

# Rossmoyne Senior High School

Year 12 Trial WACE Examination, 2015

Question/Answer Booklet

**MATHEMATICS**  
**3AB**  
Section One:  
Calculator-free

# SOLUTIONS

Student Number: In figures

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In words

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Your name

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## 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 (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.

## 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	7	7	50	50	33 $\frac{1}{3}$
Section Two: Calculator-assumed	13	13	100	100	66 $\frac{2}{3}$
Total				150	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. 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.

**Section One: Calculator-free**

**(50 Marks)**

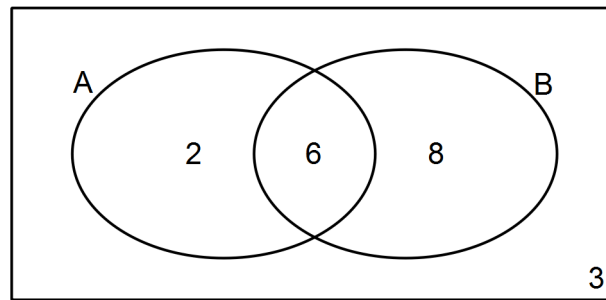
This section has **seven (7)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time: 50 minutes.

**Question 1**

**(6 marks)**

The sample space for the two events A and B is shown in the Venn diagram below.



(a) Determine

(i)  $n(A \cap \overline{B})$ .

(1 mark)

2

(ii)  $n(A \cup \overline{B})$ .

(1 mark)

11

(b) If one element is chosen at random from the universal set, determine

(i)  $P(A \cup B)$ .

(2 marks)

$\frac{16}{19}$

(ii)  $P(B | \overline{A})$ .

(2 marks)

$\frac{8}{11}$

## Question 2

(4 marks)

- (a) Determine  $f'(x)$  when  $f(x) = \frac{2x^4}{4x^2}$ , simplifying your answer. (2 marks)

$$\begin{aligned} f(x) &= \frac{2x^4}{4x^2} \\ &= \frac{x^2}{2} \\ f'(x) &= x \end{aligned}$$

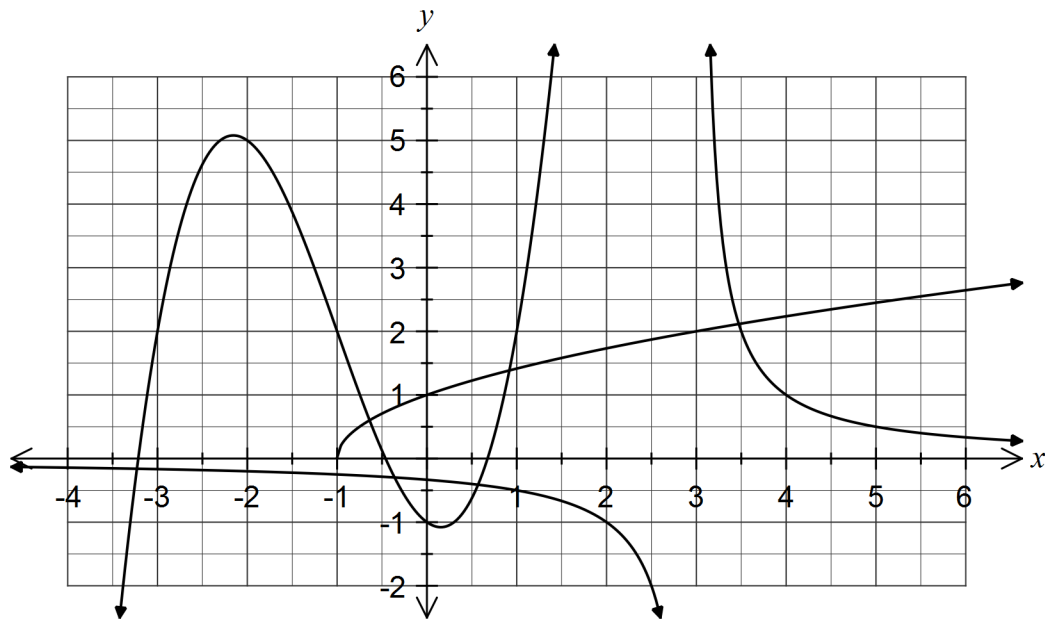
- (b) Determine  $\frac{dy}{dx}$  using the product rule when  $y = (1 - 2x^2)(5x + x^3)$ . Do not simplify your answer. (2 marks)

$$\frac{dy}{dx} = (-4x)(5x + x^3) + (1 - 2x^2)(5 + 3x^2)$$

Question 3

(8 marks)

The graphs of  $f(x) = \sqrt{x+1}$ ,  $g(x) = x^3 + 3x^2 - x - 1$  and  $h(x) = \frac{1}{x-3}$  are shown below.



- (a) State the domain and range of the function  $f(x)$ . (2 marks)

Domain:  $x \geq -1$

Range:  $y \geq 0$

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

$h(x)$   $x = 3$

- (c) One of the functions has a point of inflection. State which function and use the graph to estimate the coordinates of this point of inflection. (2 marks)

$g(x)$   $(-1, 2)$

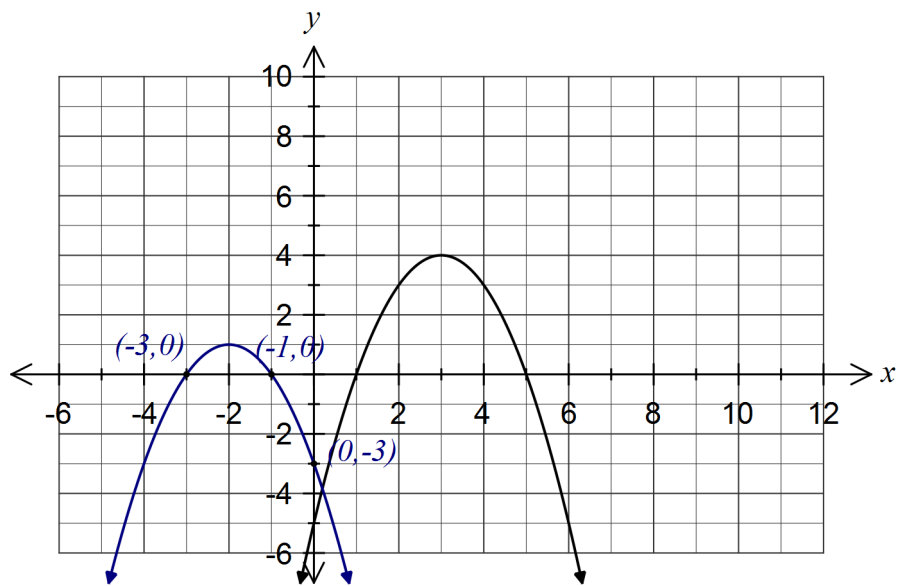
- (d) Use the graph to solve the equation  $x^3 + 3x^2 - x - 1 = \frac{1}{x-3}$  for  $x < 0$ . (2 marks)

$x = -3.2, x = -0.4$

Question 4

(8 marks)

The graph of  $y = f(x)$  is shown below.



(a) The graph of  $y = f(x)$  is transformed to produce  $g(x) = f(x+5) - 3$ .

(i) Determine the equation of  $g(x)$  in the form  $y = -(x - p)^2 + q$ . (2 marks)

$$y = -(x - 3 + 5)^2 + 4 - 3$$

$$y = -(x + 2)^2 + 1$$

(ii) Draw the graph of  $y = g(x)$  on the axes above, showing all axes intercepts. (3 marks)

(b) The graph of  $y = f(x)$  is transformed to produce  $h(x) = 2f(-x)$ .

(i) State the coordinates of the turning point of the graph of  $y = h(x)$ . (1 mark)

$$(3, 4) \rightarrow (-3, 4 \times 2) = (-3, 8)$$

(ii) Describe the transformations required to produce  $h(x)$  from  $f(x)$ . (2 marks)

*In any order:*

Reflect in the  $y$ -axis.

Dilate vertically by a scale factor 2.

**Question 5**

**(10 marks)**

Solve the following equations for  $x$ .

(a)  $x(x - 1)(2x + 1) = 0$

(2 marks)

$$x = 0, x = 1, x = -\frac{1}{2}$$

(b)  $x^2 - x - 30 = 0$

(2 marks)

$$(x - 6)(x + 5) = 30$$

$$x = 6, x = -5$$

(c)  $9^{x+1} = 3^{3-2x}$

(3 marks)

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

$$2x + 2 = 3 - 2x$$

$$4x = 1$$

$$x = \frac{1}{4}$$

(d)  $5(2)^{-2x} = 40$

(3 marks)

$$2^{-2x} = 8$$

$$2^{-2x} = 2^3$$

$$-2x = 3$$

$$x = -1.5$$

Question 6

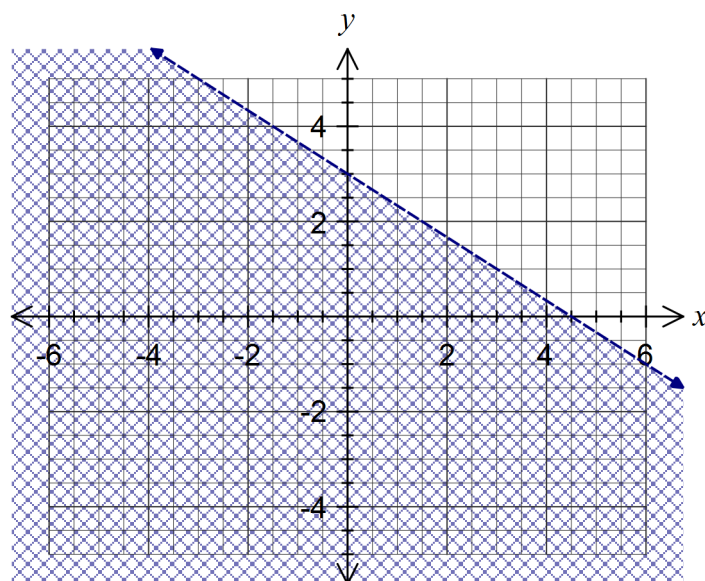
(7 marks)

- (a) Solve the inequality  $x - 3 \geq 3x - 2$ .

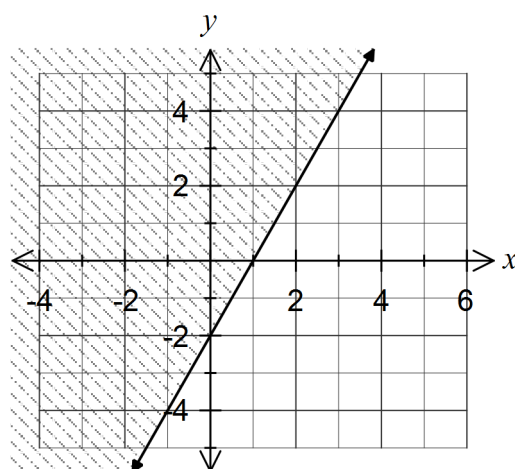
(2 marks)

$$\begin{aligned} x - 3 &\geq -2 + 3 \\ -2x &\geq 1 \\ x &\leq -\frac{1}{2} \end{aligned}$$

- (b) Sketch the region that satisfies the inequality  $2x + 3y < 9$  on the axes below. (3 marks)



- (c) State the inequality that defines the shaded region shown below. (2 marks)



$$y \geq 2x - 2$$



Question 7

(7 marks)

A recursive sequence is defined by the difference equation  $aT_{n+1} - bT_n = 12$  and is such that  $T_2 = 2$ ,  $T_3 = 4$  and  $T_4 = 20$ .

- (a) Establish the simultaneous equations  $2a - b = 6$  and  $5a - b = 3$ . (3 marks)

Using  $T_2 = 2$  and  $T_3 = 4$

$$4a - 2b = 12$$

$$2a - b = 6$$

Using  $T_3 = 4$  and  $T_4 = 20$

$$20a - 4b = 12$$

$$5a - b = 3$$

- (b) Solve the simultaneous equations from (a) to determine the values of  $a$  and  $b$ . (2 marks)

$$5a - b = 3$$

$$2a - b = 6$$

$$3a = -3 \Rightarrow a = -1$$

$$-5 - b = 3 \Rightarrow b = -8$$

- (c) Determine  $T_5$ . (2 marks)

$$(-1)T_5 - (-8)T_4 = 12$$

$$8T_4 - 12 = T_5$$

$$T_5 = 8 \times 20 - 12$$

$$= 148$$

**Additional working space**

Question number: \_\_\_\_\_

**Additional working space**

Question number: \_\_\_\_\_

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