

Insert School Logo

Semester Two Examination 2019 Question/Answer Booklet

MATHEMATICS METHODS UNITS 1 & 2

Section One: Calculator-free

Student Name: _____

Teacher's Name: _____

Time allowed for this section

Reading time before commencing work: five minutes
Working time for paper: fifty minutes

Material 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 tape/fluid, erasers, 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

	Number of questions available	Number of questions to be attempted	Working time (minutes)	Marks available	Percentage of exam
Section One Calculator—free	9	9	50	52	35
Section Two Calculator—assumed	14	14	100	98	65
					100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2019*. Sitting this examination implies that you agree to abide by these rules.
2. Answer the questions according to the following instructions.

Section One: Write answers in this Question/Answer Booklet. Answer **all** questions.

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.

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

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. The Formula Sheet is **not** handed in with your Question/Answer Booklet.

Section One: Calculator–free**52 marks**

This section has **nine (9)** questions. Attempt **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 (5 marks)

Simplify each of the following, giving your answers with positive indices.

(a) $(2a^3b^{-1})^{-2}$ (2 marks)

(b)
$$\frac{\left(\frac{1}{3}x^3y^{-2}\right)^3}{(9x^{-2}y^2)^{-2}}$$
 (3 marks)

Question 2 (6 marks)

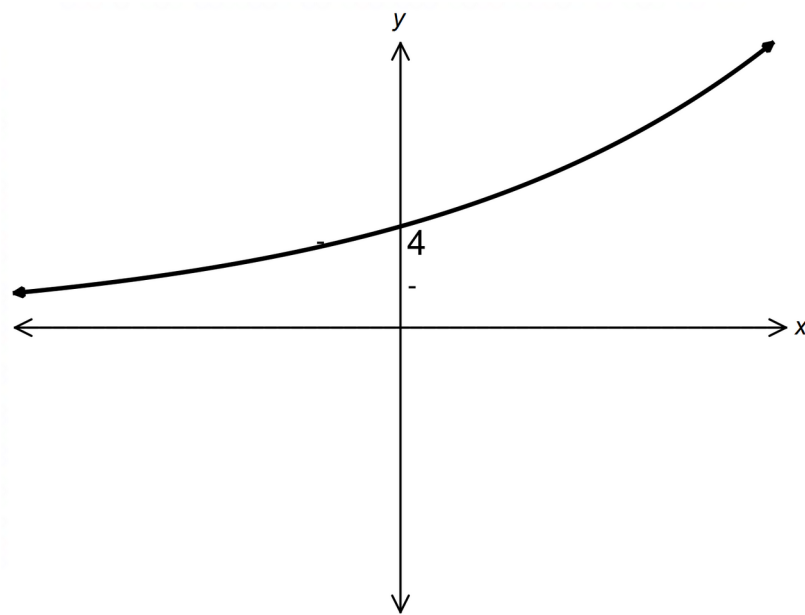
Solve the following exponential equations, giving your answers as exact values.

(a) $4^{1-x} = \frac{1}{8^{x-1}}$ (2 marks)

(b) $\sqrt{9^{x^2+1}} = 3^{x+3}$ (4 marks)

Question 3 (6 marks)

Consider the graph of $y = f(x)$, passing through $(0, 4)$.



(a) If $f(x) = ma^x$, determine:

(i) m . (1 mark)

(ii) $f(-2)$, in terms of a . (Leave with positive indices.) (1 mark)

(b) On the same set of axes, and with clear labelling, sketch:

(i) $y = f(-x)$. (2 marks)

(ii) $y = f(x) - 6$ (2 marks)

Question 4 (5 marks)

(a) Determine the derivative with respect to x of each of the following.

(i) $y = \frac{3}{4}x^4 + x^5 - 7$ (2 marks)

(ii) $f(x) = \frac{\pi x + 6x^2}{3\pi}$ (2 marks)

(b) Simplify $\lim_{h \rightarrow 0} \frac{x^3 - (x+h)^3}{h}$ (1 mark)

Question 5 (9 marks)

Given $y = t^3 - 5t^2$, determine:

(a) (i) the average rate of change of the function between $t = 1$ and $t = 3$. (2 marks)

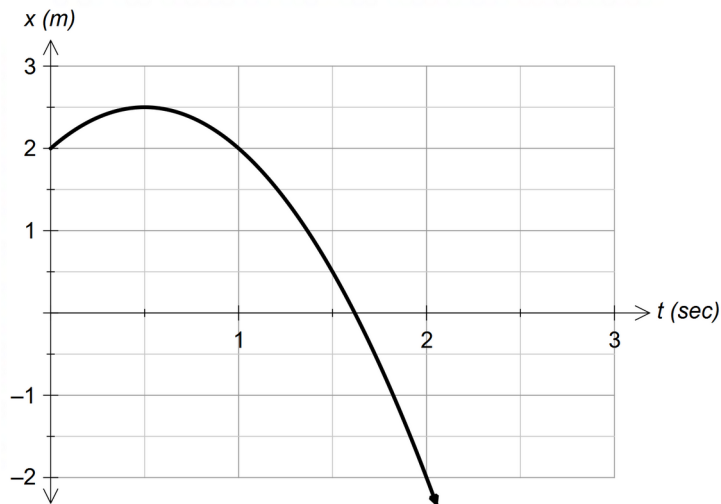
(ii) the instantaneous rate of change of the function at $t = 2$. (2 marks)

(b) Use the fact that $\delta y \approx \frac{dy}{dt} \times \delta t$ to determine the approximate change in y as t increases from 1 to 3. (2 marks)

(c) Determine the equation of the tangent to the curve $y = f(t)$ at the point where $t = 2$. (3 marks)

Question 6 (4 marks)

Consider the displacement-time graph of a particle undergoing rectilinear motion shown below.



(a) Determine, correct to the nearest 0.5 sec:

(i) when the particle is at the origin.

(1 mark)

(ii) when the particle is stationary.

(1 mark)

(b) Determine the equation of the displacement, $x(t)$, of the particle.

(2 marks)

Question 7 (5 marks)

Determine the antiderivatives of the following.

(a) $2x - \pi^2 + \frac{3}{5}x^2$ (2 marks)

(b) $\frac{n^3 - 4n^2}{3n}$ (3 marks)

Question 8 (6 marks)

James decides to ride from Perth to Sydney, a 3940 km journey.
He decides to leave on October 1st and travels 100 km the first day.
It happens that James manages to increase the number of kilometres travelled each day by 10 km, so travels 110 km the second day and continues travelling in that sequence.

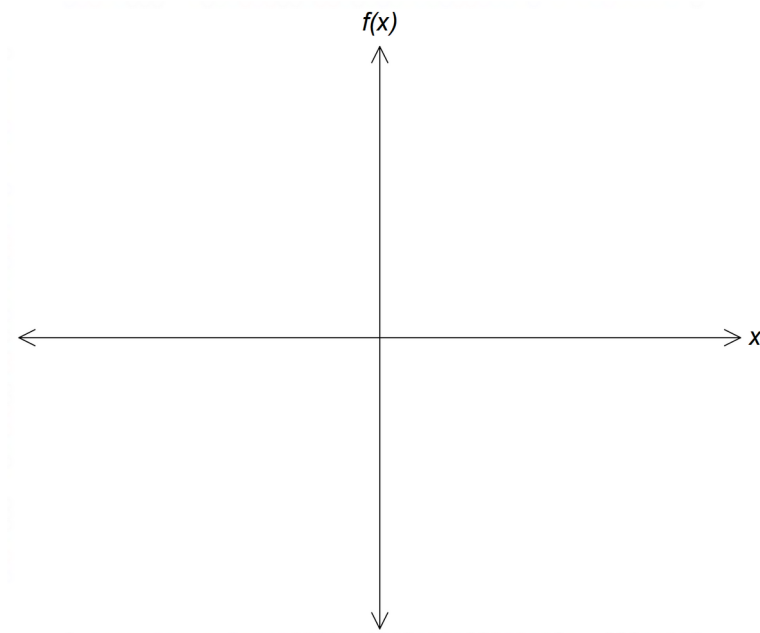
- (a) Write the number of kilometres travelled by James each day as a recursive rule. (1 mark)
- (b) Write the number of kilometres travelled by James each day as a non-recursive rule, in terms of n . (1 mark)
- (c) How far will James travel on October 8th? Show your working. (2 marks)
- (d) How far from Perth will James be at the end of October 12th? Show your working. (2 marks)

Question 9 (6 marks)

Sketch a graph for each of the functions with the features shown over the domain $-\infty < x < \infty$.
Label your graphs clearly.

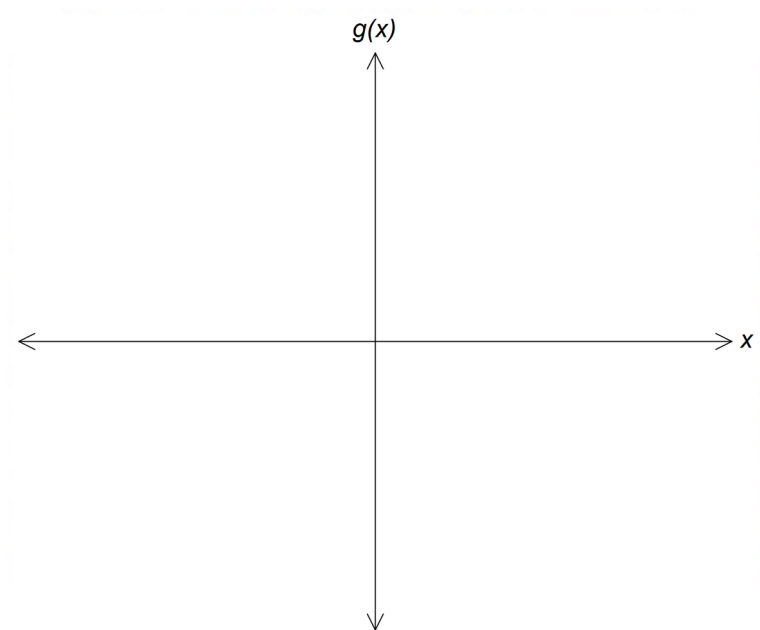
- (a) $f(-1) = 0$ and $f(0) = 1$
 $f(x) \rightarrow 2$ for $x \rightarrow \infty$
 $f(x) \rightarrow -\infty$ for $x \rightarrow -\infty$

(3 marks)



- (b) $g(x)$ has a stationary point at $x = 2$
 $g(x)$ has a global maximum at $x = 2$
 $g(x) \rightarrow 0$ for $x \rightarrow -\infty$
 $g(x) \rightarrow -\infty$ for $x \rightarrow \infty$

(3 marks)



Additional working space

Question number(s):