WA Exam Papers
Australian Curriculum Examinations

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WAEP Semester One Examination, 2017

Question/Answer booklet

MATHEMATICS METHODS UNIT 1

Section Two: Calculator-assumed

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

Student Number: In figures   ⬚⬚ ⬚⬚⬚ ⬚⬚⬚

In words   _____

Your 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	7	7	50	52	35
Section Two: Calculator-assumed	13	13	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.

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. Additional working space pages at the end of this Question/Answer booklet are for planning or continuing an answer. If you use these pages, indicate at the original answer, the page number it is planned/continued on and write the question number being planned/continued on the additional working space 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.

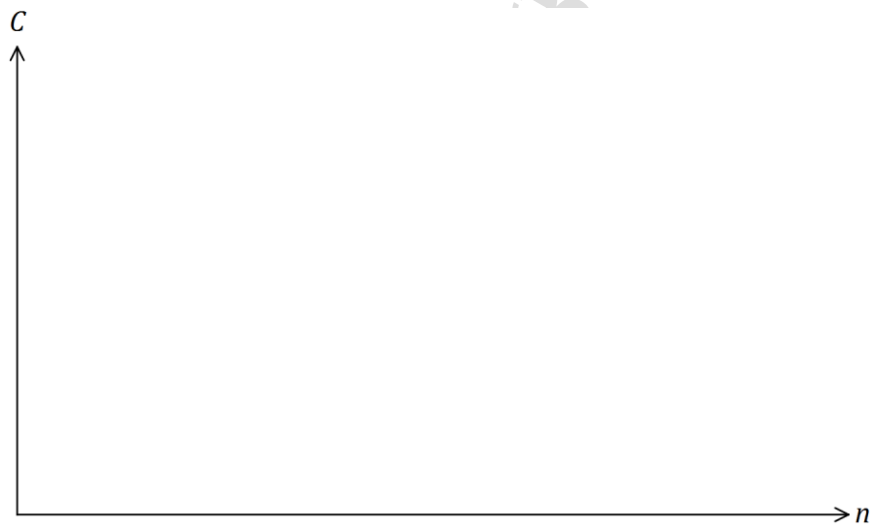**Section Two: Calculator-assumed** **65% (98 Marks)**

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

Working time: 100 minutes.

Question 8 **(6 marks)**

(a) The variables C and n are directly proportional to each other, so that when $n = 10$, it is known that $C = 25$. Sketch a graph of the relationship between C and n on the axes below. (3 marks)

(b) The variables A and n are inversely proportional to each other, so that when $n = 10$, it is known that $A = 60$.

(i) Write an equation that relates A and n. (2 marks)

(ii) Determine the value of n when $A = 15$. (1 mark)
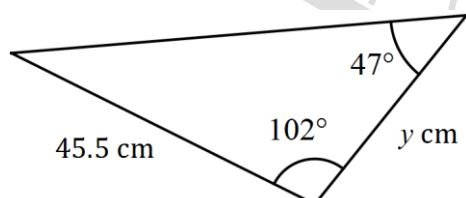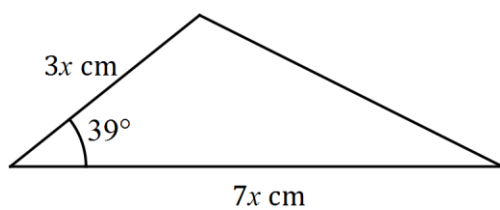
Question 9   **(9 marks)**

(a)   Determine the size, to the nearest degree, of the largest angle in a triangle with sides of lengths 23 cm, 28 cm and 31 cm.   (3 marks)

(b)   Determine the value of y in the diagram below.   (3 marks)

(c) The area of the triangle shown below is 280 cm^2. Determine the value of x. (3 marks)

Question 10   **(6 marks)**

From an analysis of the species of fish caught by 107 anglers during a competition, it was found that 67 anglers had caught tailor, 79 anglers had caught herring and 11 had caught neither of these species.

Let set T be the set of anglers who had caught tailor and set H be the set of anglers who had caught herring.

(a)   Use set notation to describe the set of anglers who caught tailor but not herring.

                                                                          (1 mark)

(b)   Determine

      (i) $n(H \cap T)$.   (2 marks)

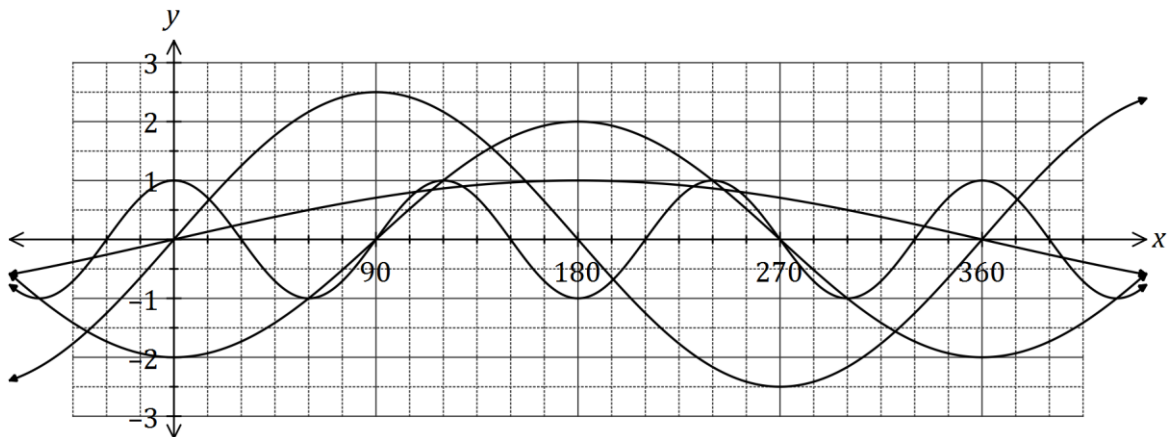   (ii) $n(H \cup \bar{T})$.   (1 mark)

(b)   If one angler from the competition is selected at random, determine $P(\bar{H} \mid (H \cup T))$.

                                                                              (2 marks)

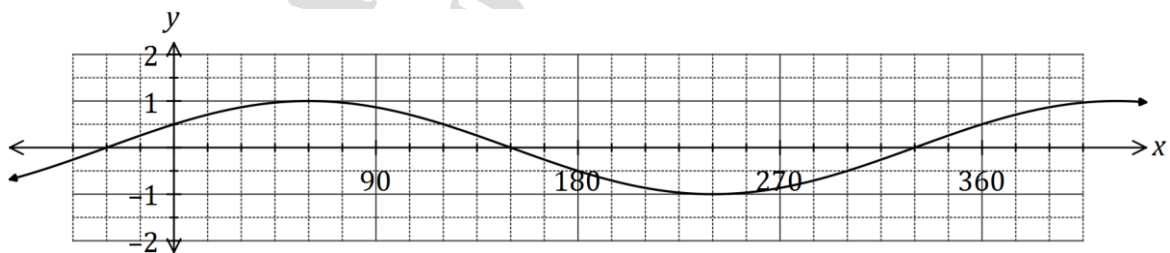**Question 11**   **(6 marks)**

(a)   The graphs of $y = a\sin(x)$, $y = \sin(bx)$, $y = d\cos(x)$ and $y = \cos(ex)$ are shown below.

Determine the values of the constants a, b, d and e.   (4 marks)

(b)   The graph of $y = \cos(x - \alpha)$ is drawn below.

(i)   State the value of the constant α, where $0° < \alpha < 360°$.   (1 mark)

(ii)   The graph is also that of $y = \sin(x + \beta)$. State the value of the constant β, where $0° < \beta < 360°$.   (1 mark)

Question 12   **(8 marks)**

The number of bottles of a drink sold by a store per day was recorded over a period of time. A summary is shown in the table below.

| Number of bottles per day	0	1	2	3	4
Frequency	80	50	40	20	10

Based on the above records and assuming sales from day to day are independent

(a)   determine the probability that on any given day in the future

        (i)   at least one bottle of the drink is sold.   (2 marks)

        (ii)   exactly three bottles are sold, given that at least one bottle is sold.   (2 marks)

(b)   determine the probability that a total of two bottles will be sold over any given two-day period.   (4 marks)

Question 13 **(5 marks)**

(a) Using the unit circle shown, determine the following in terms of a and/or b, given that θ is an acute angle measured in degrees.
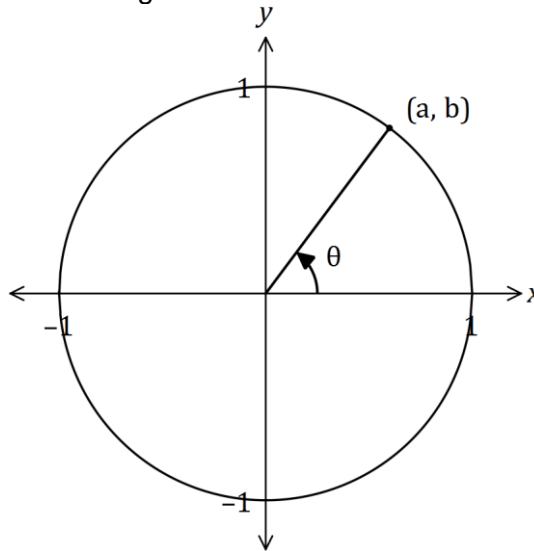
(i) $\sin(\theta)$. (1 mark)

(ii) $\cos(180 - \theta)$. (1 mark)

(iii) $\tan(90 + \theta)$. (1 mark)

(b) Determine x in each of the following cases, where $0 \le x \le \frac{\pi}{2}$.

(i) $\sin x = \sin 17\pi$. (1 mark)

(ii) $\cos x = \cos \frac{23\pi}{6}$. (1 mark)
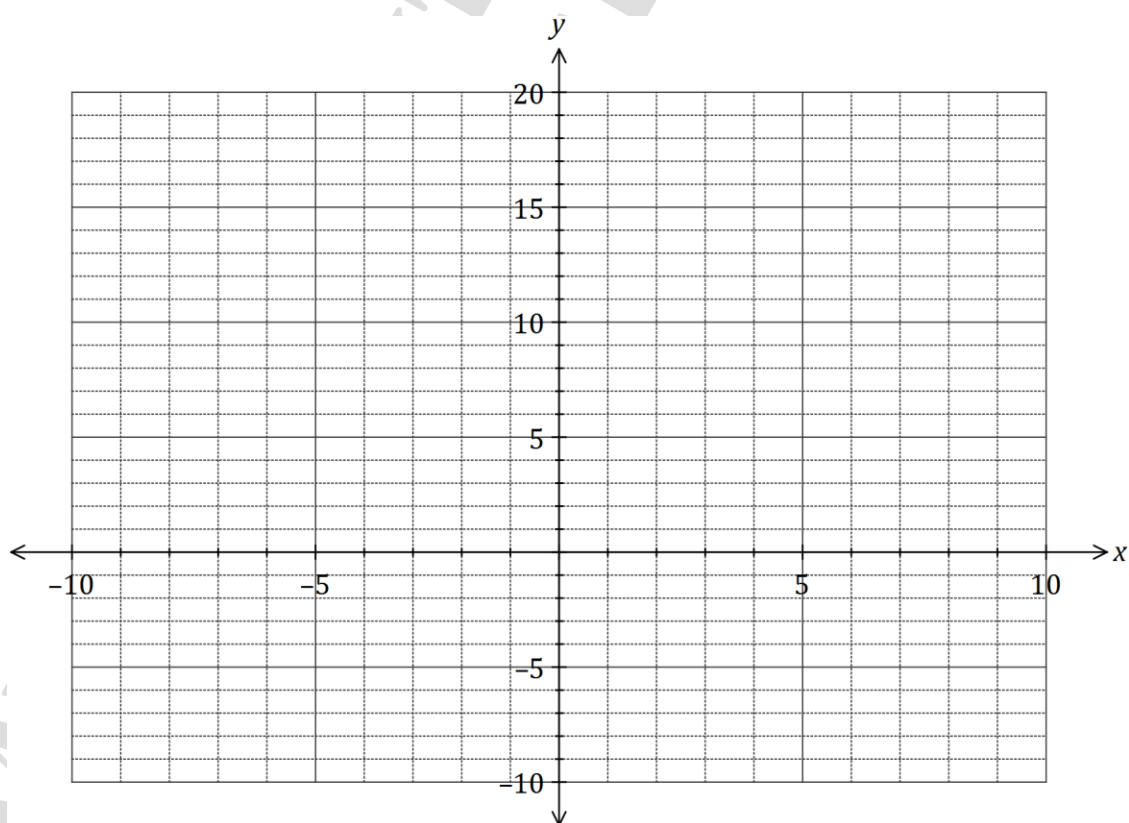
Question 14 **(8 marks)**

(a)   The graph of $y = 2x^2 + bx + 16$ has a line of symmetry with equation $x = 3$.

   (i)   Determine the value of b. (2 marks)

   (ii)   Draw the graph of the parabola on the axes below. (3 marks)

(b)   One of the solutions to the equation $2x^3 + 21x^2 + cx - 495 = 0$ is $x = 5$. Determine the value of c and all other solutions.   (3 marks)

Question 15   **(8 marks)**

In a school survey of 197 students in Year 11 and Year 12, it was observed that 75 of the 96 Year 12 students studied a science subject and that 10 students in Year 11 did not study a science subject.

(a)   If one student is selected at random from those surveyed, determine the probability that

    (i)   they were in Year 11.   (1 mark)

    (ii)   they studied a science subject.   (1 mark)

    (iii)   they were in Year 12 or studied a science subject.   (2 marks)

    (iv)   they studied a science subject given that they were in Year 11.   (2 marks)

(b)   Without calculating any further probabilities, is there any indication that studying a science subject is independent of Year? Justify your answer.   (2 marks)

See next page

Question 16   **(8 marks)**

The graph of the function defined by $f(x) = \dfrac{a}{x+b}$ is shown below.
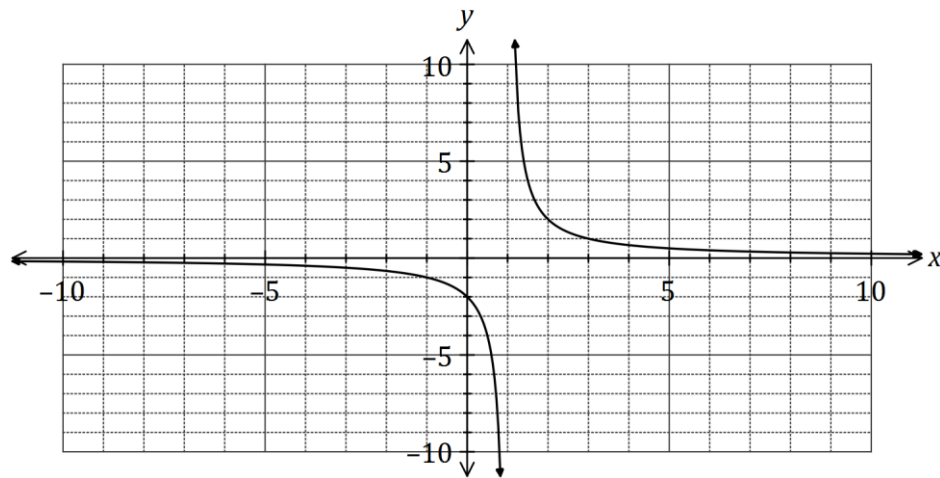
(a)   Determine the values of a and b.   (2 marks)

(b)   State the domain and range of $f(x)$.   (2 marks)

(c)   Determine the equations of the asymptotes of the graph of $y = f(2x)$.   (2 marks)

(d)   Describe the transformation required on the graph of $y = f(x)$ to obtain the graph of

(i) $y = f(x + 8)$.   (1 mark)

(ii) $y = \frac{1}{2}f(x)$.   (1 mark)

Question 17 **(9 marks)**

An assortment box contains 16 different chocolates, 7 of which have soft centres and the remainder have hard centres. A selection of 5 chocolates is to be made from the box.

(a)　Determine the number of different selections that can be made. (2 marks)

(b)　Determine the number of different selections that can be made if the chocolates must all have hard centres. (2 marks)

(c)　Determine the probability that a randomly chosen selection has

(i)　two more soft centred chocolates than hard centred chocolates. (1 mark)

(ii)　no more than one soft centred chocolate. (4 marks)

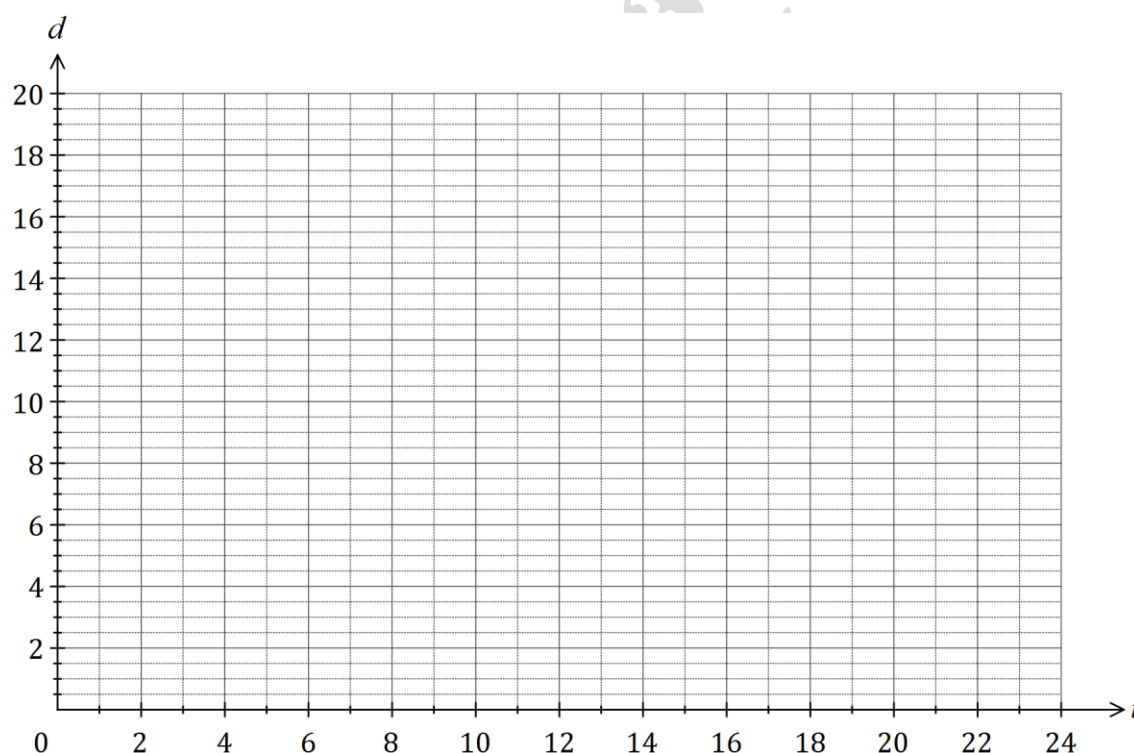**Question 18** **(8 marks)**

Over a 24-hour period, the depth of water, d metres, in a harbour at time t hours after midnight was given by

$$d = 7.5 \sin\left(\frac{\pi t}{6}\right) + 9, \qquad 0 \le t \le 24.$$

(a) Determine the depth of water at 11 pm. (1 mark)

(b) Draw the graph of the water depth on the axes below. (3 marks)

(c) At what time, in hours and minutes, did the depth of water first exceed 15 metres?

(2 marks)

(d) Determine the fraction of the 24-hour period during which the depth of water exceeded 12.75 m. (2 marks)

See next page

Question 19 **(8 marks)**

For two events A and B, $P(A) = x$, $P(B) = 0.45$ and $P(A \cap \bar{B}) = 0.15$.

Determine the value of x under each of the following conditions:

(a) $P(A \cap B) = 0.1$. (1 mark)

(b) $P(\bar{A} \cap B) = 0.1$. (1 mark)

(c) A and B are mutually exclusive. (2 marks)

(d) $P(B \mid A) = 0.75.$ (2 marks)
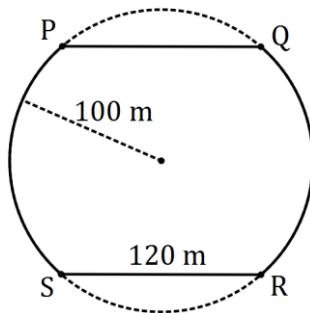
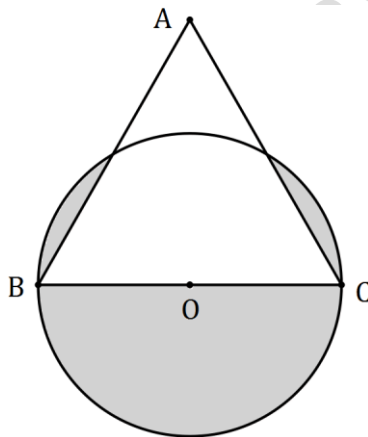(e) A and B are independent. (2 marks)

Question 20 **(9 marks)**

(a) A running track has circular ends of radius 100 m and two straight, parallel sides PQ and RS that are both 120 m long, as shown below. Determine, to the nearest metre, the total length of the track. (4 marks)

(b) The diagram shows a circle with centre O and diameter BC, and an equilateral triangle ABC. Determine the exact fraction of the area of the circle that lies outside the triangle. (5 marks)

End of questions S0441-092-3

Additional working space

Question number: _____