

Semester Two Examination, 2022

Question/Answer booklet

MATHEMATICS
Year 11 METHODS
UNITS 1&2

Copy details of Section 1 sticker here:

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Teacher: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Section Two:
Calculator-assumed

Booklet 3 of 3

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| Number of additionalanswer booklets used(if applicable): |  |

## Time allowed for this section

Reading time before commencing work: ten minutes

Working time: one hundred minutes

## Materials required/recommended for this section

***To be provided by the supervisor***

This Question/Answer booklet

Formula sheet (retained from Section One)

***To be provided by the candidate***

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener,
correction fluid/tape, eraser, ruler, highlighters

Special items: drawing instruments, templates, notes on two unfolded sheets of A4 paper, and up to three calculators, which can include scientific, graphic and Computer Algebra System (CAS) calculators, are permitted in this ATAR course examination

## 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 material. If you have any unauthorised material with you, hand it to the supervisor before reading any further.

**Question 14 (9 marks)**

Let $S\_{n}$ be the sum of the first $n$ terms of an arithmetic sequence with first term $a$ and common difference $d$.

The sum of the first $16$ terms of the sequence is $320$.

(a) Show that $2a+15d=40$. (2 marks)

The sum of the first $80$ terms of the sequence is $576$.

(b) Determine the sum of the first $58$ terms of the sequence. (3 marks)

The sum $S\_{n}$ can be expressed in the form $S\_{n}=pn^{2}+qn$, where $p$ and $q$ are constants.

(c) Determine the value of $p$, the value of $q$ and then use calculus to show that $S\_{58}$ is the maximum sum of the sequence. (4 marks)

Question 15 (7 marks)

The graph of $y=a^{x+5}$ is shown below, where $a$ is a positive constant and $a>1$.



(a) On the axes above sketch and label the graphs of

(i) $y=a^{x}$. (2 marks)

(ii) $y=a^{x+5}-2$. (2 marks)

(b) Given that the curve $y=a^{x+5}$ passes through the point $(0, 5)$, solve $a^{x}=a^{x+5}-2$ for $x$.

 (3 marks)

Question 16 (8 marks)

For two events $A$ and $B$, $P\left(A\right)=0.45, P\left(B\right)=b$ and $P\left(\overbar{A}∩B\right)=0.22$. Determine the value of the constant $b$ in each of the following cases:

(a) $A$ and $B$ are mutually exclusive. (1 mark)

(b) $P\left(A | B\right)=0.6$. (2 marks)

(c) $P\left(\overbar{B} | A∪B\right)=0.3$. (2 marks)

(d) $P\left(B | A\right)=P(B)$. (3 marks)

Question 17 (8 marks)

The length of a is twice its width, and the sum of its height, width and length is $126$ cm. Let the width of the cuboid be $x$ cm.

(a) Show that the volume of the rectangular prism is $252x^{2}-6x^{3}$ cm3. (2 marks)

(b) Use a method involving differentiation to determine the **height** of the rectangular prism that maximises its volume. Justification of nature is not required. (3 marks)

(c) Determine the maximum possible total surface area of the rectangular prism. Justification of nature is not required. (3 marks)

Question 18 (8 marks)

(a) Determine the global minimum and maximum values of the function $f\left(x\right)=13+4x-2x^{2}$ when the domain of $f$ is restricted to $-2\leq x\leq 3$. (2 marks)

(b) Determine the discriminant of $g\left(x\right)=5x-4-x^{2}$ and use it to explain how many roots the function $g$ has. (2 marks)

(c) The graph of $y=ax^{2}+bx+c$ is symmetrical about the line $x=2$ and passes through the points $\left(0, -9\right)$ and $(5, 11)$. Determine the roots of the graph. (4 marks)

Question 19 (7 marks)

A team of workers is using a pile driver to drive wooden poles 4 metres long into the ground. The first hit of the pile driver drives a pole 50 cm into the ground. The second hit drives the pole another 40 cm into the ground. The third hit drives the pole another 32 cm into the ground and successive distances driven by the pile driver form a geometric sequence.

(a) How much further will the fifth hit drive the pole into the ground? (1 mark)

(b) Determine the total distance the wooden pole has been driven into the ground after 12 hits of the pile driver. (2 marks)

(c) If the worker continued in this way, what length of the wooden pole will always be left above ground in the long term? Justify your answer. (2 marks)

A second team of workers is also using a different pile driver to drive the same length poles into the ground. The first hit of this pile driver drives the pole 12 cm into the ground. The second hit drives the pole $x$ cm into the ground and the third hit drives the pole another 27 cm into the ground.

(d) Determine $x$ given that the successive distances form a geometric sequence. (2 marks)

Supplementary page

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

Supplementary page

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

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