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Government of Western Australia
Curriculum Council

WACE
Western Australian Certificate of Education

Western Australian Certificate of Education
Examination, 2010

Question/Answer Booklet

MATHEMATICS 3A/3B

Section One: Calculator-free

Please place your student identification label in this box

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

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, pencils, pencil sharpener, eraser, correction fluid/tape, ruler, highlighters

Special items: nil

Important note to candidates
No other items may be used in this section of the examination. 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.

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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	8	8	50	40	
Section Two: Calculator-assumed	8	8	100	80	
			Total	120	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2010*. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in the spaces provided in this Question/Answer Booklet. 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(s) that you are continuing to answer at the top of the page.

3. **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 an answer to any question, ensure that you cancel the answer you do not wish to have marked.

4. It is recommended that you **do not use pencil**, except in diagrams.

See next page

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Additional working space

Question number: _____

Additional working space

Question number: _____

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Section One: Calculator-free **(40 Marks)**

This section has **eight (8)** 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(s) that you are continuing to answer at the top of the page.

Working time: 50 minutes.

Question 1 **(3 marks)**

Use the method of elimination to solve the simultaneous equations

$$x - 2y = 12 \quad \text{and} \quad 3x - 10y = 0 .$$

See next page

Question 2 **(3 marks)**

A curve has equation $y = x^3 + ax + b$. The gradient of the curve at the point (2, 7) is 3.
Determine the values of a and b.

See next page

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Question number: _____

Question 8 **(5 marks)**

A universal set U is defined by $U = \{-4, -3, -2, -1, 0, 1, 2, 3\}$. A, B and C are subsets of U.

Given that $B \cap C = \{-2, -1, 0, 1\}$, $A \cup B = \{-4, -3, -2, -1, 0, 1, 2\}$, $A \cap \overline{B} = \{2\}$, $\overline{C} = \{-4, -3, 3\}$ and $n(A) = 6$:

(a) determine the elements of set C. (1 mark)

(b) determine the elements of sets A and B. Show your working. (4 marks)

End of questions

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Question 3 **(4 marks)**

(a) Write a numerical expression to determine the number of possible eight-digit phone numbers that

(i) start with 9 and have no digits the same. (1 mark)

(ii) start with 9 and have no adjacent digits the same. (1 mark)

(b) A child presses '9' on the phone and then presses seven other digits at random. What is the probability that the number dialled contains no zero, given that no digits are the same? (2 marks)

See next page

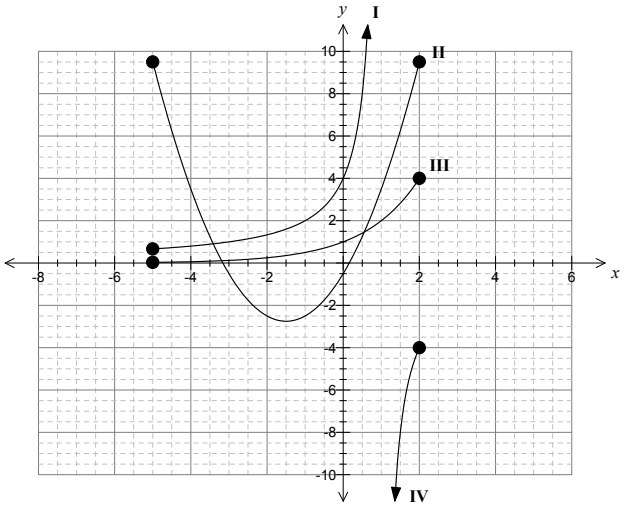
Question 4 **(13 marks)**

The functions below have been graphed over the domain $-5 \le x \le 2$.

$$f(x) = -\frac{4}{(x-1)}$$

$$g(x) = x^2 + 3x - \frac{1}{2}$$

$$h(x) = 2^x$$



Answer the following questions for the functions over the given domain.

(a) Complete the table below by matching the appropriate sections of the graphs (I, II, III and IV) with their functions. (3 marks)

Function	Section(s)
$f(x)$	
$g(x)$	
$h(x)$	

See next page

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(d) It is possible to reduce the completion time of some activities in building the extension by paying an additional cost.

Activities C and E originally cost \$2000 and \$6000 respectively. One proposed suggestion is to shorten the completion times for activities C and E as much as possible. The tables below show the cost increase of each activity in order to reduce the completion time.

Activity C	
Completion time (weeks)	**Cost increase**
3	\$2000
2	\$5000
1	\$9000

Activity E	
Completion time (weeks)	**Cost increase**
7	\$4000
6	\$9000

(i) What is the maximum number of weeks by which CEG can be reduced before there is a change in the original critical path? (1 mark)

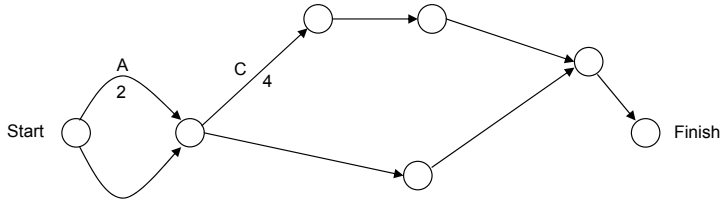
(ii) With justification, state the new completion time for the extension and the minimum cost increase. (2 marks)

See next page

Question 7 **(6 marks)**

Activities A, B, C, …, H are required to build a small extension to an existing house. The estimated completion times (weeks) for these activities are shown in the table below.

Activity	Completion time (weeks)	Predecessor(s)
A	2	–
B	3	–
C	4	B, A
D	4	B, A
E	8	C
F	6	D
G	2	E
H	3	F, G



(a) Complete the project network above by labelling the arcs. (1 mark)

(b) State the critical path. (1 mark)

(c) State the minimum number of weeks required to build the extension. (1 mark)

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(b) State which function has a vertical asymptote and write down the equation of this asymptote. (2 marks)

(c) Which function displays symmetry? (1 mark)

(d) From the graphs, determine the values of x for which $h(x) \geq f(x)$. (2 marks)

(e) What is the range of $h(x)$? (2 marks)

(f) Use the graph to estimate the **positive** solution to the equation $2^x = x^2 + 3x - \frac{1}{2}$. (1 mark)

(g) Add a suitable linear function to the graph and use it to estimate the solution(s) to the equation $x^2 + 3x - 7 = 0$. (2 marks)

Question 5 **(3 marks)**

Prove that the difference between the squares of consecutive integers is always odd.

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Question 6 **(3 marks)**

The gradient function of a curve is given by $\frac{dy}{dx} = 2 - 2x - \frac{3}{2}x^2$. Find the equation of the curve, given that it passes through the point $(3, \frac{1}{2})$.