MATHEMATICS METHODS UNIT 1
Section Two:
Calculator-assumed

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

WA 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

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 (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, which can include scientific, graphic and Computer Algebra System (CAS) calculators, are permitted in this ATAR course 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
				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 Two: Calculator-assumed 65% (98 Marks)

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

Working time: 100 minutes.

Question 9 **(5 marks)**

Shape $AOBCDA$ below consists of sector BOC of circle centre O joined to sector DOA of a different circle, also centre O. AB is a straight line of length 65 cm, arc AD is 12 cm long and $\angle AOD = 0.32$ radians.
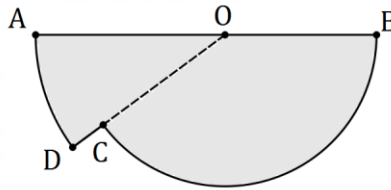
(a)   Determine the length OA. (2 marks)

(b)   Determine the area of the shape. (3 marks)

Question 10   **(8 marks)**

The height h metres of a particle above level ground is defined as a function of time t seconds as follows:

$$h(t) = 68.75 + 15t - 5t^2, \qquad 0 \le t \le 5.5 \,.$$

(a)   Determine the height of the particle when

(i) $t = 0$.   (1 mark)

(ii) $t = 4.5$.   (1 mark)

(b)   Determine the maximum height reached by the particle and the time it reached this height.
                                                                                        (2 marks)

(c)   Determine the time(s) that the particle was at a height of 75 m.   (2 marks)

(d)   State the range of the function $h(t)$ for the given domain.   (2 marks)

Question 11 **(6 marks)**

Two events are such that $P(X) = 0.2$, $P(Y) = 0.5$ and $P(Y|X) = 0.1$.

Determine the probability that

(a) both events occur. (2 marks)

(b) at least one event occurs. (2 marks)

(c) neither event occurs. (1 mark)
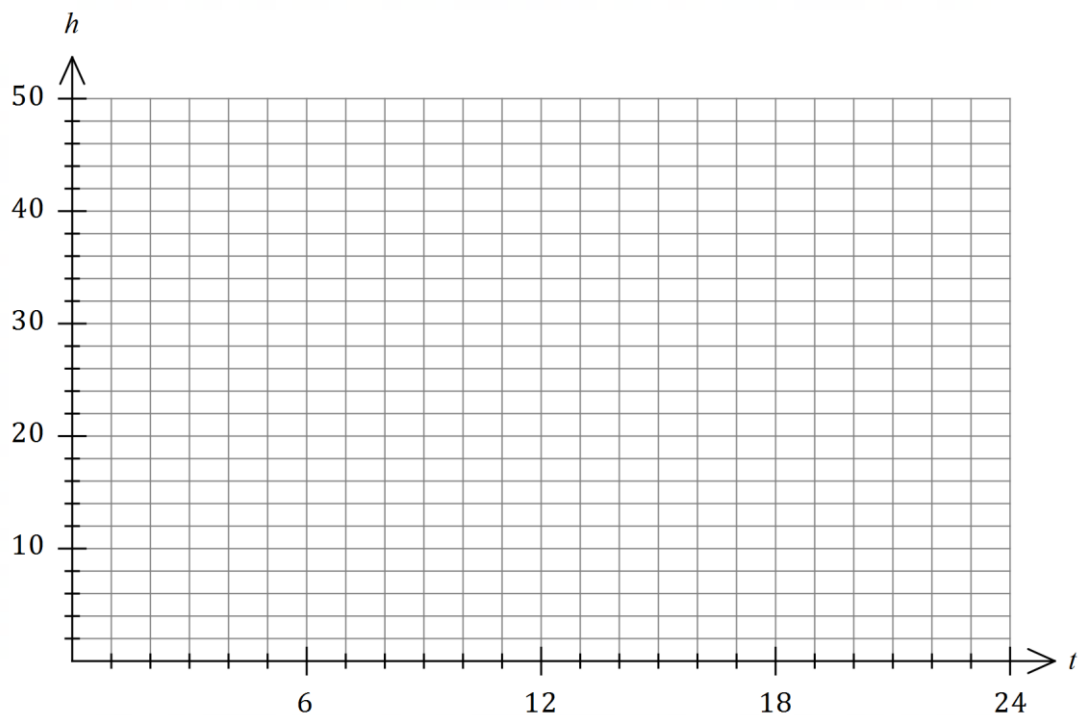
(d) X occurs given that Y has occurred. (1 mark)

Question 12 **(8 marks)**

The height above ground level, h m, of a seat on a steadily rotating Ferris wheel t minutes after the wheel begins to move is given by $h = 21.5 - 18.5 \cos\left(\frac{\pi t}{6} + \frac{\pi}{3}\right)$.

(a) Determine the initial height of the seat. (1 mark)

(b) Graph the height of the seat against time on the axes below. (4 marks)

(c) Determine

  (i) the maximum height above ground reached by the seat. (1 mark)

  (ii) the time taken, to the nearest second, for the seat to first reach a height of 4 m above ground level. (2 marks)

Question 13   **(6 marks)**

The graph $y = f(x)$, where $f(x) = x^2 + bx + c$ has a turning point at $(2, -7)$.

(a)   State the equation of the line of symmetry for the graph of $y = f(x)$.   (1 mark)

(b)   Determine the value of the constant b and the value of the constant c.   (3 marks)

(c)   The graph of $y = f(x)$ is translated 3 units to the left and 2 units upwards. Determine the equation of the resulting curve.   (2 marks)

Question 14 **(9 marks)**

When a random sample of 173 people from a university were classified according to whether they had a driver's licence (event D) and whether they wore spectacles (event S), it was observed that $n(D) = 140$, $n(S) = 53$ and $n(S \cap \bar{D}) = 10$.

(a) Determine

(i) $n(\bar{S})$. (1 mark)

(ii) $n(D \cap S)$. (1 mark)

(b) Determine the probability that a randomly chosen person from the sample

(i) does not have a driver's licence. (2 marks)

(ii) wears spectacles given that they have a driver's licence. (2 marks)

(c)   Does the sample provide any indication of possible independence of events S and D? Justify your answer. (3 marks)

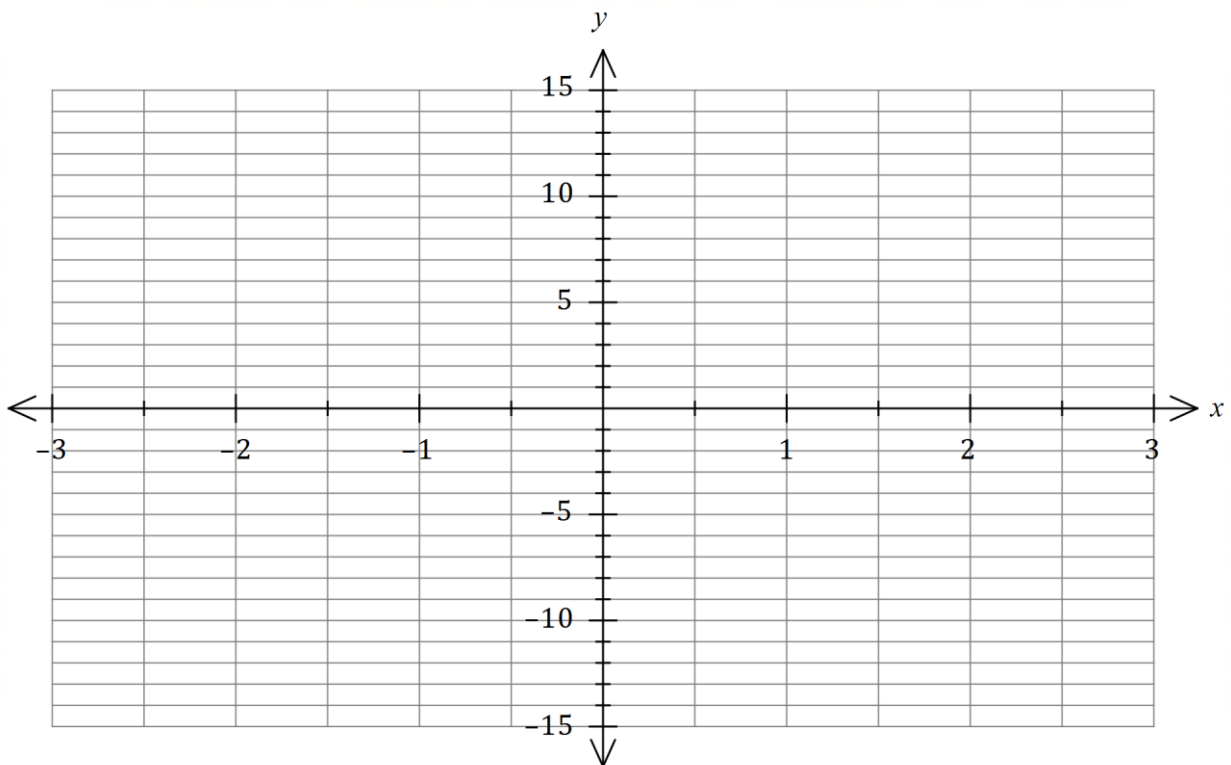**Question 15**   **(8 marks)**

A polynomial of degree 3 passes through the points with coordinates $(0, 4), (-2, 0), (2, 0)$ and $(0.5, 0)$.

(a)   Determine the equation of the polynomial in expanded form.   (4 marks)

(b)   Draw the graph of the polynomial on the axes below, indicating the coordinates of all turning points.   (4 marks)

Question 16 **(7 marks)**

Bag A contains 6 red and 4 blue counters. Bag B contains 3 red and 5 blue counters.

(a) A counter is randomly drawn from bag A, replaced and then a second counter randomly drawn from the same bag. Determine the probability that the second counter drawn is blue. (1 mark)

(b) A counter is randomly drawn from bag B, **not** replaced and then a second counter is randomly drawn from the same bag. Determine the probability that the second counter drawn is red. (3 marks)

(c) A counter is randomly drawn from bag A, its colour noted and then placed in bag B. A second counter is then randomly drawn from bag B. Determine the probability that this counter is the same colour as the first counter drawn. (3 marks)
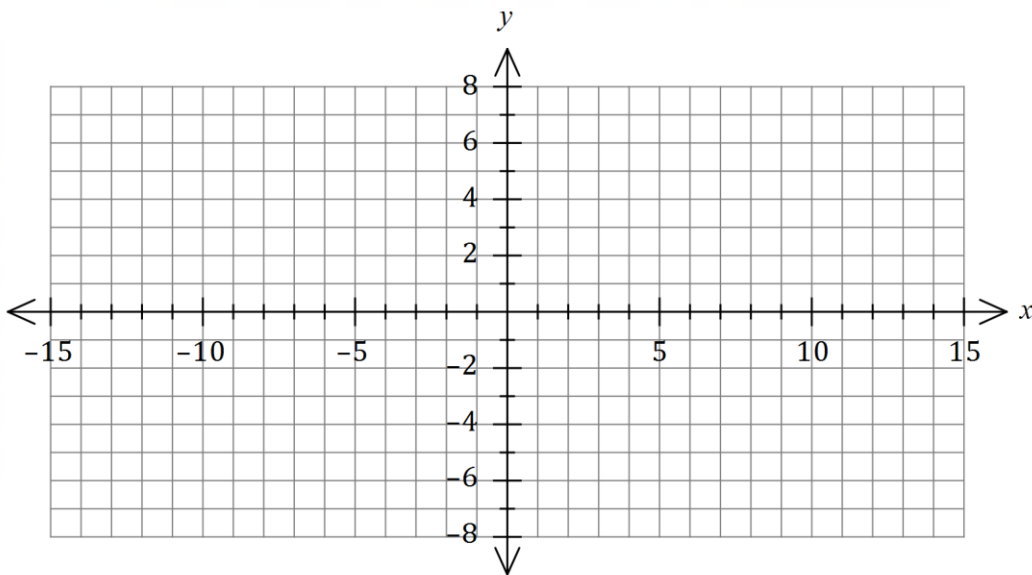
Question 17 **(8 marks)**

The graph of $y = f(x)$ is drawn below, where $f(x) = \sqrt{x + a} + b$.
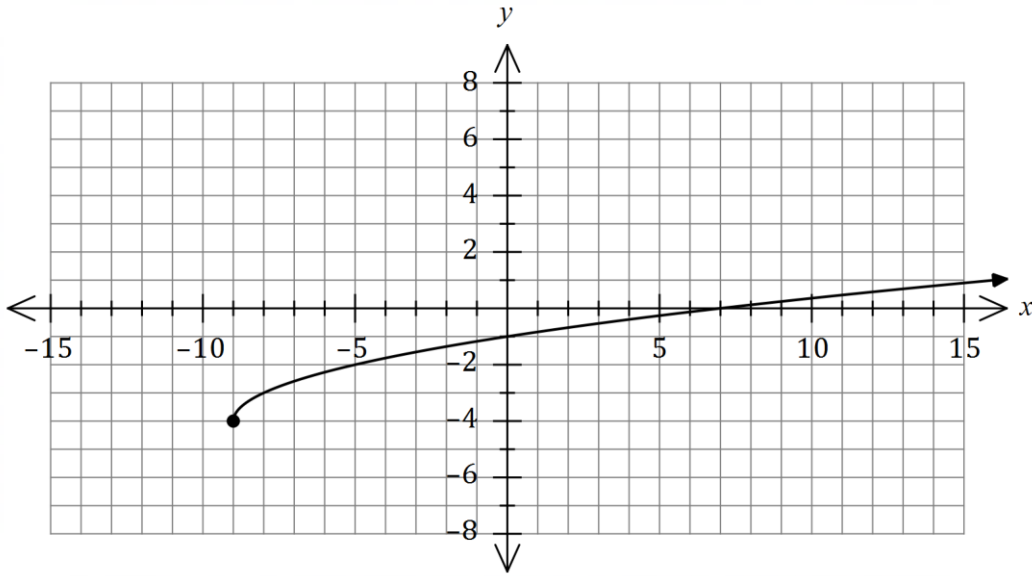
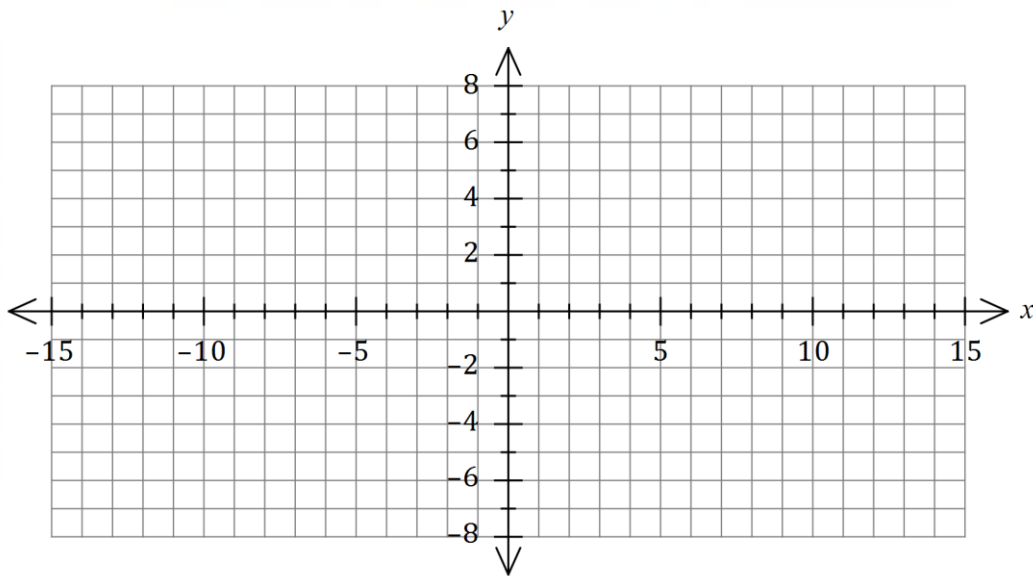(a) Determine the value of the constant a and the value of the constant b. (2 marks)

(b) Draw the graph of $y = -2f(x)$ on the axes below. (3 marks)

(c)   Draw the graph of $y = f(2x)$ on the axes below.   (3 marks)

Question 18 **(9 marks)**

The probabilities that Alf, Bess and Cleo will attend the next work social are $P(A) = 0.7$, $P(B) = 0.55$ and $P(C) = 0.85$ respectively. It is also known that $P(A \cap B) = 0.45$.

(a) Determine $P(A \cup B)$. (2 marks)

(b) Describe, in the context of this question, the event $(A \cap \bar{B}) \cup (\bar{A} \cap B)$ and calculate the probability that it happens. (3 marks)

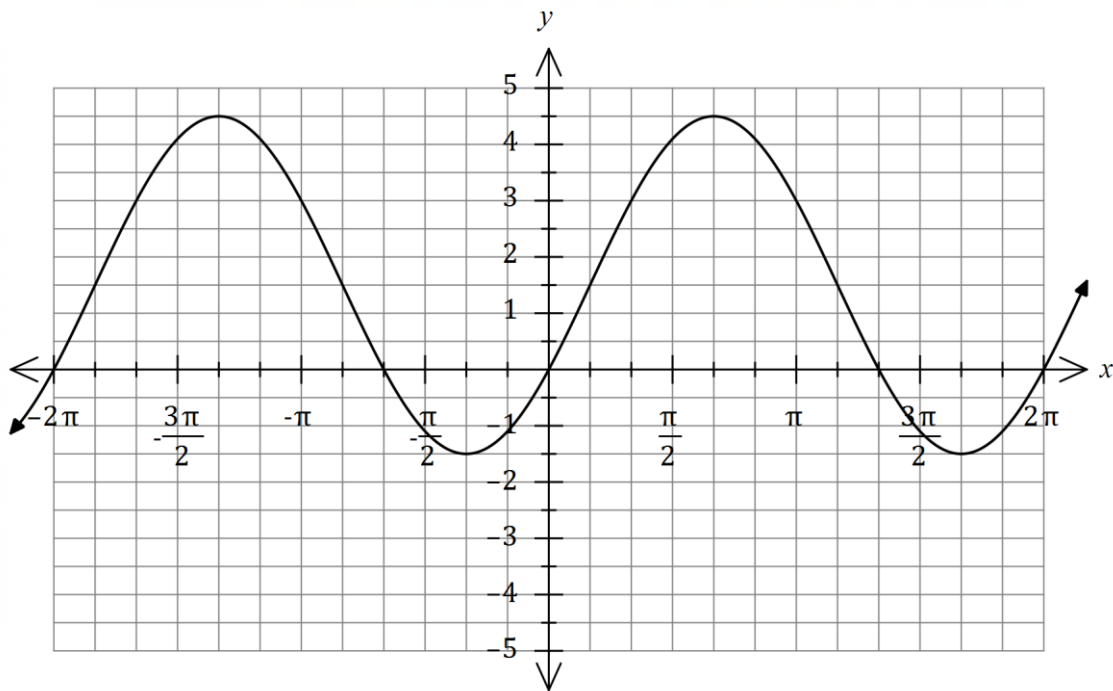(c) State, with justification, whether events A and B are mutually exclusive. (1 mark)

(d)   The attendance of Cleo at the next work social is independent of the attendance of anyone else. Determine the probability that none of the three named people attend the next work social.   (3 marks)

Question 19   **(8 marks)**

The graph of $y = a + b\sin(x - c)$ is drawn below, where a, b and c are positive constants.

(a)   Determine the value of a, the value of b and the value of c, where $c < \pi$.   (3 marks)

(b)   On the same axes, draw the graph of $y = a + \dfrac{b}{2}\sin(x + c)$.   (3 marks)

(c)   Solve $b\sin(x - c) = \dfrac{b}{2}\sin(x + c)$ for $-\pi \le x \le \pi$.   (2 marks)

Question 20   **(8 marks)**
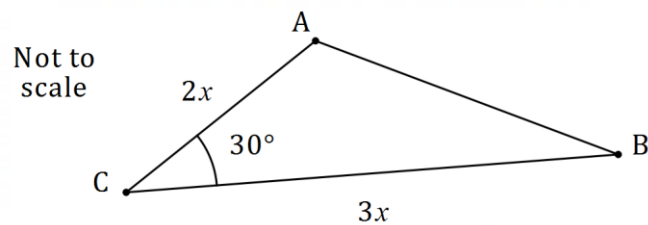
(a)   Determine the area of triangle PQR when $\angle PQR = 26°$, $\angle PRQ = 122°$ and $PQ = 57$ cm.

                (4 marks)

(b)   The area of triangle ABC is 96 cm², $\angle ACB = 30°$ and $2BC = 3AC$ as shown in the diagram. Determine the length of AB.   (4 marks)

Not to scale

See next page

Question 21 **(8 marks)**

A squad of 6 cyclists is to be chosen at random from 17 applicants. 3 of applicants live in Tasmania, 6 live in WA and the rest live in Queensland.

(a)   Determine the number of different squads that can be chosen.   (2 marks)

(b)   Determine the number of different squads that can be chosen that

(i)   include all the Tasmanians.   (2 marks)

(ii)   include an equal number of cyclists from each of the states.   (2 marks)

(iii)   have at least 5 cyclists from Queensland.   (2 marks)

Supplementary page

Question number: _____