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

WACE
Western Australian Certificate of Education

Western Australian Certificate of Education Examination, 2015

Question/Answer Booklet

MATHEMATICS: SPECIALIST 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

Number of additional answer booklets used (if applicable): ☐

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	8	8	50	50	33⅓
Section Two: Calculator-assumed	13	13	100	100	66⅔
				Total	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2015*. 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

Section One: Calculator-free **33⅓% (50 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 that you are continuing to answer at the top of the page.

Working time: 50 minutes.

Question 1 **(4 marks)**

Differentiate the following with respect to x, simplifying your answers as far as possible.

(a) $6x^2e^{2x-1}$ (2 marks)

(b) $-\dfrac{3}{\sqrt[3]{x^2+1}}$ (2 marks)

Question 2 **(10 marks)**

(a) Simplify the following as fully as possible.

(i) $(-2a^3) \times \left(\frac{a^2b}{3}\right)^2$ (2 marks)

(ii) $\frac{2^{p+2} + 8}{5 \times 2^p + 10}$ (2 marks)

(iii) $\frac{\log(a^2) + \log(b^4)}{\log(ab^2)}$ (2 marks)

(b) Given that $\log_a y - 3\log_a(x + 1) = 5$:

(i) prove that $y = a^5 (x + 1)^3$. (2 marks)

(ii) find the gradient of the tangent to the curve $\log_a y - 3\log_a(x + 1) = 5$ at $x = 1$. (2 marks)

See next page

Question 3 **(4 marks)**

(a) Convert the Cartesian coordinates $(-\sqrt{3}, 1)$ into polar coordinates $[r, \theta]$ where $0 \leq \theta < 2\pi$. (2 marks)

(b) Convert the polar coordinates $\left[4, -\frac{\pi}{4}\right]$ into Cartesian coordinates. (2 marks)

See next page

Question 4 **(4 marks)**

Points A and B have position vectors $2\mathbf{i} + 3\mathbf{j}$ and $7\mathbf{i} - 9\mathbf{j}$, respectively. Determine:

(a) $\overrightarrow{AB}$. (1 mark)

(b) $\left|\overrightarrow{AB}\right|$. (1 mark)

(c) the position vector of point C located on $\overrightarrow{AB}$ such that the ratio $\left|\overrightarrow{AC}\right| : \left|\overrightarrow{CB}\right|$ is 2:3. (2 marks)

Question 5 **(3 marks)**

The definition of the derivative of a function $y = f(x)$ is $\frac{df}{dx} = \lim_{h \to 0} \left(\frac{f(x+h) - f(x)}{h} \right)$.

Use this definition to determine the derivative of $3x - x^2$.

See next page

Question 6 **(7 marks)**

Given that $f(x) = |2x + 1|$ and $g(x) = |x - 3|$, solve the following:

(a) $g(x + 3) = 3$. (2 marks)

(b) $f(x) \leq g(x)$. (3 marks)

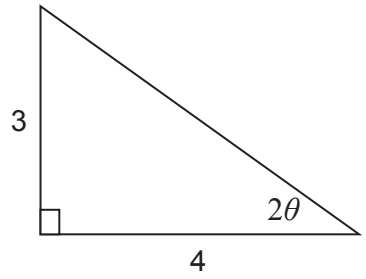
(c) If $h(x) = 5 - 2x$, define $h \circ f(x)$ and determine the range of this composite function. (2 marks)

See next page

Question 7 **(7 marks)**

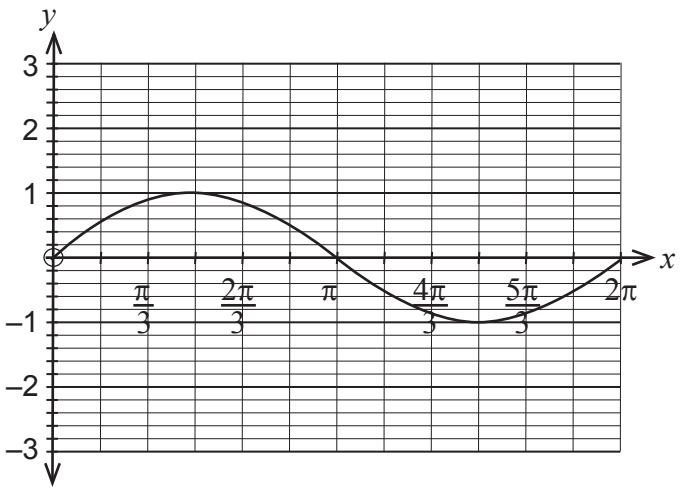
(a) Show that $\cos(3\theta) = 4\cos^3\theta - 3\cos\theta$. (3 marks)

(b) If the acute angle 2θ is as shown below, determine the exact value of $\cos\theta$. (4 marks)



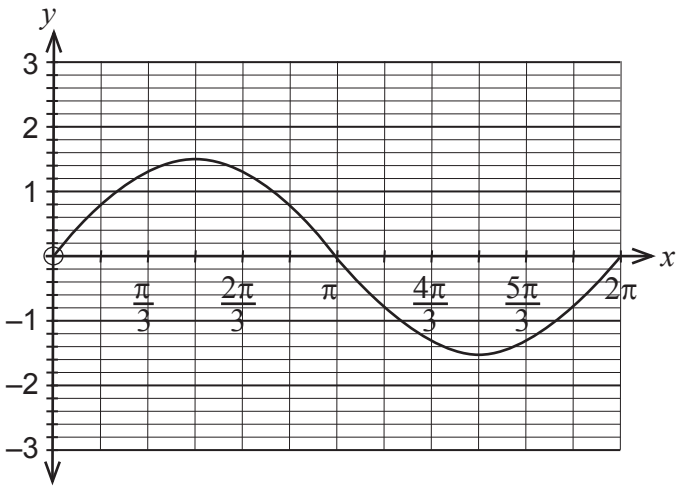
Question 8 **(11 marks)**

The graph for $y = \sin x$, $0 \leq x \leq 2\pi$, is shown below.

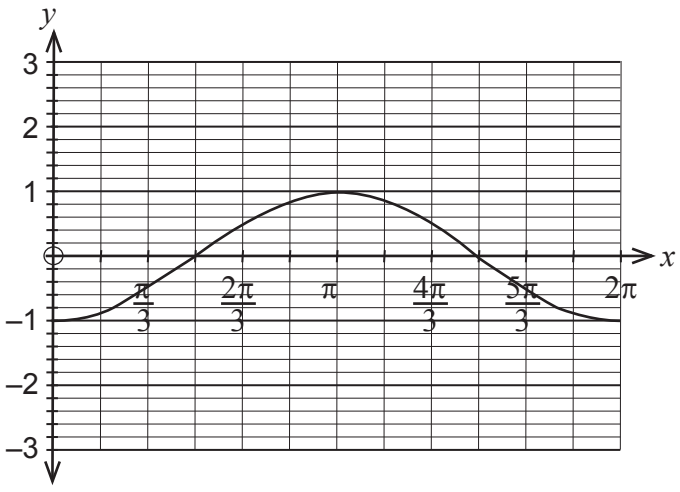


(a) The graphs shown below are all transformations of $y = \sin x$. Write the equation of the function shown in each graph.

(i) _____ (2 marks)



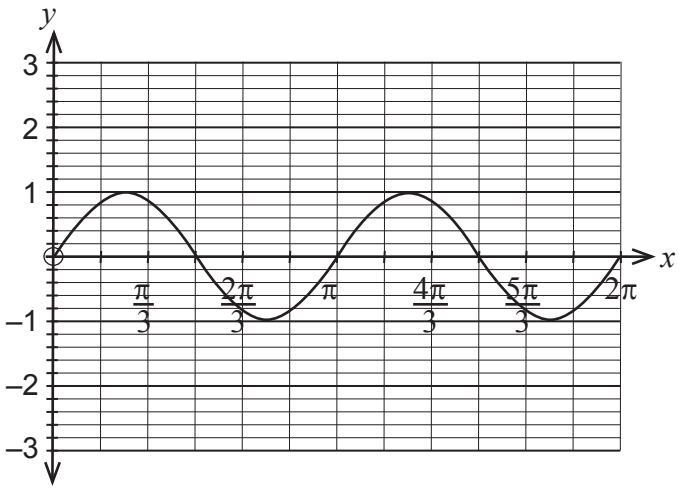
(ii) _____ (2 marks)



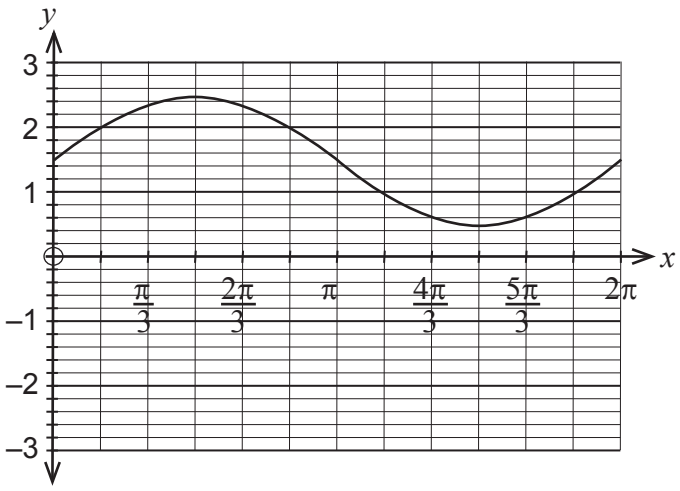
See next page

Question 8 (continued)

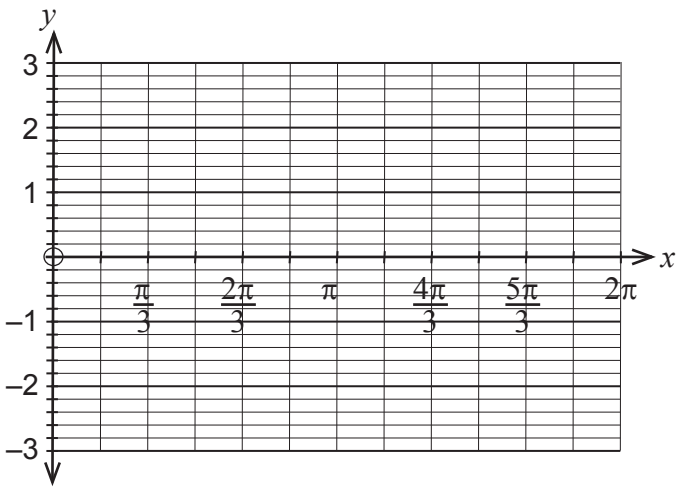
(iii) _____ (2 marks)



(iv) _____ (2 marks)



(b) On the axes provided, sketch the graph of $y = 1.5 \sin\left(2x - \frac{\pi}{2}\right) + 1.5,\ 0 \le x \le 2\pi$. Clearly indicate and state the values of any x -intercepts and turning points. (3 marks)



End of questions

Additional working space

Question number: _____

Additional working space

Question number: _____

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Question number: _____

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