Published by the School Curriculum and Standards Authority of Western Australia
27 Walters Drive
OSBORNE PARK WA 6017

Government of **Western Australia**
School Curriculum and Standards Authority

WACE
Western Australian Certificate of Education

Western Australian Certificate of Education
Sample Examination, 2016

Question/Answer Booklet

MATHEMATICS METHODS

Please place your student identification label in this box

Section One: Calculator-free

Student Number: In figures | | | | | | | | |

In words _____

_____

Time allowed for this section

Reading time before commencing work: five minutes
Working time for this section: fifty 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

To be provided by the candidate
Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: nil

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 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.

2013/42084

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	9	9	50	52	35
Section Two: Calculator-assumed	12	12	100	92	65
				Total	100

Instructions to candidates

1. The rules for the conduct of Western Australian external 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 responses to the specific questions asked and to follow any instructions that are specific 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.

See next page

Additional working space

Question number: _____

Additional working space

Question number: _____

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

Section One: Calculator-free **35% (52 Marks)**

This section has **nine (9)** questions. Answer **all** questions. Write your answers in the spaces provided.

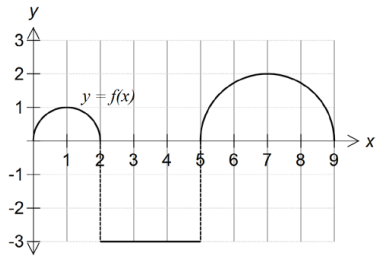
Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- 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.

Working time: 50 minutes.

Question 1 **(4 marks)**

Use the graph of $y = f(x)$ to calculate the following definite integrals.



(a) $\int_0^5 f(x)dx$ (2 marks)

(b) $\int_0^9 f(x)dx$ (2 marks)

See next page

Question 2 **(7 marks)**

(a) Solve, exactly, each of the following equations.

(i) $\log_x 4 = 2$ (2 marks)

(ii) $e^{2x} = 5$ (2 marks)

(b) If $\log a + \log a^2 + \log a^3 + ... + \log a^{50} = k \log a$, determine k. (3 marks)

See next page

Additional working space

Question number: _____

Question 9 (continued)

(b) This simulation in part (a) is repeated another 100 times and the proportion (p) of even numbers is recorded for each simulation. Comment on the key features of a typical graph, showing the results of 100 simulations. (3 marks)

Question 3 **(5 marks)**

A curve has a gradient function $\frac{dA}{dt} = 60 - 3at^2$, where a is a constant.

Given that the curve has a maximum turning point when $t = 2$ and passes through the point (1, 62), determine the equation of the curve.

Question 4 **(5 marks)**

Harry fires an arrow at a target n times. The probability, p, of Harry hitting the target is constant and all shots are independent.

Let X be the number of times Harry hits the target in the n attempts.

The mean of X is 32 and the standard deviation is 4.

(a) State the distribution of X. (1 mark)

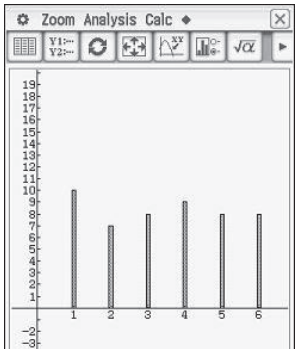
(b) Determine n and p. (4 marks)

See next page

Question 9 **(6 marks)**

The graph on the calculator screen shot below shows the results of a simulation of the tossing of a standard six-sided die, 50 times.

Simulated results of 50 tosses of a standard six-sided die



This simulation is repeated another 100 times.

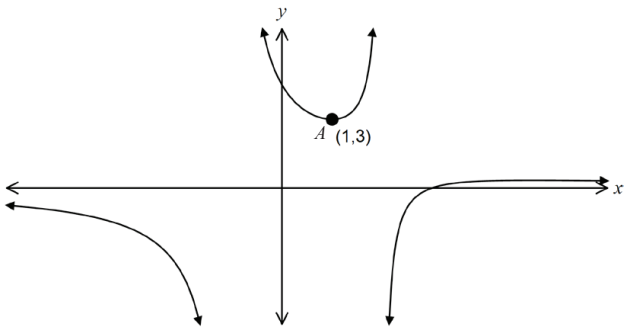
(a) (i) Describe the type of probability distribution related to this simulation (1 mark)

(ii) Calculate the proportion of even numbers recorded in this simulation. (1 mark)

End of questions

Question 8 **(6 marks)**

Consider the graph of $f(x) = \dfrac{3x-9}{x^2-x-2}$ shown below with a local minimum at A (1, 3).



(a) Show that $f'(x) = \dfrac{-3(x-1)(x-5)}{(x^2-x-2)^2}$. (3 marks)

(b) Hence or otherwise determine the coordinates of the local maximum value of $f(x)$. (3 marks)

Question 5 **(5 marks)**

The continuous random variable X is defined by the probability density function

$$f(x) = \begin{cases} \dfrac{q}{x} & 1 \le x \le 3 \\ 0 & \text{elsewhere.} \end{cases}$$

(a) Determine the exact value of q. (3 marks)

(b) Determine $P(2 < X < 3)$. (2 marks)

Question 6 **(6 marks)**

(a) Given $f'(x) = x^2 \ln(2x + 1)$, determine $f''(x)$. Do not simplify. (3 marks)

(b) Determine $f'(t)$, where $f(t) = t\sqrt{t} + \int_0^t \frac{dx}{1 - x^2}$. (3 marks)

See next page

Question 7 **(9 marks)**

A particle moves in a straight line according to the function $x(t) = e^{\sin t},\ t \geq 0$, where t is in seconds and x is in metres.

(a) Determine the velocity function for this particle. (3 marks)

(b) Determine the rate of change of the velocity at any time, $t \geq 0$ seconds. (3 marks)

(c) Evaluate exactly $\int_0^{\frac{\pi}{2}} x'(t)dt$. (2 marks)

(d) Interpret the answer to part (c) in terms of the context of the particle moving according to the function $x(t) = e^{\sin t},\ t \geq 0$ seconds. (1 mark)

See next page