

**INSERT
SCHOOL
LOGO**

**Semester One
Examination 2020
Question/Answer booklet**

**MATHEMATICS
METHODS UNIT 3**

**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 | 7 | 7 | 50 | 50 | 35 |
| Section Two Calculator—assumed | 11 | 11 | 100 | 100 | 65 |
| Total marks | | | | | 100 |

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2020*. Sitting this examination implies that you agree to abide by these rules.
2. Answer the questions according to the following instructions.

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**35% (50 marks)**

This section has **seven (7)** 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 (7 marks)

Determine: (Do not simplify)

(a) $\frac{d}{dx} \left[\sin^3 \left(\frac{x}{2} \right) \right]$ (2 marks)

(b) $\frac{dx}{dt}$ if $x = t^2(\tan t)$ (2 marks)

(c) $f'(y)$ if $f(y) = \cos(\sqrt{\sin y})$ (3 marks)

Question 2 (6 marks)

A robotic welding machine used in the manufacture of cars, moves along a factory floor with its acceleration given as $a = 4e^{2t} - 2e^2$ m sec⁻². It is initially at a point on the floor defined to be $x = 0$ and passes through that point again at $t = 1$.

- (a) Show that the displacement is given by $x(t) = e^{2t} - e^2 t^2 + t - 1$. (4 marks)

- (b) Determine the change in displacement during the first second. (1 mark)

- (c) Determine the initial velocity. (1 mark)

Question 3 (9 marks)

Determine each of the following.

(a) $\int \left(\cos \frac{x}{2} + \sin x e^{\cos x} \right) dx$ (2 marks)

(b) $f(y)$ if $f'(y) = \frac{1}{\sqrt{1-2y}}$ and $f(-4) = 3$ (4 marks)

(c) $g'(x)$ if $g(x) = \int_{2x}^{-1} \frac{2}{\tan^2 t} dt$ (3 marks)

Question 4 (6 marks)

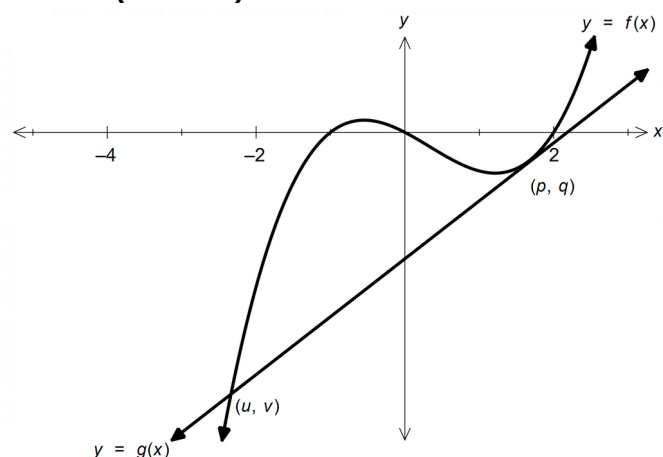
People were asked to review a product. The ratings were given as a number of stars from 1 to 5.

| X | 1 | 2 | 3 | 4 | 5 |
|---------------------|---------------|---------------|---------------|-----|----------------|
| Number of Responses | 6 | 8 | 12 | f | g |
| P(X) | $\frac{1}{8}$ | $\frac{1}{6}$ | $\frac{1}{4}$ | h | $\frac{5}{24}$ |

(a) Determine the values of f , g and h . (4 marks)

(b) Calculate $E(X)$. (2 marks)

Question 5 (8 marks)



The graph above displays $f(x) = x(x + 1)(x - 2)$ and $y = g(x)$.
 $g(x)$, a linear function, intersects $f(x)$ at (u, v) and is tangential at (p, q) .

(a) State integrals, in terms of $f(x)$ and/or $g(x)$, which determine:

(i) the area bounded by $f(x)$ and the x -axis. (2 marks)

(ii) the area bounded by the two curves. (2 marks)

(b) It is known that the gradient of $g(x)$ is 3.
 Determine the value of p . (4 marks)

Question 6 (6 marks)

$$\int_{-4}^5 h(t) \, dt = 10 \text{ and } \int_0^{-4} h(t) \, dt = 4 .$$

(a) Determine:

(i) $\int_0^5 h(t) \, dt$ (1 mark)

(ii) $\int_{-4}^0 [2 - h(t)] \, dt$ (2 marks)

(iii) $2 - \int_5^{-4} 3h(t) \, dt$ (2 marks)

(b) The area bounded by the function $y = h(t)$ and the x -axis between $x = -4$ and $x = 5$ cannot be calculated. Explain why not. (1 mark)

Question 7 (8 marks)

A function $y = ax^4 + bx^3 + cx^2 + dx + e$ has a horizontal point of inflection at (0, 2) and an oblique point of inflection at (-2, 0).

Determine the values of a , b , c , d and e . (8 marks)

Additional working space

Question number(s):

Additional working space

Question number(s):