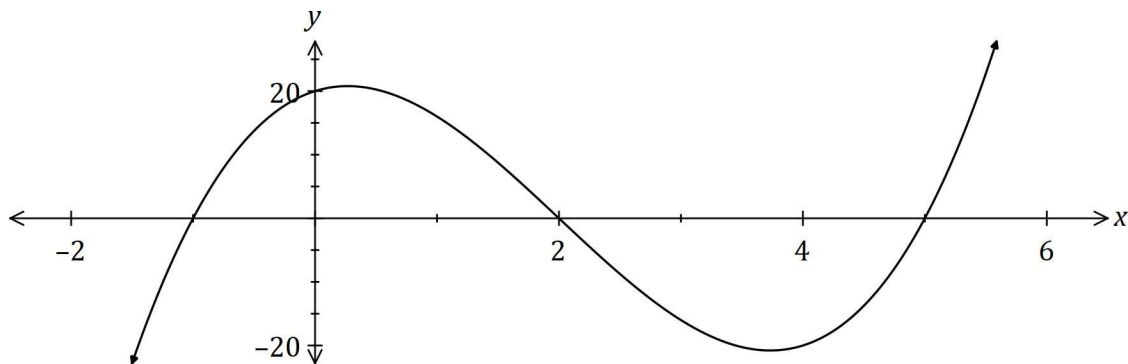
(8 marks)

(a) A parabola with equation  $y = a(x - b)(x + c)$  has turning point at  $(2, -8)$  and  $y$ -intercept at  $(0, -6)$ . The constants  $a, b$  and  $c$  are all positive.

(i) Determine the values of the positive constants  $a, b$  and  $c$ . (3 marks)

(ii) The parabola is translated 10 units to the left and 5 units downwards. Determine the equation of the transformed parabola in the form  $y = a(x - p)^2 + q$ . (2 marks)

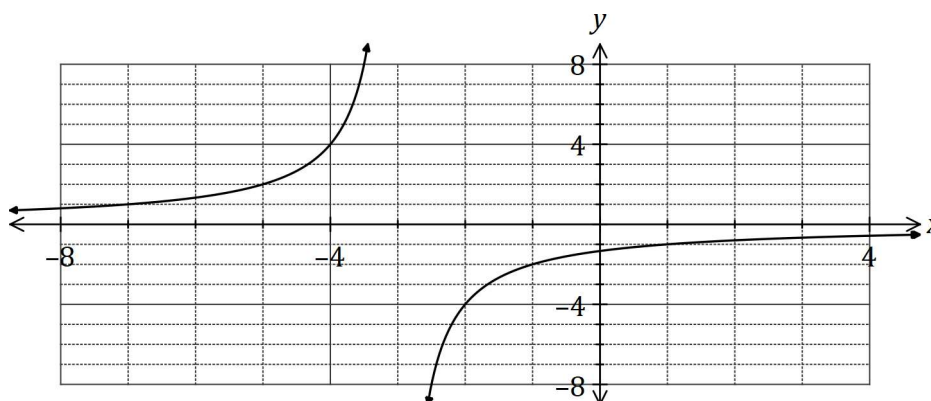
(b) The graph of the cubic function  $y = f(x)$  is shown below. Determine  $f(10)$ . (3 marks)



## Question 13

(8 marks)

The graph of  $y = f(x)$  is shown below where  $f(x) = \frac{a}{b-x}$ .



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

(b) The hyperbola shown above has two asymptotes. State their equations. (2 marks)

(c) Describe how to transform the graph of  $y = f(x)$  to obtain the graph of  $y = f(x) + 1$  and state the domain and range of the transformed function. (3 marks)

**Question 14**

(a) Convert, giving an exact answer

(i)  $24^\circ$  to radians.

(ii) 0.3 radians to degrees.

(1 mark)

(b) Calculate, to the nearest degree, the acute angle between the line  $y = 0.75x - 3$ .

and the line  $y = -0.25x + 2$  and the  
(3 marks)

**Not Assessed**

(c) The sides adjacent to the smallest angle in a right-angled triangle have lengths 56 cm and 33 cm. If the smallest angle is  $\alpha$ , determine an exact value for

(i)  $\tan \alpha$ . (1 mark)

(ii)

(2 marks)



**Question 15****(7 marks)**

An **obtuse** angled triangle  $WXY$  has  $w = 45$  cm,  $y = 34$  cm and an area of  $739$  cm<sup>2</sup>.

(a) Sketch a triangle to show this information. (1 mark)

(b) Determine the size of  $\angle X$ . (2 marks)

(c) Show that  $x \approx 63$  cm. (2 marks)

(d) Show that  $\angle Y \approx 31^\circ$ . (2 marks)

**Question 16**

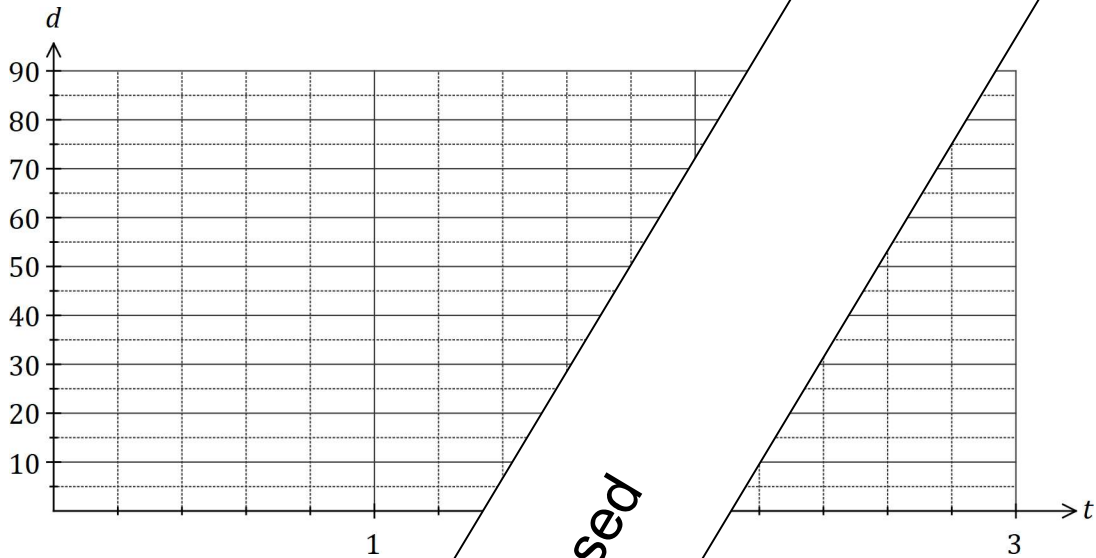
A small weight, attached to the bottom of a spring, oscillated up and down. The distance of the weight from the top of the spring after  $t$  seconds can be modelled by

$$d = 45 + 35 \sin \frac{3\pi t}{4}$$

(8 marks)

- (a) Sketch the graph on the axes below for  $0 \leq t \leq 3$ .

(4 marks)



- (b) Mark on your graph point  $M$ , where the weight is 40 cm from the top of the spring and is moving downwards.

(1 mark)

- (c) Determine

- (i) the maximum distance of the weight from the top of the spring.

(1 mark)

- (ii) the time taken for the weight to first return to its initial position.

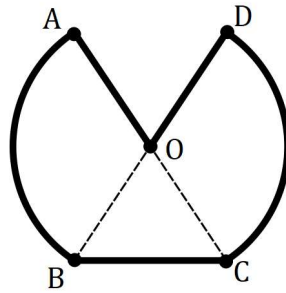
(1 mark)

- (iii) the distance moved by the weight between  $t = 1$  and  $t = 2$ .

(1 mark)

**Question 17**

In shape  $OABCD$  below,  $\angle AOB = 126^\circ$  and  $AC, BD$  are diameters of the circle with centre  $O$  and radius 35 cm.



(a) Calculate the perimeter of  $OABCD$ .

(4 marks)

(b) Calculate the area of  $OAB$ .

(3 marks)

Not Assessed

**Question 18****(8 marks)**

- (a) The equation of the axis of symmetry for the graph of  $y = 3x^2 + 6x + 7$  is  $x = k$ . Determine the value of  $k$ , using a method that does not refer to the graph of the parabola. (2 marks)
- (b) A parabola with equation  $y = ax^2 + bx + c$  has a turning point at  $(6, -5)$  and passes through the point  $(-2, -37)$ . Determine the value of  $a$ , the value of  $b$  and the value of  $c$ . (3 marks)
- (c) Determine the value of the discriminant for the quadratic equation  $16x^2 - 24x + 9 = 0$  and use it to explain how many solutions the equation  $(x + 1)(16x^2 - 24x + 9) = 0$  will have. (3 marks)

**Question 19****(6 marks)**

- (a) A shelf held a collection of 22 different books, of which 5 were encyclopedias, 10 were science fiction and the rest were poetry.

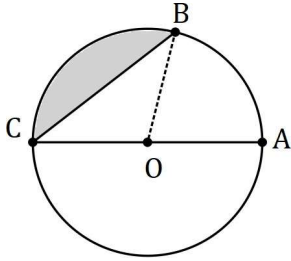
A random selection of 4 books is to be made from the shelf.

Determine the number of ways:

- (i) this can be done. (1 mark)
- (ii) a selection can be made that will not contain any encyclopedias. (2 marks)
- (b) When  $(x + by)^n$  is expanded, the fourth term is  $80x^2y^3$ . Determine:
- (i) the value of  $n$  (1 mark)
- (ii) the value of  $b$ . Show your working. (2 marks)

**Question 20**

- (a) The circle shown has centre  $O$  and diameter  $AC$  of length 60 cm. Determine the area given that  $7 \times \angle AOB = 5 \times \angle BOC$ .



- (b) A sector of a circle has a perimeter of 49 cm and an area of 490 cm<sup>2</sup>. Determine the radius of the circle. (4 marks)

*Not Assessed*

Question 21

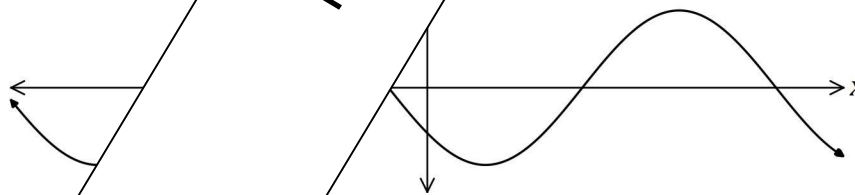
(8 marks)

- (a) Show, using one or more identities from the formula sheet and without using the value of any trigonometric term, that (2 marks)

$$\cos 15^\circ \cos 65^\circ + \sin 15^\circ \sin 65^\circ = \sin 140^\circ$$

- (b) Simplify  $\sin(A + B) \cos B - \cos(A + B) \sin(B)$ . (2 marks)

- (c) The graph of  $y = f(x)$  is shown. The function  $f(x) = \cos(x + a)$  and  $a$  is a constant. (2 marks)



Explain how the values of  $b$  and  $c$  are determined from the graph of  $f(x)$ , given that  $f(x) = \cos(b(x + c))$ .

- (i) (2 marks)

(1 mark)

Not Assessed

Supplementary page

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



Supplementary page

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

Supplementary page

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