**Papers written by Australian Maths Software**

# SEMESTER TWO

# YEAR 11

# MATHEMATICS SPECIALIST
# Units 1 & 2
# 2016
# REVISION TWO

## Section One
## (Calculator–free)

**Name:** _____

**Teacher:** _____

**TIME ALLOWED FOR THIS SECTION**

Reading time before commencing work: 5 minutes
Working time for section: 50 minutes

**MATERIAL REQUIRED / RECOMMENDED FOR THIS SECTION**

**To be provided by the candidate**
Standard items*:* pens, pencils, pencil sharpener, highlighter, eraser, ruler.

**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.

**To be provided by the supervisor**
Question/answer booklet for Section One.
A formula sheet which may also be used for Section Two.

**Structure of this examination**

| | Number of questions available | Number of questions to be answered | Working time (minutes) | Marks available | Percentage of exam |
|---|---|---|---|---|---|
| **Section One Calculator—free** | **6** | **6** | **50** | **52** | **35** |
| Section Two Calculator—assumed | 12 | 12 | 100 | 98 | 65 |
| Total marks | | | | 150 | |

**Instructions to candidates**

1. The rules for the conduct of this examination are detailed in the Information Handbook. Sitting this examination implies that you agree to abide by these rules.

2. Write your answer in the 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 provided at the end of this booklet. If you need to use them, 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 an answer to 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.

## Section One: Calculator–free 52 marks

This section has **six (6)** questions. Attempt **all** questions.
Working time: 50 minutes

**Question 1** **(7 marks)**

(a) Find a matrix with dimensions $2 \times 2$ that has no inverse. (2)

(b) Solve the simultaneous equations $x + y = 2$ and $2x - 3y = 11 = 0$ using a matrix method. (3)

(c) For matrices $A$ and $B$, explain under what conditions $(A + B)^2 = A^2 + 2AB + B^2$ is valid? (2)

**Question 2** **(17 marks)**

(a) Given the complex numbers $z_1$ and $z_2$ are defined as $z_1 = 1 + i, z_2 = 1 - i$ and $z_3 = 2 - 3i$ Determine

(i) $z_1 + z_2 - z_3$ (2)

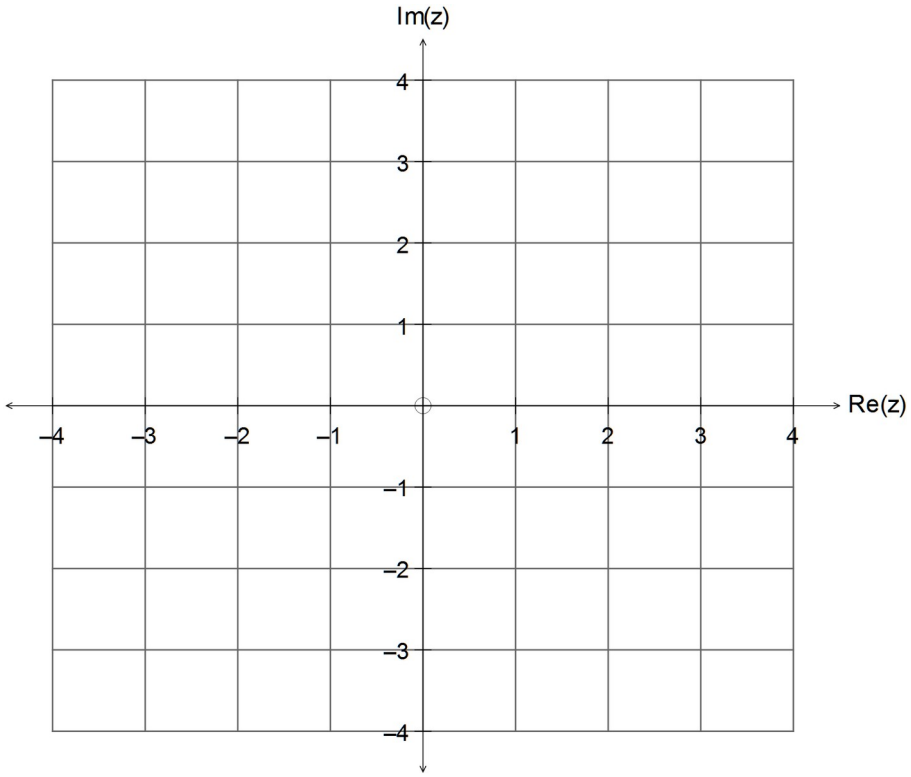
(ii) $\dfrac{z_1 \times z_2}{z_3}$ (2)

(iii) $\left| \dfrac{(z_1)^2}{\overline{z_2}} \right|$ (2)

(iv) $(z_2)^2 + (z_1)^{-1}$ (3)

(b) (i) Sketch $z_1 + z_2 - z_3$ on the set of axes below. (2)

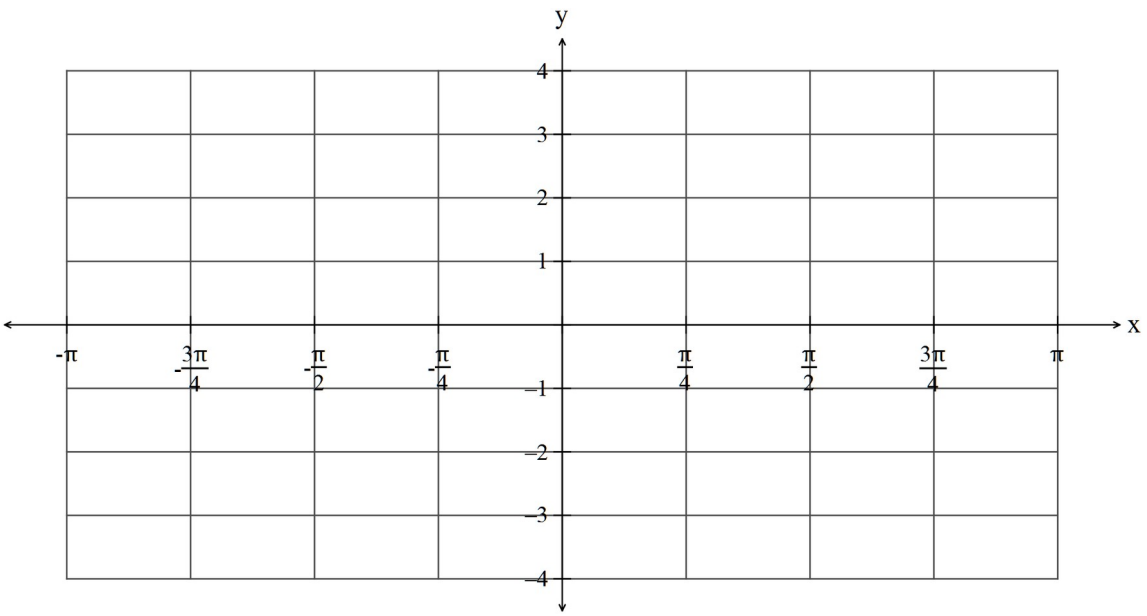
(ii) If $z = 1 - 3i$ sketch $z + \overline{z}$ on the set of axes below. (2)



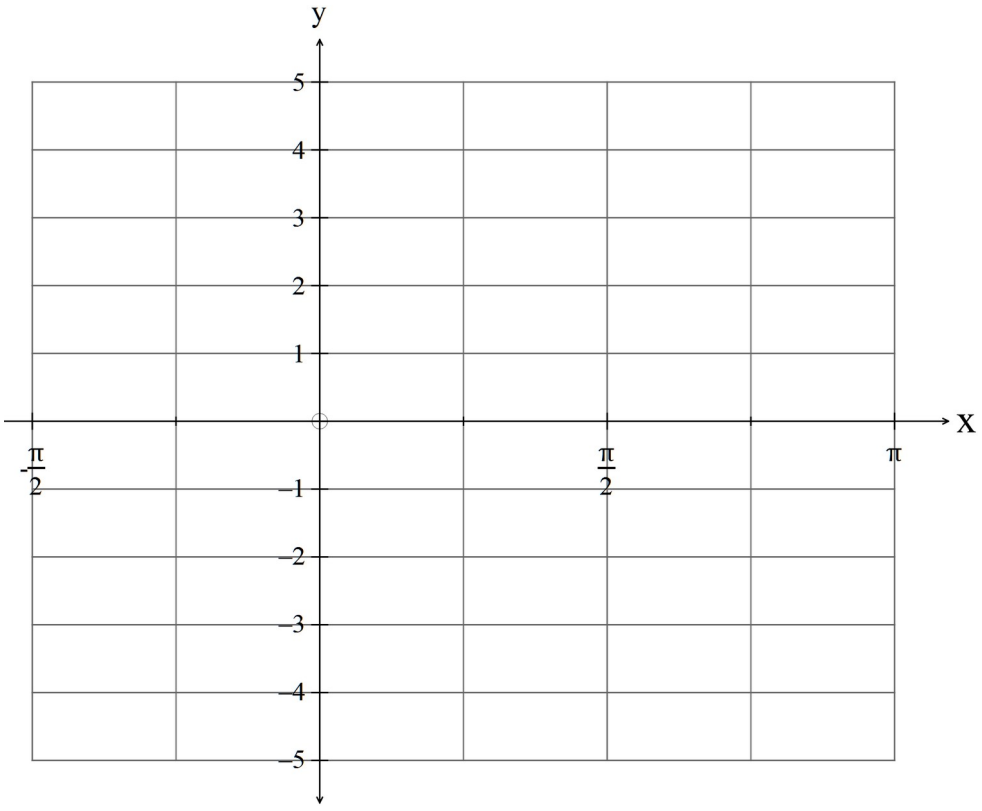

(c) Find $a$ and $b$ if $\dfrac{(1-3i)^2}{2-i} = a + bi$. (4)

**Question 3** **(5 marks)**

(a) Sketch the function $y = 2 + 2\cos(x)$ on the domain $-\pi \leq x \leq \pi$. (3)




(b) Sketch the function $y = -\sec(x)$ on the domain $-\frac{\pi}{2} < x \leq \pi$ (2)



**Question 4** **(6 marks)**

(a) Establish the formula of $\sin(3x)$ using the expansion for $\sin(A+B)$. (3)

(b) Solve $\sin(60^\circ + \theta) - \sin(60^\circ - \theta) = \frac{1}{2}$ for $0^\circ \leq \theta \leq 180^\circ$. (3)

**Question 5** **(9 marks)**

Consider the points $A(2,2)$, $B(5,5)$, $C(-4,4)$, $D(0,8)$ and $E(3,5)$.

(a) Show that

(i) $|\mathbf{AB}| = 3\sqrt{2}$. (1)

(ii) $\mathbf{AB}$ is parallel to $\mathbf{CD}$. (1)

(iii) $\mathbf{AC}$ is perpendicular to $\mathbf{AE}$. (1)

(b) (i) Find two points $P_1$ and $P_2$ such that $\mathbf{AB} = \mathbf{P_1E} = \mathbf{P_2E}$ (2)

(ii) Find the cosine of the angle $\mathrm{BAE}$. (2)

(iii) Find the projection of $\mathbf{AE}$ on $\mathbf{AB}$. (2)

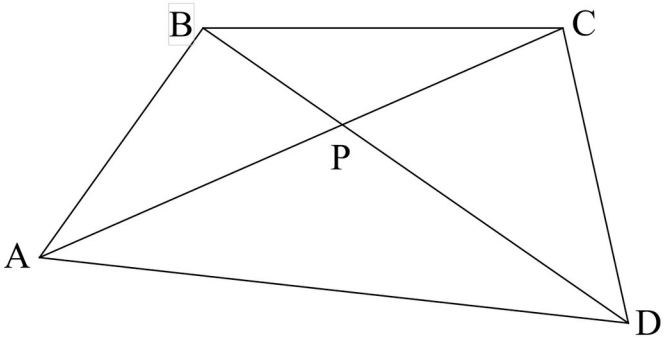
**Question 6** **(8 marks)**

(a) *All horses have four legs.*
*Penny is a horse.*
*Therefore Penny has four legs.*

Explain why this is an example of deductive reasoning. (1)

(b) Prove that "*Angles at the circumference of a circle subtended by the same arc are equal*". (3)

(c) Prove the following using vectors:
"*If the diagonals of a quadrilateral bisect each other, then the quadrilateral is a parallelogram*." (4)




**END OF SECTION**