



ATAR course examination, 2022

Question/Answer booklet

MATHEMATICS APPLICATIONS

Section One: Calculator-free

Place one of your candidate identification labels in this box.
Ensure the label is straight and within the lines of this box.

WA student number: In figures

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In words

Time allowed for this section

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

Number of additional
answer booklets used
(if applicable):

Materials 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 fluid/tape, eraser, 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 material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.



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	7	7	50	54	35
Section Two: Calculator-assumed	10	10	100	97	65
Total					100

Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2022: Part II Examinations*. Sitting this examination implies that you agree to abide by these rules.
2. Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.
3. You must be careful to confine your answers to the specific question asked and to follow any instructions that are specified to a particular question.
4. 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.
5. It is recommended that you do not use pencil, except in diagrams.
6. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.
7. The Formula sheet is not to be handed in with your Question/Answer booklet.

Section One: Calculator-free**35% (54 Marks)**

This section has **seven** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Working time: 50 minutes.

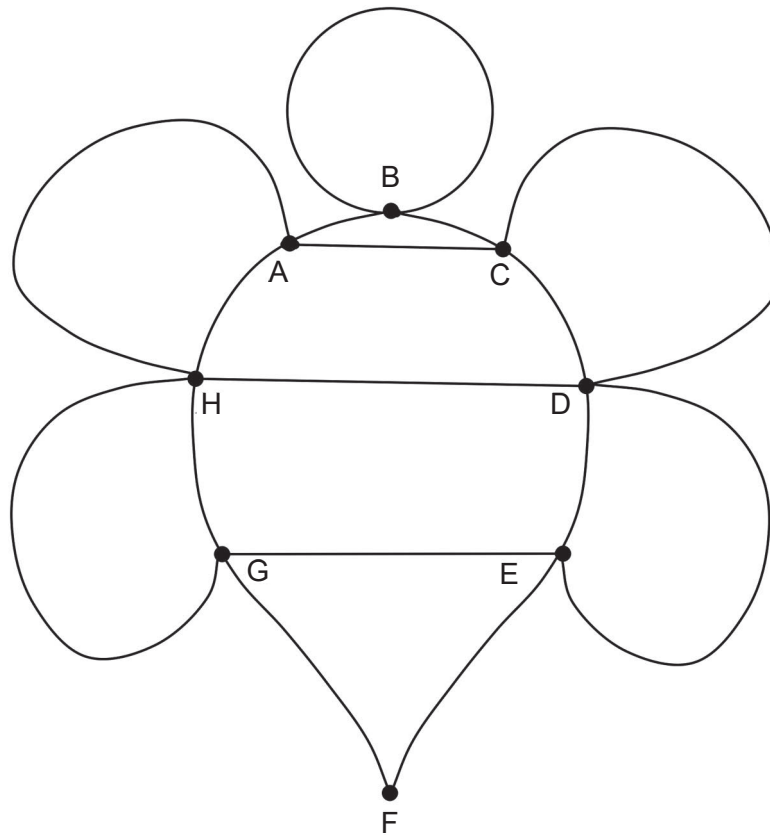
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Question 1

(7 marks)

The network below shows the different paths around a botanical exhibition.



(a) Explain why this is **not** a simple graph. (1 mark)

(b) Is this network Eulerian or semi-Eulerian? Justify your response. (2 marks)

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(c) Use Euler's formula to prove that this network is planar. (2 marks)

(d) A visitor to the exhibition has taken her child in a pram and wishes to walk along every path exactly once to see all the floral displays, excluding the walk back to the car park. If the only car parks are located next to D and F, where would you suggest they park? Use mathematical reasoning to support your answer. (2 marks)

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Question 2

(7 marks)

A gardener purchases a new lawnmower valued at \$4800. The lawnmower depreciates at a constant rate of \$250 per year.

(a) (i) Determine a recursive rule for the value of the lawnmower after n years. (2 marks)

(ii) Deduce a rule for the n^{th} term of this sequence. (1 mark)

(b) Determine the value of the lawnmower after 4 years. (1 mark)

As part of his business plan, the gardener will sell his lawnmower when its value drops below \$1300.

(c) Calculate when the lawnmower will be sold. (3 marks)

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Question 3

(8 marks)

An analysis was done on hospital patients based on their age and injuries received from various outdoor activities. The information is displayed below.

		Activity			Total
		Trampoline	Bike	Skateboard	
Age (years)	0–8	150	120	30	300
	9–16	180		90	450
	17–24	120	80		400
	25–32	20			250
Total		470		400	1400

- (a) Complete the two-way table above. (2 marks)
- (b) Identify the explanatory variable for these data. (1 mark)
- (c) The incomplete two-way percentaged table is shown below.

		Activity			Total
		Trampoline	Bike	Skateboard	
Age (years)	0–8	50			
	9–16			20	
	17–24	30			
	25–32		60		
Total					

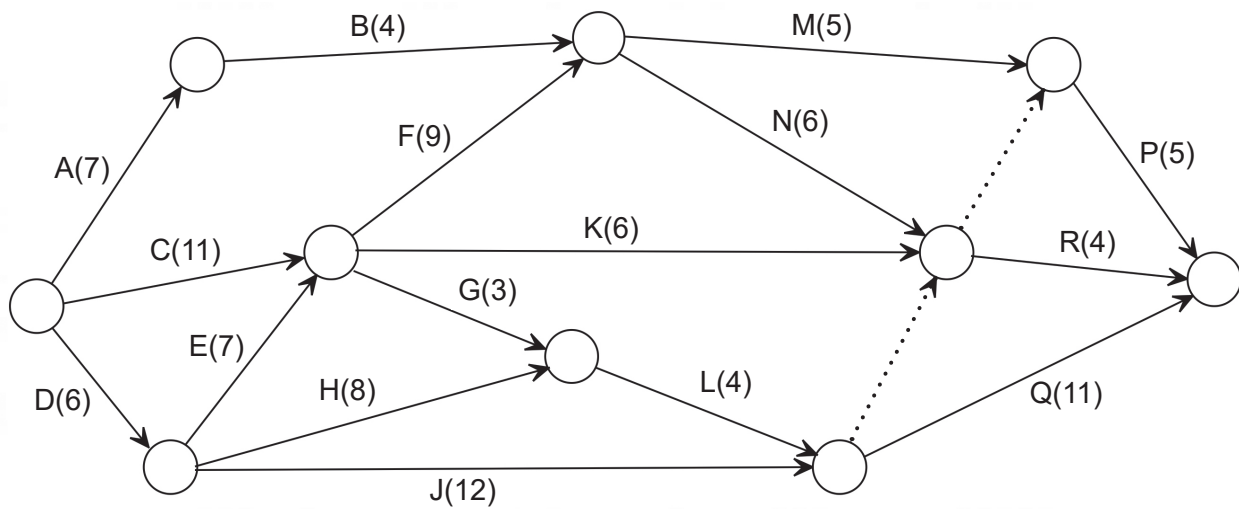
- (i) Show how the value of 20% was calculated. (1 mark)
- (ii) Complete the table by using either row percentages **or** column percentages, as appropriate. (3 marks)
- (d) State an association that can be observed from the two-way percentaged table. (1 mark)

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Question 4

(9 marks)

The project network shown below is to be followed when installing a new conveyor belt system for a mining company. The tasks, with their completion time in days, are shown on the network. The project will commence on 20 November, with work continuing for seven days each week.



- (a) Determine the critical path and the minimum completion time. (2 marks)

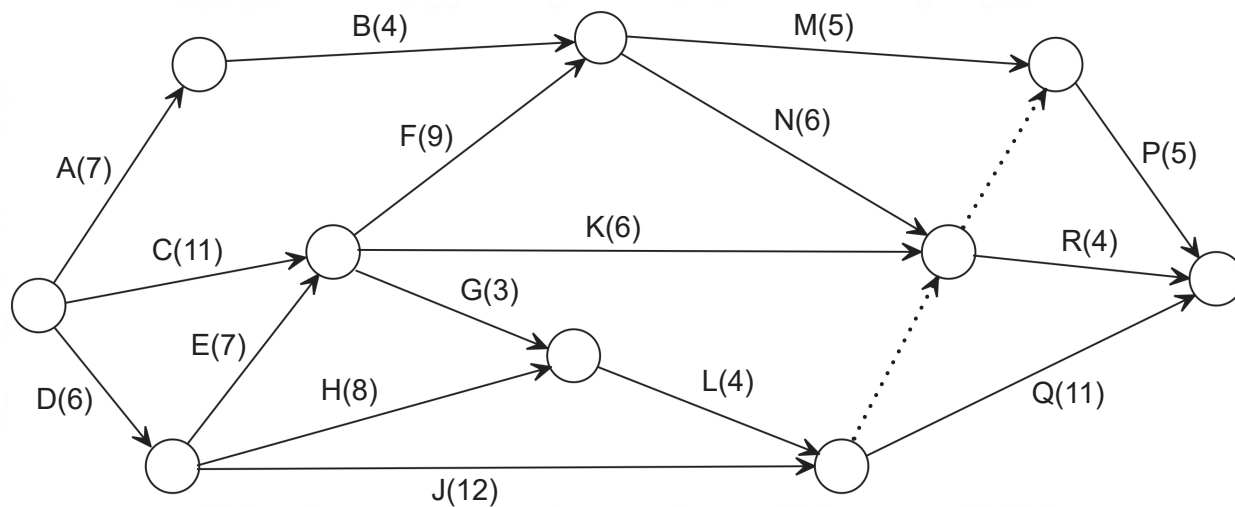
- (b) Determine the immediate predecessors for Task P. (2 marks)

- (c) What is the latest date in November that Task H can commence? (2 marks)

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- (d) It has been confirmed that there is a delay in obtaining some parts from overseas. This means Task G will take 5 days longer to complete. Discuss all implications for the completion of the project. A copy of the **original** network is given below. (3 marks)



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Question 5

(12 marks)

A stall at a local market sells leather handbags. Sales over the past three weeks are tabulated, along with other calculations.

Week	Day	t	Sales	3 point moving average	Daily mean	Percentage of daily mean	Deseasonalised sales
1	Friday	1	2	—	5	40	4
	Saturday	2	9	5		180	6
	Sunday	3	4	5.33		80	4
2	Friday	4	3	4.33	5	60	6
	Saturday	5	6	5		120	4
	Sunday	6	6	5		120	6
3	Friday	7	3	6	6	50	6
	Saturday	8	9	6		150	
	Sunday	9	6	—		100	

(a) Show clearly how each of the numbers in bold type was calculated. (3 marks)

5.33

120

6

(b) Determine the seasonal index for Friday and explain its meaning. (2 marks)

(c) (i) Give a reason why time series data are deseasonalised. (1 mark)

(ii) Calculate the deseasonalised value for Friday of Week 3. (2 marks)

The equation of the least-squares line for the deseasonalised sales, based on time t , is
 $y = 0.2t + 4.3$.

(d) How does this equation support the observation that sales are increasing? (1 mark)

(e) Predict the sales for Friday of Week 4. (3 marks)

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Question 6

(8 marks)

A company has four different models of robotic welders that are used to assemble components that require welding. Each of these welders must be set up to assemble just one type of component. The number of components that each welder can assemble per hour for the three different types of components required is shown below.

		Welders			
		A	B	C	D
Components	1	15	12	13	11
	2	13	16	13	9
	3	15	16	12	14

- (a) Use the Hungarian Algorithm to determine the allocation of welder to component that will maximise the number of components assembled. (6 marks)

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- (b) State how many of each component will be produced each hour with the allocation determined in part (a). (2 marks)

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Question 7

(3 marks)

The following table shows activities and their immediate predecessors for a project to develop, produce and sell a new interactive game for children.

Activity	Activity description	Immediate Predecessor
A	Market analysis	-
B	Product design	A
C	Manufacture product	B
D	Develop software	B
E	Software testing	C, D
F	Design and produce packaging	C
G	Assemble product	E, F
H	Sales promotion	G

Draw the project network for the information given in the table.

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Supplementary page

Question number: _____

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