

Question	Marks	Max	Question	Marks	Max
17			12		
16			4		
15			23		
14			6		
13			4		
12			22		
11			4		
10			20		
9			18		
8			19		
7			21		
6			22		
5			23		
4			24		
3			21		
2			20		
1			19		
0			18		

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.

Special items: drawing instruments, templates, notes on two unjolted sheets of A4 paper, and up to three calculators approved for use in this examination.

To be provided by the candidate Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

To be provided by the supervisor Formula sheet (retained from Section One)

Materials required/recommended for this section This Question/Answer booklet

Time allowed for this section Reading time before commencing work: ten minutes Working time: one hundred minutes

Name: \_\_\_\_\_ Teacher's Name: \_\_\_\_\_

Calculator-assumed  
Section Two:

UNIT 1 AND 2

MATHEMATICS METHODS

Q

uestion/Answer booklet

Semester Two Examination, 2020

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Independent

Public

School



**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	9	9	50	44	34
Section Two: Calculator-assumed	14	14	100	85	66
<b>Total</b>					<b>100</b>

**Additional working space**

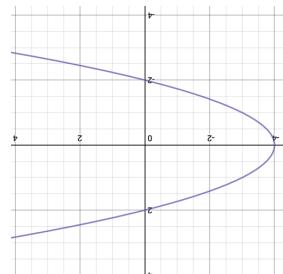
Question number: \_\_\_\_\_

**Instructions to candidates**

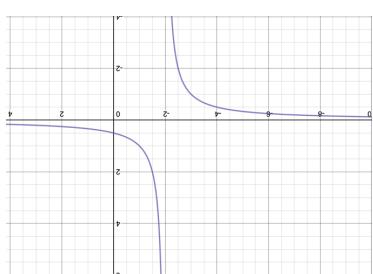
1. The rules for the conduct of the Western Australian Certificate of Education ATAR course examinations are detailed in the *Year 12 Information Handbook 2016*. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in this Question/Answer booklet.
3. You must 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.

**Question 10 {1.1.28}**  
 Applying the vertical line test to each of the following graphs and conclude whether the graph represents a relation or a function.  
 (4 marks)

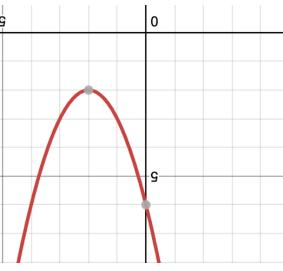
(c)



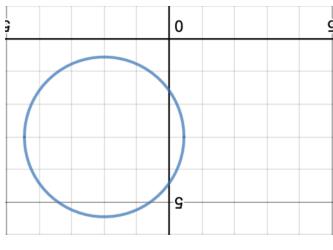
(d)



(a)



(b)



Working time: 100 minutes.

- This section has 14 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 spare pages for planning, indicate this clearly at the top of the page.
  - Responses and/or as additional space if required to continue an answer.
- 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.

**Question 10 {1.1.28}**  
 Applying the vertical line test to each of the following graphs and conclude whether the graph represents a relation or a function.  
 (4 marks)

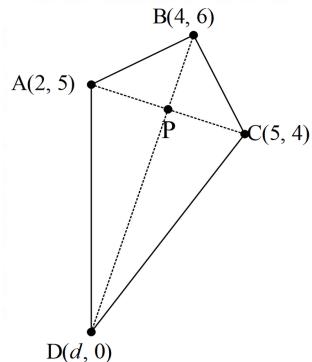
represents a relation or a function.

**Question 11 (1.1.1 – 1.1.6)****(2, 2, 1, 3, 2 = 10 marks)**

The kite ABCD is graphed below.

The coordinates of the vertices are A(2, 5), B(4, 6), C(5, 4) and D( $d$ , 0) as shown below.

NB Kites have diagonals that meet at right angles.



- a) Show that  $AB = BC$ .
- b) Find the gradient of AC and hence the equation of the diagonal BD.

**Additional working space**

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

- c) Determine the value of  $d$ , the  $x$ -coordinate of point D.

- c) Find the midpoint of AC and show it belongs to diagonal BD.

value of  $d$ .

- e) Show how the midpoint of AC could have been used to determine the

**Question 12 {1.1.26}**

(2, 2 = 4 marks)

- a) Give the equation of the image of  $y=x^2$  after the following transformation:  
Translate 3 units horizontally left followed by reflection in the  $x$ -axis.

- b) Give the equation of the image of  $y=\frac{1}{x}$  after the following transformation:  
Translate vertically up 2 units then reflect in the  $y$ -axis.

**Additional working space**

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

**Question 13 {2.3.4}**

(3 marks)

Determine the gradient of the secant passing through the graph  $y=x^3-2x^2-4$  at the points where  $x=6$  and  $x=9$ .

By first calculating the relevant positions of the car, determine its average velocity in:

$$x(t) = 30t + \frac{t+1}{30}, \text{ for } 0 \leq t \leq 4$$

A car's position at time  $t$  seconds is represented by  $x(t)$  metres, where:

(3, 2 = 5 marks)

#### Question 14 {2.3.1}

a) the first 2 seconds.

b) the last 2 seconds.

**Question 15 {2.3.5, 2.3.8}**

(3, 1 = 4 marks)

A balloon's volume at time  $t$  seconds is represented by  $V(t) \text{ cm}^3$ , where:

$$V(t) = -2t^2 + 800, \text{ for } 0 \leq t \leq 20$$

$$\frac{f(x+h) - f(x)}{h}$$

- a) Using the difference quotient, i.e.  $\frac{f(x+h) - f(x)}{h}$ , determine the average rate of change over  $[5, 5+h]$ .

- b) Hence, determine the instantaneous rate of change as  $h \rightarrow 0$ .

Working out space

Differentiate  $f(x) = 5x^3$  by first principles, i.e.  $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$

(4 marks)

**Question 17 {2.3.19}****(3, 2, 3, 4 = 12 marks)**

A particles displacement (in metres) from the origin with respect to time (in seconds) is given by the following equation:

$$s(t) = \frac{t^3}{3} - 5t^2 + at + b \quad \text{where } 0 \leq t \leq 8 \text{ s}$$

- a) Given that the particle is initially at the origin and has a displacement of 27 metres at 3 seconds, determine the values of a & b.

- b) Determine the particles displacement at 5 seconds to 2 decimal places.

- c) Use calculus techniques to determine when the particle is at rest.

- d) Use calculus techniques to determine the maximum displacement of the particle.

a) Determine  $f(x)$   
Given that  $f(x)$  runs through the point (2,4) and  $f'(x) = 3x^2 - 3$ :

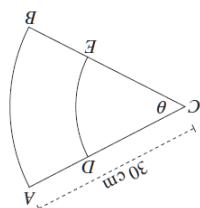
(3, 6 = 9 marks)

MATHEMATICS	12	CALCULATOR ASSUMED	MATHEMATICS	17	CALCULATOR ASSUMED
Question 19 {2.3.22}		(8 marks)	Question 23 (1.3.7, 1.3.11, 1.3.14, 1.3.16)		(1, 1, 1, 1, 1 = 6 marks)
Anika has her own private plane that she uses to travel from Perth to Melbourne. The amount of fuel she consumes on the journey and therefore the cost of her flight, $C$ (\$), is dependent on the speed at which she flies, $x$ (km/h).			a) Events A and B are such that $P(A)=0.4$ , $P(B)=0.7$ and $P(\bar{A} \cap B)=0.4$ . Determine: i. $P(A \cap \bar{B})$		
The relationship between the overall cost of the flight is modelled by the equation below.			ii. $P(\bar{A} \cap \bar{B})$		
$C = \frac{x^2}{200} - 8x + 20400$ where $550 \leq x \leq 900$			b) Given $P(D)=\frac{2}{3}$ , $P(C D)=\frac{3}{5}$ and $P(C \bar{D})=\frac{1}{5}$ . Determine: i. $P(C \cap D)$		
Use calculus techniques to determine both the <b>optimal speed</b> to travel in order to minimise the <b>cost of her flight</b> .			ii. $P(C \cap \bar{D})$		
			iii. $P(C)$		
			iv. $P(\bar{D} C)$		

(4 marks)

**Question 20 {1.2.6}**

- The region ABC is a sector of a circle with radius 30cm, centred at C. The angle in the sector is  $\theta$ . The arc DE lies on a circle also centred at C, as shown in the diagram.
- The arc DE divides the sector ABC into two regions of equal area.



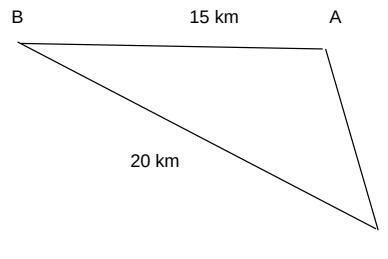
- Find the length of the interval CD.

**Question 21 {1.2.4}**

(4 marks)

A ground search for a lost hiker is being organised using three camping sites in a national park as bases. It is known that the hiker is within the triangular area formed with the three campsites as vertices. Campsite A is 15km due east from campsite B. Campsite C is on a bearing of  $170^\circ$  from campsite A (hint :  $\angle BAC = 100^\circ$ ). Campsite B is 20km from campsite C.

Note: The diagram is not to scale.



Calculate the area of the search to the nearest square kilometre.

**Question 22 {1.3.11, 1.3.13}**

(2, 2, 2, 2 = 8 marks)

There are 250 Year 11 students at Perth Modern School where 205 students study Mathematics Methods, 125 study Chemistry. Also, 91 study both Mathematics Methods and Chemistry.

- a) Represent this information in a completed Venn diagram.
- b) What is the probability that a student in Year 11 studies neither Mathematics Methods nor Chemistry?
- c) Given that a student in Year 11 studies Mathematics Methods, what is the probability that they also study Chemistry?
- d) Given that a student in Year 11 studies Chemistry, what is the probability that they also study Mathematics Methods?