

Question	Mark	TOTAL
1		
2		
3		
4		
5		
6		

hand it to the supervisor before reading any further.

You do not have any unauthorised material. If you have any unauthorised material with you, No other items may be taken into the examination room. It is your responsibility to ensure that

**Important note to candidates**

Special items: nil

*To be provided by the candidate*  
Standard items: Pens (blue/black preferred), pencils (including coloured), sharpener,

Formula sheet

This Question/Answer booklet

To be provided by the supervisor

**Materials required/recommended for this section**

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

Working time: fifty minutes

Reading time before commencing work: five minutes

Teacher's Name:

Name:

Calculator-free  
Section One:

**UNIT 1 AND 2**

**MATHEMATICS METHODS**

**Question/Answer booklet**

**Semester Two Examination, 2018**



**Structure of this paper**

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	50	33
Section Two: Calculator-assumed	9	9	100	100	67
<b>Total</b>					<b>100</b>

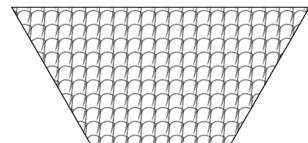
**Instructions to candidates**

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.

<p>Identifying important info</p> <p>Setting up equation to find <math>n</math></p> <p>The value of <math>n</math></p> <p>Setting up equation to find <math>S</math></p> <p>Showing that there are 116 tiles</p>
<p>∴ There are 18 rows of tiles, and a total of 116 tiles on the roof.</p> <p style="text-align: center;"><math>S_{18} = \frac{2}{2(28+96)}</math></p> <p style="text-align: center;"><math>d = 418 = n</math></p> <p style="text-align: center;"><math>a_1 = 2896 = 28 + (n-1)(4)</math></p> <p style="text-align: center;"><math>a_n = 9696 = 24 + 4n</math></p> <p style="text-align: center;"><math>1116</math></p>

**Solution**

There are 28 root tiles in the top row and each consecutive row has an extra 4 tiles than the row above it. If the bottom row has 96 tiles, show that there is a total of 116 tiles on the roof of the museum.



**Question 1**  
**(5 marks)**

The roof of a heritage building has root tiles arranged neatly in horizontal rows. A sample diagram is shown below.

Working time: 50 minutes.

This section has **six (6)** questions. Answer all questions. Write your answers in the spaces provided.

• Continuing an answer: if you need to use the space to continue an answer, 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.

Space 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.

**(50 Marks)**

**Section One: Calculator-free**

This section has **six (6)** questions. Answer all questions. Write your answers in the spaces provided.

**Question 2**

( 5 marks)

Evaluate the expression below, giving your answer as a simplified fraction.

$$\left( 125^{\frac{1}{3}} \times 25^{\frac{1}{2}} + 16^{\frac{3}{4}} \times 64^{\frac{1}{3}} + \frac{1}{49^{\left(\frac{1}{-2}\right)}} \right)^{-\frac{2}{3}}$$

**Solution**

$$\begin{aligned} &= \left( (5^3)^{\frac{1}{3}} \times (5^2)^{\frac{1}{2}} + (2^4)^{\frac{3}{4}} \times (2^6)^{\frac{1}{3}} + 7 \right)^{-\frac{2}{3}} \\ &= (5 \times 5 + 2^3 \times 2^2 + 7)^{-\frac{2}{3}} \\ &= (64)^{-\frac{2}{3}} \\ &= \left( 64^{\frac{1}{3}} \right)^{-2} \\ &= 4^{-2} \\ &= \frac{1}{16} \end{aligned}$$

- evaluating indices
- applying BIMDAS
- evaluated/simplified fraction

**Additional working space**

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



- (c) What is the instantaneous rate of change when  $x = -2$ ? (2 marks)

**Solution**

$$f'(x) = 4x - 6$$

$$f'(-2) = -14$$

- (d) Is the rate of change increasing or decreasing for  $x < 2$ ? Justify. (3 marks)

**Solution**

Stationary point is when  $f'(x) = 0$

$$\begin{aligned} f'(x) &= 4x - 6 \\ 0 &= 2(2x - 3) \end{aligned}$$

$\therefore$  Stationary point is when  $x = 1.5$

Taking a point to the left of  $x = -2$ ,  
 $f'(-3) = -18$ .

Hence, the rate of change is decreasing for  $x < 2$ .

- determining stationary points
- rate of change increasing
- valid justification

**Additional working space**

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

$(2^y - 1)(2^y - 8) = 0$ $2^y - 17 \cdot 2^y + 8 = 0$	<b>Solution</b>
$\checkmark$ factorising quadratic $\checkmark$ values $\checkmark$ for solutions to the exponential equation	
$2^y = 1 \rightarrow y = 0$ $2^y = 8 \rightarrow y = 3$ $\therefore y = 0 \vee y = 3$	

(b) hence, determine the solution(s) to the exponential equation. (4 marks)

$2^y + \frac{y}{8} = 17$ $2^y \cdot 2^{\frac{y}{8}} = 17$ $2^y \cdot 2^{y+1} = 17$ $2^y \cdot 2^y \cdot 2 = 17$ $2^{2y+1} = 17$ $2^{2y} = 17$ $2^y = \sqrt{17}$ $2^y = 4$ $y = 2$	<b>Solution</b>
$\checkmark$ using appropriate substitution $\checkmark$ quadratic equation (- for every wrong term)	

(a) use a suitable substitution to rewrite the equation above as a quadratic equation. Given the equation  $2^{x+1} + 2^{-x} = 17$ ,  $x \in \mathbb{R}$ . (3 marks)

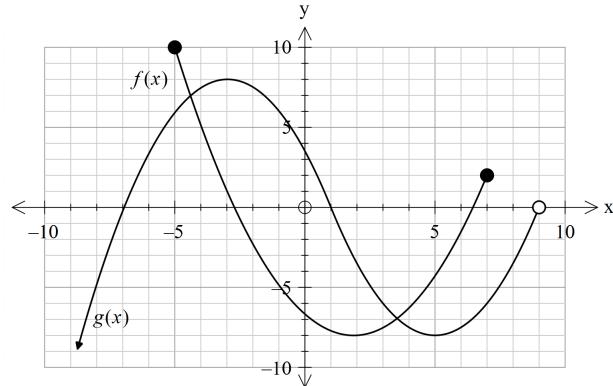
(c) Question 4 (7 marks)

Question number:

Additional working space

**Question 5****(11 marks)**

The graphs of the functions  $f(x)$  and  $g(x)$  are shown below.



- (a) State the domain of
- $g(x)$
- .

(1 mark)

**Solution**

$$[x \in R : x < 9]$$

- (b) State the range of
- $f(x)$
- .

(1 mark)

**Solution**

$$[f(x) \in R : -8 \leq f(x) \leq 10]$$

- (c) Which function(s), if any, have a point of inflection?

(1 mark)

**Solution**

$$g(x)$$

- (d) Describe how the graph of
- $y = -g(x)$
- may be obtained from the graph of
- $y = g(x)$
- and hence state the coordinates of the turning point(s) of the graph
- $y = -g(x)$
- . (3 marks)

**Solution**

Reflection about the x axis.

Turning points:  $(-3, 8) \leftarrow (-3, -8)$  and  $(5, -8) \leftarrow (5, 8)$

Identifying transformation points correctly turning points

(c) Hence find the x-coordinates of the points of intersection between the graphs of  $y_1$  and  $y_2$  over the domain  $[0, 2\pi]$ .  
(4)

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(4)

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- (e) Describe how the graph of  $y = f(x+1)$  may be obtained from the graph of  $y = f(x)$  and hence state the coordinates of the endpoints of the graph  $y = f(x+1)$ . (3 marks)

**Solution**

Horizontal translation of 1 unit to the left.

End points:  $(-5, 10) \rightarrow (-6, 10)$  and  $(7, 2) \rightarrow (6, 2)$

✓ identifying transformation

✓✓ correct end points

- (f) State the approximate solution(s) to the equation  $f(x) = g(x)$ . (2 marks)

**Solution**

$$\left(4\frac{1}{3}, 7\right) \wedge \left(3\frac{1}{2}, -7\right)$$

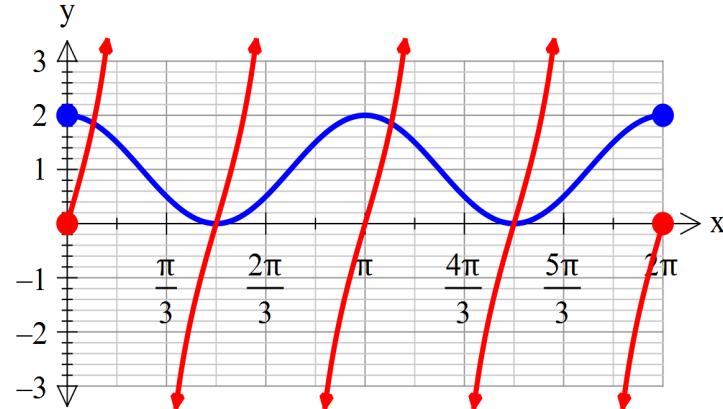
**Question 6**

(12 marks)

Given the following equations:

$$y_1 = 2\cos 2x, y_2 = 3\tan 2x, 0 \leq x \leq 2\pi.$$

- (a) Sketch on a single set of axes the graph of  $y_1$  and  $y_2$ . (4 marks)



**Solution**  
See graph above.

For each function:  
✓ shape  
✓ accuracy

- (b) Show that the coordinates of the points of intersection between the graphs of  $y_1$  and  $y_2$  are solutions of the equation  $2\sin^2 2x + 3\sin 2x - 2 = 0$ . (4 marks)

**Solution**

$$2\cos 2x = 3\tan 2x$$

$$2\cos 2x = \frac{3\sin 2x}{\cos 2x}$$

$$2\cos^2 2x = 3\sin 2x$$

$$2\cancel{\cos^2} 2x = 3\sin 2x$$

$$2\sin^2 2x + 3\sin 2x - 2 = 0$$

✓ rewriting tan in terms of sin and cos  
✓ multiplying both sides by cos  
✓ using Pythagorean identity  
✓ required equation