



## Structure of this paper

### Working out space

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of examination
Section One: Calculator-free	6	6	50	48	33
Section Two: Calculator-assumed	13	13	100	97	67
<b>Total</b>					<b>100</b>

## Instructions to candidates

1. The rules for the conduct of the Western Australian Certificate of Education ATAR course examinations are detailed in the *Year 12 Information Handbook 2016*. 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 answers to the specific questions asked and to follow any instructions that are specific to a particular question.
4. Additional pages for the use of planning your answer to a question or continuing your answer to a question have been provided at the end of this Question/Answer booklet. If you use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number.
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.

(3 marks)

c) State  $h \circ g(x)$  and its natural domain.

(3 marks)

b) Does  $g \circ h(x)$  exist over the natural domain of  $h(x)$ ? Explain.

(3 marks)

a) Determine the natural domain and range of  $g(x)$ .

Consider the functions  $g(x) = \frac{x^2 - 1}{x}$  and  $h(x) = \sqrt{x - 4}$

(9 marks)

**Question 1**

Working time: 50 minutes.

- This section has six (6) questions. Answer all questions. Write your answers in the spaces provided.
- Continuity: If you need to use the space pages for planning, indicate this clearly at the top of the page.
  - Planning: If you use the space pages for planning, indicate this clearly at the top of the page.
  - Responses and/or as additional space if required to continue an answer.
- 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.

(48 Marks)

**Section One: Calculator-free****Working out space**

**Question 2**

Determine the following integrals.

a)  $\int \frac{2x}{\sqrt{1-3x}} dx$

(7 marks)

(3 marks)

b)  $\int_0^{\pi} 5\sin^3(2x)dx$

(4 marks)

**Question 6**

Let  $v=1+\sqrt{3}i$ .

(a) Determine the three cube roots of  $v$ .

(8 marks)

(3 marks)

(b) Consider the polynomial  $P(z)=z^4-8z^3+kz^2-46z+44$ , where  $k$  is a real constant.

Given that  $P(v)=0$ , solve the equation  $P(z)=0$ .

(5 marks)

(4 marks)

b) Hence determine

$$\int \frac{(x+2)(x^2+6x+1)}{4x^2+22x+14} dx$$

(4 marks)

Determine the values of

 $a, b \text{ & } c$ 

where

are constants.

a) The function

$$\frac{x^2 + 6x + 1}{bx + c}$$

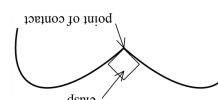
can be expressed in the form

(8 marks)

Question 3

(b) (i) Determine the coordinates of the point of contact. (1 mark)

The jeweller plans to attach a small square shaped clasp to the pendant. One corner of the square will sit in the cusp on the curve at the point of contact. The situation is illustrated on the right below.



Q5 continued-

(iii) At the point of contact, will the gradient of the heart match that of the clasp? (3 marks)

Justify your answer.

**Question 4****(9 marks)**

Consider a herd of 25 horses,  $N$ , in an isolated habitat such that the growth rate after  $t$  years is given by

$$\frac{dN}{dt} = \frac{N}{4} - \frac{N^2}{1000}$$

- a) By using separation of variables and partial fractions, derive  $N(t)$  showing all working. (5 marks)

Q4 continued

- b) Determine the limiting value of the number of horses. (2 marks)

- c) Set up an equation, but do not solve, that will allow the time to be calculated where the growth rate is a maximum. (2 marks)

**Question 5****(7 marks)**

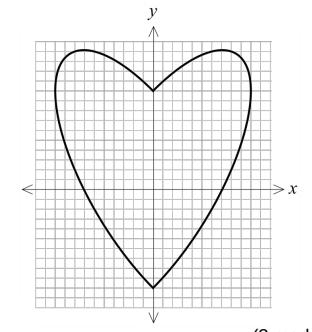
A designer creates a heart-shaped pendant for Valentine's Day shown on the right, using the function

$$2|x|^2 - 2|x|y + y^2 - 1 = 0$$

For  $x \geq 0$  this equation becomes

$$2x^2 - 2xy + y^2 - 1 = 0$$

- (a) Show that  $\frac{dy}{dx} = \frac{2x-y}{x-y}$  for  $x \geq 0$  (3 marks)



(3 marks)