Trial Examination 2022

VCE Further Mathematics Units 3&4

Written Examination 1

Multiple-choice Question Booklet

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of booklet

Section	Number of questions	Number of questions to be answered	Number of modules	Number of modules to be answered	Number of marks
A – Core	24	24			24
B – Modules	32	16	4	2	16
					Total 40

Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, one bound reference, one approved technology (calculator or software) and, if desired, one scientific calculator. Calculator memory DOES NOT need to be cleared. For approved computer-based CAS, full functionality may be used.

Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied

Question booklet of 28 pages

Formula sheet

Answer sheet for multiple-choice questions

Working space is provided throughout the booklet.

Instructions

Write your **name** and your **teacher's name** in the space provided above on this page, and on the answer sheet for multiple-choice questions.

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

At the end of the examination

You may keep this question booklet and the formula sheet.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2022 VCE Further Mathematics Units 3&4 Trial Examination.

SECTION A – CORE

Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** for the question.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

Data analysis

Question 1

The table below shows the grouped frequencies of a set of ages.

Age	Frequency
$0 - <10$	3
$10 - <20$	6
$20 - <30$	5
$30 - <40$	1

The mean of this set of data is closest to

A.   15

B.   17.7

C.   22.7

D.   66.3

E.   231.9

Question 2

A stem plot of a data set is shown below.

Stem	Leaf
0	6 8
1	0 2 3 5
2	0 2 4 6 8 9
3	0 2 3 3 5 8 9
4	0 2 3 5 7 9
5	3 5 6

Key: 1 | 0 = 10

Which one of the following statements about the data set is incorrect?

A.   The range is 50.

B.   The IQR is 21.5.

C.   The data is symmetrical.

D.   The median is 33.

E.   The mode is 33.

Use the following information to answer Questions 3 and 4.

A car wash uses recycled water stored in an underground tank.

There is a bivariate relationship between the time it takes to wash a car and the water remaining in a recycling tank, where $r = -0.8$.

The initial volume of the tank is 5000 L. Washing a small car requires 250 L of water and takes 5 minutes. Let w represent the water remaining after a car wash and t represent the time it takes to complete a car wash.

Question 3

The equation of the linear relation between w and t is given by

A. $w = -\dfrac{t}{50} + 5000$

B. $w = 5000 - 0.8t$

C. $w = 5000 - 50t$

D. $t = -50w + 50\,000$

E. $t = 0.8w - 5000$

Question 4

It can be concluded that

A. 64% of the change in w is due to the change in t.

B. 64% of the change in t is due to the change in w.

C. 80% of the change in w is due to the change in t.

D. 80% of the change in t is due to the change in w.

E. no causation can be determined because the correlation coefficient is negative.

Question 5

Consider the following data set.

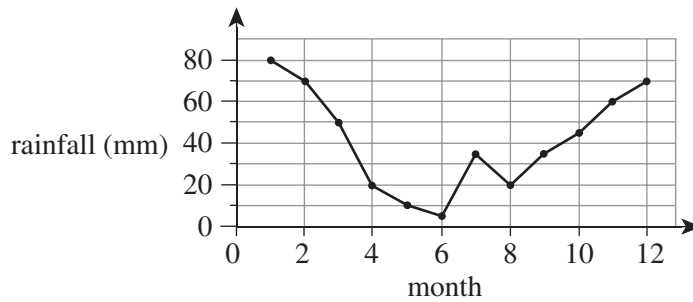$$6, 42, 41, 33, 21, 28, 33$$

The five-number summary for the data set is

A. 33.

B. 6, 21, 33, 41, 42.

C. 6, 42, 33, 28, 33.

D. unable to be calculated because 6 is an outlier.

E. unable to be calculated because 33 appears twice.

Use the following information to answer Questions 6 and 7.

The graph below shows the monthly rainfall, in mm, over a period of 12 months in a single town.

Question 6

The graph is best described as a

A.   scatterplot that shows a strong, linear trend.

B.   residual plot that shows the assumption of linearity is wrong.

C.   time series plot that shows a seasonal pattern.

D.   line graph that shows a seasonal pattern.

E.   time series line graph.

Question 7

The quickest method of smoothing the curve would be

A.   using a three-point moving mean.

B.   using a three-point moving median.

C.   using a five-point moving median.

D.   drawing a line of best fit.

E.   removing the outliers by finding the IQR.

Question 8

After a $\dfrac{1}{x}$ transformation has been applied to a graph, the values in the table below were found.

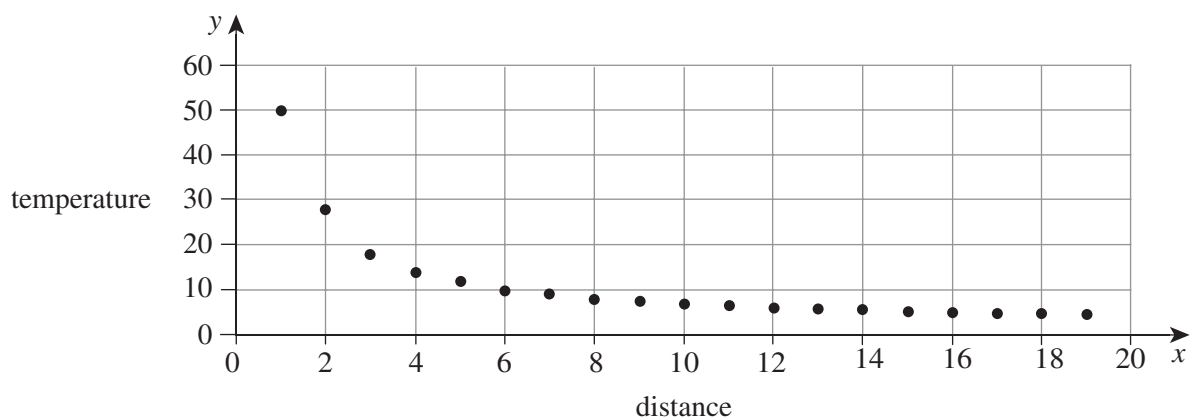| r	Gradient	y-intercept
0.9	–3.2	25

The equation of the least squares line is

A. $y = 25 - 3.2x$

B. $y = 0.9x + 25$

C. $y = 0.9 + \dfrac{25}{x}$

D. $y = 25 - \dfrac{3.2}{x}$

E. $y = 25 + \dfrac{3.2}{x}$

Question 9

While camping, Lini and her friends start a bonfire.

When Lini moves away from the bonfire, the temperature decreases, as shown in the graph below.

Which one of the following would transform this data into a linear graph?

A. performing a four-point moving median

B. performing a three-point moving mean

C. finding the line of best fit

D. applying an x^2 transformation

E. applying a $\log(x)$ transformation

Question 10

A survey of 200 university students under and over the age of 20 years old is conducted.

The students are asked to rate their level of satisfaction with the University's online learning platform, with a response of 1 being extremely unhappy and a response of 7 being extremely unhappy. The results are shown in the table below.
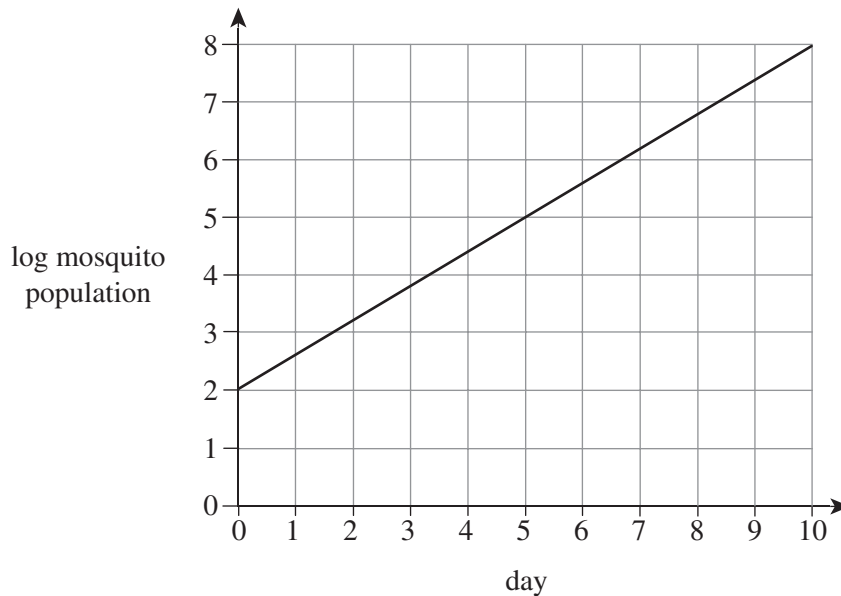
Rating	Frequency <20 years old	Frequency >20 years old
1	4	20
2	8	25
3	12	10
4	18	5
5	26	8
6	38	2
7	24	0

The percentage of students who are older than 20 and gave a rating of less than 4 is

A. 5%

B. 27%

C. 27.5%

D. 55%

E. 78.6%

Question 11

During the wet season, the mosquito population was recorded each day. The results are shown in the log graph below.

How many mosquitoes were present after five days?

A.   5

B.   50

C.   5000

D.   10 000

E.   100 000

Use the following information to answer Questions 12 and 13.

Experimental data was collected on the energy, E, produced by burning different volumes, v, of biofuel. The least squares line $E = 2.6v + 0.2$ is found to apply to a set of data with $r = 0.85$.

Question 12

The residual for the real data point (15, 40) is closest to

A. -0.8

B.   0.8

C.   39

D.   39.2

E.   104.2

Question 13

A data point is incorrectly recorded as (10, 30) when it is should have been (10, 27).

Which one of the following statements best describes the effect of the error on the bivariate statistics?

A.   There is no effect because the change is too small.

B.   The residual for the point (10, 27) will increase slightly.

C.   Both the gradient and y-intercept will decrease slightly.

D.   The value of r will increase slightly.

E.   The five-number summary will not change.

Question 14

95% of sultana snack packs weigh between 9.4 g and 9.8 g. The weight is distributed symmetrically.

The standard deviation is closest to

A.   0.02

B.   0.1

C.   0.2

D.   0.4

E.   9.6

Question 15

After marking the practical reports of their Chemistry class, a teacher produced a statistical comparison of this single result with each student's 10 previous results.

Which one of the following was used in the comparison?

A.   a scatterplot showing a medium positive correlation

B.   a back-to-back stem plot

C.   a box plot

D.   a time series graph

E.   a residual plot

Question 16

A convenience store's quarterly sales, in dollars, of soft drink are shown in the table below.

	Summer	Autumn	Winter	Spring	Total	Mean
2018	15 000	14 000	12 000	16 000	57 000	14 250
2019	15 500	13 500	11 500	14 500	55 000	13 750
2020	14 000	13 500	12 000	16 000	55 500	13 875
Total	44 500	41 000	35 500	46 500	167 500	

The seasonal index for the sale of soft drinks in winter is closest to

A.   0.21

B.   0.84

C.   0.85

D.   11 833

E.   23 666

Recursion and financial modelling

Question 17

Consider the following sequence.

$$42, -6, \frac{6}{7}, \frac{-6}{49}, \dots n$$

This sequence is generated by the rule

A. $t_{n+1} = -\frac{1}{7}t_n$

B. $t_{n+1} = \frac{1}{7}t_n$

C. $t_{n+1} = -\frac{1}{7}t_n, \ t_1 = 42$

D. $t_{n+1} = \frac{1}{7}t_n, \ t_1 = 42$

E. $t_n = -\frac{1}{7}t_{n+1}, \ t_1 = 42$

Question 18

A video of a bystander's reaction to a man loudly talking on his phone goes viral. The number of views of the video increases by 65% each day for the first 20 days. The number of views on day 1 was 4.

Which of the following relationships describes the number of views on day n?

A. $t_{n+1} = 65t_n + 4, \ t_0 = 0$

B. $t_n = 165t_n, \ t_1 = 4$

C. $t_{n+1} = 1.65_n + 4, \ t_0 = 0$

D. $t_{n+1} = 1.65t_n, \ t_0 = 0$

E. $t_{n+1} = 1.65t_n, \ t_1 = 4$

Question 19

Jai buys a new car for \$45 000 and keeps it for five years before trading it in to a car dealer.

The value of the car decreases by 20% in the first year, then decreases by 10% in each subsequent year.

The average percentage (flat rate) depreciation per year is

A. 9.5%

B. 10.5%

C. 12%

D. 21 380.4%

E. 23 619.6%

Question 20

Markel deposits his savings of $50 000 into an account that earns interest at a rate of 3.4% per annum, compounding monthly.

Which of the following expressions could be used to calculate the balance of the account after five years?

A. $T_5 = 50\,000 \times \left(1 + \dfrac{\frac{3.4}{12}}{100}\right)^{(5 \times 12)}$

B. $T_6 = 50\,000 \times (1 + 1.0028)^{60}$

C. $T_5 = 50\,000 \times \left(1 + \dfrac{1.34}{100}\right)^3$

D. $T_5 = \dfrac{50\,000 \times \frac{3.4}{12} \times 60}{100}$

E. $T_5 = 50\,000 \times \left(\dfrac{3.4}{12}\right)^{(5 \times 12)}$

Question 21

Sara buys a new kitchen for $25 000 on hire purchase. An initial deposit of 20% is required and the remaining value is to be paid over three years with a flat interest rate of 6% per annum.

The monthly repayments are closest to

A. $656

B. $736

C. $3600

D. $2650

E. $2860

Question 22

A commercial printer is purchased with the expectation that it will be scrapped and replaced after making 40 million prints. The purchase price of the printer is $260000 and the scrap value will be $5000.

The depreciation in value per print, in cents, is closest to

A. 0.006375

B. 0.06375

C. 0.6375

D. 0.65

E. 1.5

Question 23

The following recurrence relation is used to model the balance of an investment on an annual basis.

$$V_0 = \$6000, \ V_{n+1} = 1.042V_n$$

Which one of the following statements is correct?

A.   The investment earns 4.2% interest per annum, compounding monthly.

B.   After five years, the value of the investment will be more than $8000.

C.   The investment earns 4.2% simple interest per annum.

D.   The investment will take 10 years to exceed $9000.

E.   The investment earns 0.35% interest per annum, compounding monthly.

Question 24

Laudna was approved for a mortgage of $280 000 over a period of 25 years.

After 10 years of making monthly repayments of $1509, the remaining balance of the mortgage is $201 272.13. The interest is charged monthly.

The mortgage's interest rate per annum is closest to

A.   2.5%

B.   4.2%

C.   6.0%

D.   98 920%

E.   181 080%

SECTION B – MODULES

Instructions for Section B

Select **two** modules and answer **all** questions within the selected modules in pencil on the answer sheet provided for multiple-choice questions.

Show the modules you are answering by shading the matching boxes on your multiple-choice answer sheet **and** writing the name of the module in the box provided.

Choose the response that is **correct** for the question.

A correct answer scores 1; an incorrect answer scores 0.

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Contents   Page

Module 1 – Matrices

Before answering these questions, you must **shade** the 'Matrices' box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

Question 1

Which of the following matrices has a determinant of 1?

A. $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

B. $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

C. $\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 1 \\ 0 & 1 \end{bmatrix}$

E. $\begin{bmatrix} 4 & 3 \\ 3 & 2 \end{bmatrix}$

Question 2

The matrix product of $\begin{bmatrix} 2 & 0 \\ 1 & 1 \end{bmatrix} \times \begin{bmatrix} 3 & 0 & 2 \\ 1 & 1 & 0 \end{bmatrix}$ is

A. $\begin{bmatrix} 6 & 1 & 4 \\ 4 & 0 & 2 \end{bmatrix}$

B. $\begin{bmatrix} 7 & 0 & 4 \\ 4 & 1 & 2 \end{bmatrix}$

C. $\begin{bmatrix} 6 & 0 & 4 \\ 4 & 1 & 2 \end{bmatrix}$

D. $\begin{bmatrix} 10 & 1 & 6 \end{bmatrix}$

E. $\begin{bmatrix} 6 & 4 \\ 0 & 1 \\ 4 & 2 \end{bmatrix}$

Question 3

If $A = \begin{bmatrix} 2 & 0 \\ 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 3 \\ 1 & 2 \end{bmatrix}$, then $3AB^2$ is

A. $\begin{bmatrix} 19 & 18 \\ 6 & 7 \end{bmatrix}$

B. $\begin{bmatrix} 38 & 40 \\ 25 & 27 \end{bmatrix}$

C. $\begin{bmatrix} 114 & 108 \\ 75 & 75 \end{bmatrix}$

D. $\begin{bmatrix} 63 & 20 \\ 9 & 16 \end{bmatrix}$

E. $\dfrac{1}{5}\begin{bmatrix} 2 & -3 \\ -1 & 4 \end{bmatrix}$

Question 4

Which one of the following matrices contains only elements that obey the rule $a_{i,j} = 2i - 3j$?

A. $\begin{bmatrix} 1 & -1 \\ 4 & 2 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 4 \\ -1 & 2 \end{bmatrix}$

C. $\begin{bmatrix} -1 & 1 \\ 4 & 2 \end{bmatrix}$

D. $\begin{bmatrix} -1 & -4 \\ 1 & -2 \end{bmatrix}$

E. $\begin{bmatrix} 5 & 7 \\ 7 & 10 \end{bmatrix}$

Question 5

The table shown below outlines the bakery orders placed by a worksite during the month of May.

	Number ordered				
	Pie	**Sausage roll**	**Bread roll**	**Loaf of bread**	**Total cost**
8 May	10	0	0	0	$50
12 May	4	6	0	0	$44
18 May	5	0	6	0	$31
23 May	0	10	5	2	$51

Let p represent the cost of a pie, s represent the cost of a sausage roll, r represent the cost of a bread roll and l represent the cost of a loaf of bread.

The cost matrix $\begin{bmatrix} p \\ s \\ r \\ l \end{bmatrix}$ is

A. $\begin{bmatrix} 10 \\ 6 \\ 6 \\ 2 \end{bmatrix}$

B. $\begin{bmatrix} 10 \\ 4 \\ 5 \\ 0 \end{bmatrix}$

C. $\begin{bmatrix} 4 \\ 5 \\ 1 \\ 3 \end{bmatrix}$

D. $\begin{bmatrix} 5 & 4 & 1 & 3 \end{bmatrix}$

E. $\begin{bmatrix} 5 \\ 4 \\ 1 \\ 3 \end{bmatrix}$

Question 6

A group of 100 teenagers each watched two movies. Of the teenagers, 50 chose to watch a comedy movie first and 50 chose to watch a science fiction movie second.

Of the teenagers who watched a comedy movie first, 40% chose to watch a comedy movie second.

Of the teenagers who watched a science fiction movie first, 70% chose watch a science fiction movie second.

When picking the second movie, the number of teenagers that chose each genre is given by the matrix

A. $T = \begin{bmatrix} 0.4 \\ 0.7 \end{bmatrix}$

B. $S_1 = \begin{bmatrix} 0.4 \\ 0.7 \end{bmatrix}$

C. $S_1 = \begin{bmatrix} 20 \\ 35 \end{bmatrix}$

D. $S_1 = \begin{bmatrix} 35 \\ 65 \end{bmatrix}$

E. $S_2 = \begin{bmatrix} 34 \\ 66 \end{bmatrix}$

Question 7

A set of simultaneous equations is shown below.

$$\begin{bmatrix} 5 & -4 \\ 3 & -2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 7 \\ 5.7 \end{bmatrix}$$

The solutions to this set are

A. $x = 12.6$ and $y = 9.6$

B. $x = 4.4$ and $y = 3.75$

C. $x = 3.75$ and $y = 4.4$

D. $x = 6.1$ and $y = 4.8$

E. $\dfrac{1}{2} \begin{bmatrix} -2 & 4 \\ -3 & 5 \end{bmatrix}$

Question 8

Consider the matrix below.

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Which one of the following terms does **not** describe this matrix?

A. symmetrical matrix

B. unit matrix

C. triangular matrix

D. column matrix

E. binary matrix

END OF MODULE 1

Module 2 – Networks and decision mathematics

Before answering these questions, you must **shade** the 'Networks and decision mathematics' box
on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

Question 1
Some of the roads connecting the towns of Ararat (*A*), Ballarat (*B*), Castlemaine (*C*) and Daylesford (*D*) are shown in the diagram below.
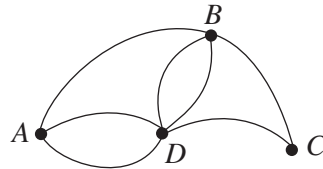
Which one of the following statements is correct?

A. Castlemaine is an isolated vertex.

B. The highest degree vertex is Ballarat with $n = 4$.

C. The diagram is an example of a minimum spanning tree.

D. Using only the roads shown, it is possible to get directly from Ararat to Castlemaine without passing through another town.

E. An Euler trail can be found.

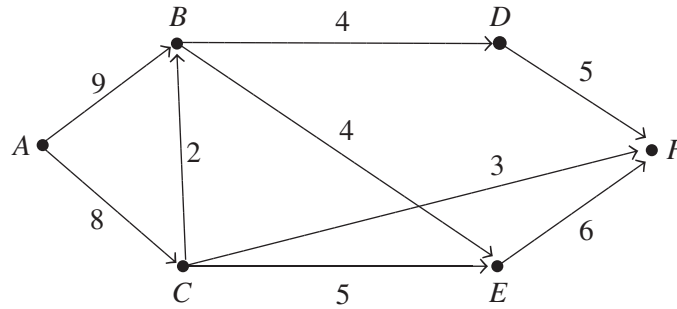### Question 2
Consider the following network diagram.
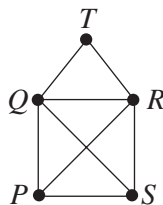
To create a planar graph from this network, which line could be relocated?

A. *P–Q*

B. *P–R*

C. *P–S*

D. *Q–R*

E. *Q–T*

Question 3

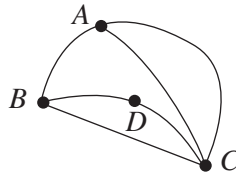The water pipes between towns A–F are shown in the diagram below.

What is the maximum flow between town A and town F?

A. 11

B. 13

C. 14

D. 16

E. 17

Question 4

Consider the diagram below.

Which one of the following best represents the diagram?

A. $\begin{bmatrix} 3 \\ 3 \\ 4 \\ 2 \end{bmatrix}$

B. $\begin{bmatrix} 0 & 1 & 2 & 0 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$

C. $\begin{bmatrix} 0 & 1 & 2 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

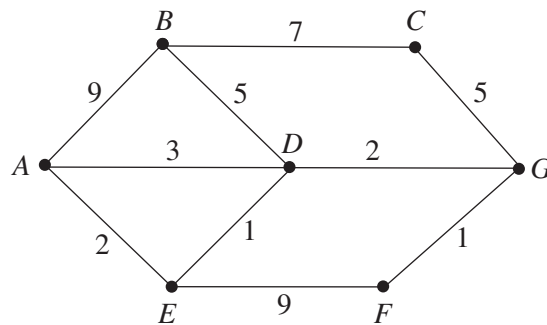D. $\begin{bmatrix} 0 & 1 & 2 & 0 \\ 1 & 0 & 1 & 1 \\ 2 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$

E. A–B–D–C–A

Question 5

A planar graph with four faces could have

A.   two vertices and six edges.

B.   three vertices and six edges.

C.   four vertices and six edges.

D.   five vertices and eight edges.

E.   five vertices and nine edges.

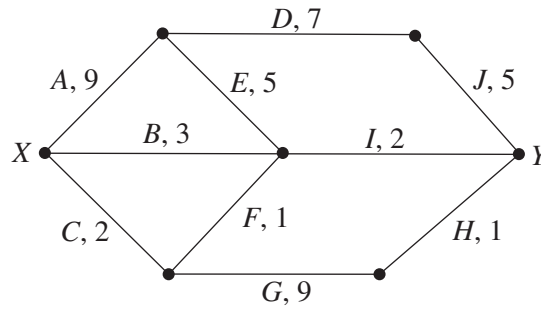**Question 6**

Consider the following network diagram.

Which one of the following represents the minimum spanning tree for the network?

A.

B.

C.

D.

E.

Question 7

The figures shown in the diagram below represent the time required to complete each task.

The minimum time to complete all the tasks from X to Y is

A.   5

B.   8

C.   12

D.   16

E.   21

Question 8

Which one of the following statements about critical paths is correct?

A.   A critical path includes all the longest activities.

B.   Assuming no other changes, reducing the time along the critical path by five will always reduce the overall time by five.

C.   Introducing a dummy activity will speed up the critical path.

D.   Assuming that there are no other changes to the network, increasing the time along the critical path by five will always increase the overall time by five.

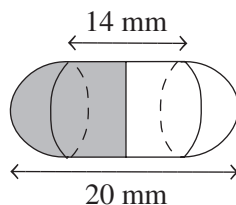**E.**   The critical path contains no dummy edges.

END OF MODULE 2

Module 3 – Geometry and measurement

> Before answering these questions, you must **shade** the 'Geometry and measurement' box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

Question 1

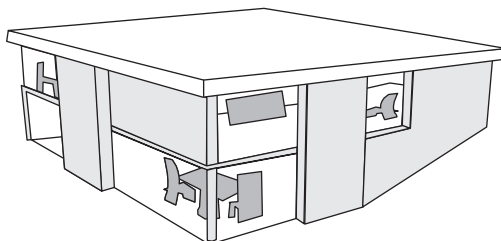Consider the drug capsule shown in the following diagram.

The volume of the drug capsule shown is closest to

A. 113 mm^3

B. 395 mm^3

C. 509 mm^3

D. 2490 mm^3

E. 395 cm^3

Question 2

The following model of a home has a vertical surface area of 50 cm^2, of which 30% is glass.

The model home is used as the basis for the construction of a real house. A scale factor of $k = 450$ is applied to the model home to find the dimensions for the real house.

Which one of the following is closest to the area of glass, in square metres, required for the real house?

A.   304

B.   709

C.   1013

D.   6750

E.   30 375

Question 3

A single slice is taken from an apple pie with a diameter of 30 cm. The height of the pie filling is 2.5 cm and the volume of filling in the slice is 176.7 cm^3.

How many slices of the same size can be taken from the pie?

A.   5

B.   8

C.   9

D.   10

E.   20

Question 4

The time difference, in hours, between the cities of Nuremburg (46° N, 11° E) and Perth (32° S, 116° E) is closest to

A.   4

B.   5

C.   7

D.   14

E.   17

Question 5

Assuming that the radius of the Earth is 6400 km, the great circle distance from the Black Sea (45° N, 35° E) to Djoser (31° N, 35° E), in kilometres, is closest to

A.   249

B.   782

C.   1561

D.   1955

E.   20 106

Question 6

Ami is standing 25 m from the base of a tree. The angle of elevation from where she is standing to the top of the tree is 22°. Bree is looking at the same tree, but she is standing 35 m away from the base of the tree.

The angle of elevation from where Bree is standing is closest to

A.   0.006°

B.   5.9°

C.   10.1°

D.   16°

E.   16.1°

Question 7

Bob is standing due east from Charlie. Asha is 10 m from Charlie on a bearing of N 57° E.

Asha is 6 m from Bob.

The bearing of Asha from Bob is closest to

A.   65.2°

B.   114.8°

C.   N 24.8° E

D.   S 114.8° W

E.   N 65.2° E

Question 8

The locations of Vienna and Dakar are approximately 48° N, 16° E and 16° N, 14° W respectively. A plane leaves Dakar at 2:30 am and lands in Vienna at 3:30 am local time.

How many hours did the flight last?

A.   1

B.   2

C.   3

D.   4

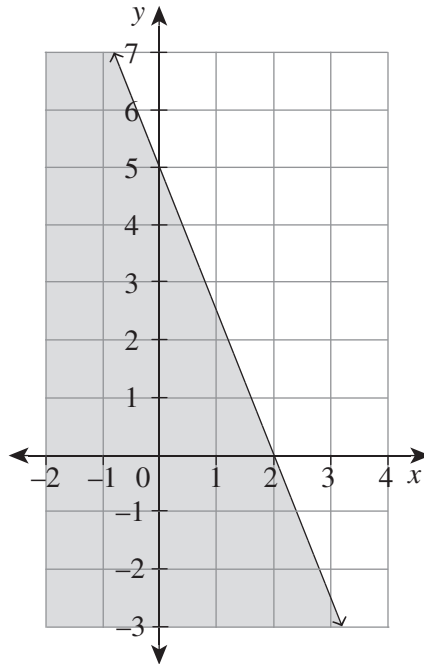E.   The length of the flight is impossible to calculate as it depends upon the speed of the plane.

END OF MODULE 3

Module 4 – Graphs and relations

Before answering these questions, you must **shade** the 'Graphs and relations' box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.
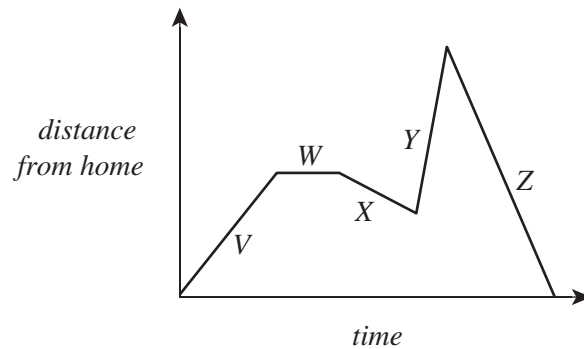
Question 1

Consider the graph below.

The equation that best represents the shaded region is

A. $y = \dfrac{-5x}{2} + 5$

B. $5y + 2x < 10$

C. $5y + 2x \leq 10$

D. $2y + 5x < 10$

E. $2y + 5x \leq 10$

Question 2

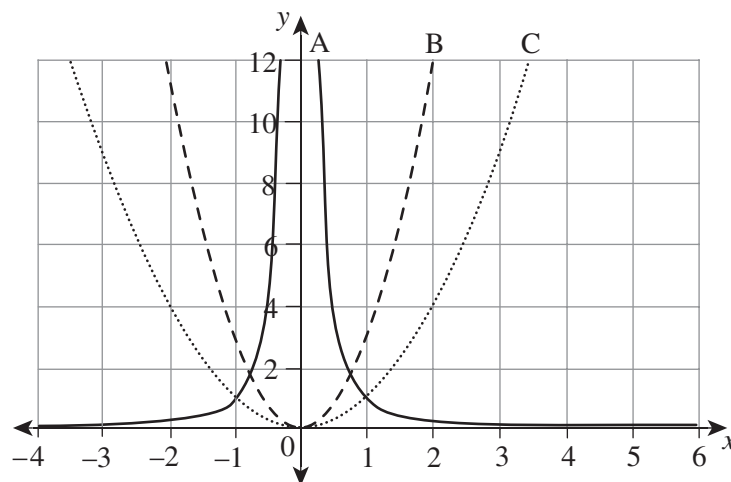The graph below shows the distance that Travis travels from his house during one day.

At which stage (*V*, *W*, *X*, *Y* or *Z*) is Travis travelling the fastest towards his house?

A. *V*

B. *W*

C. *X*

D. *Y*

E. *Z*

Question 3

This graph shows three curves of the form $y = kx^n$, where $n \in \{-2, -1, 1, 2, 3\}$.

Which one of the following statements is correct?

A. The equation of graph A is $y = -x^2$ and the equation of graph B is $y = x^3$.

B. The equation of graph A is $y = x^{-2}$ and the equation of graph B is $y = x^3$.

C. The equation of graph A is $y = x^{-2}$ and the equation of graph B is $y = 3x^2$.

D. The equation of graph A is $y = x^{-2}$ and the equation of graph C is $y = 3x^2$.

E. The equation of graph A is $y = -x^2$ and the equation of graph C is $y = x^2$.
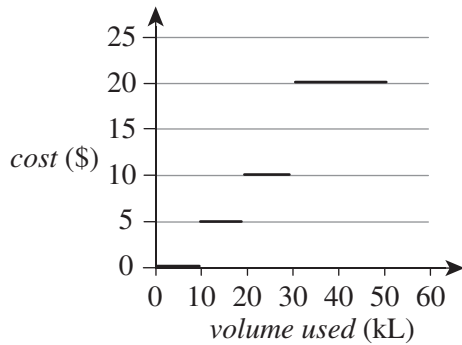
Question 4

The cost of household water on the island of Phuket is very cheap and depends upon the volume used. However, the pricing of water is not linear and the charge increases over four stages, as shown in the table below.

Volume of water used per month (kL)	Monthly charge ($AUD)
0–10	0 + 0.444/kL
11–20	4.44 + 0.70/kL
21–30	11.44 + 0.82/kL
31–50	19.64 + 0.93/kL

Which one of the following graphs shows the total cost of water to a household?

A.

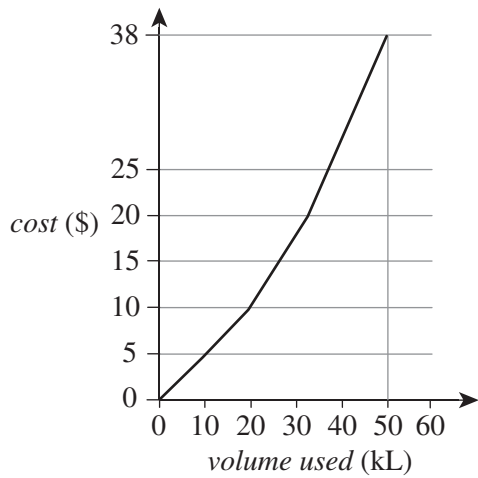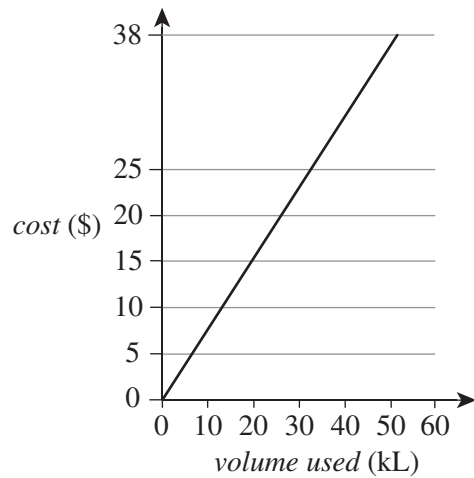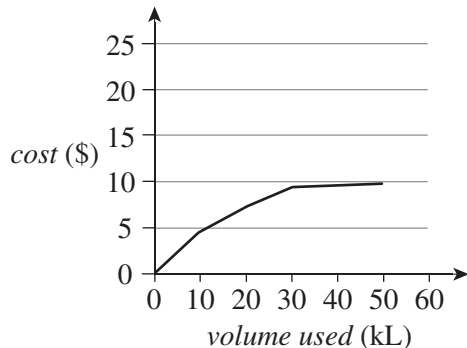**B.**
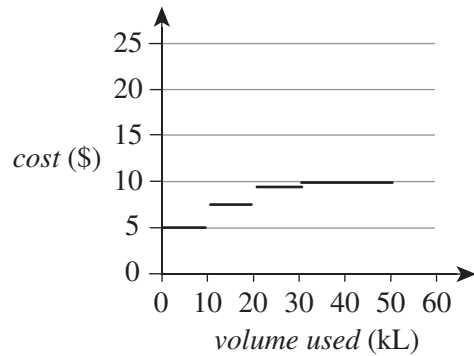
C.

D.

E.

Question 5

Garry's place of work is 2 km from the start of a mountain bike trail.

On Saturday, Garry decides to complete the trail. He is dropped off at the start of the trail and will be picked up from the national park at the end of the trail 10 hours later. After 4 hours, the trail becomes steeper and his speed decreases. The distance between Garry and his place of work over this time period is shown in the graph below.
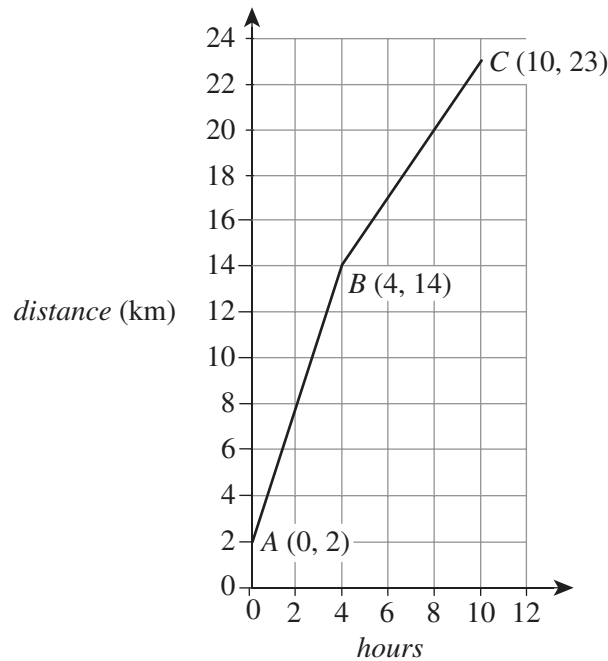
His average speed, in kilometres per hour, for the entire trip is

A. 1.5

B. 2.1

C. 2.3

D. 3.0

E. 3.5

Question 6

After further experimental data is collected, the researcher suspects the relationship between the variables may be in the form $y = kx^2$ instead.

Which one of the following steps should the researcher complete to verify the form of the relationship and calculate a value for k?

A. Plot the data to see if it has an x^2 shape.

B. Plot the data to see if it has an x^2 shape and use a random coordinate to calculate k.

C. Plot the graph of $y = x^2$ to see if the graph is linear.

D. Plot the graph of $y = x^2$ to see if the graph is linear and use a random coordinate to calculate k.

E. Plot the graph of $y = x^2$, draw a line of best fit (trend line) and calculate the gradient of the trend line to find k.

Use the following information to answer Questions 6–8.

A researcher is investigating the number of mosquitoes in a particular swamp in the days after rainfall. The researcher models the number of mosquitoes and creates the graph below.
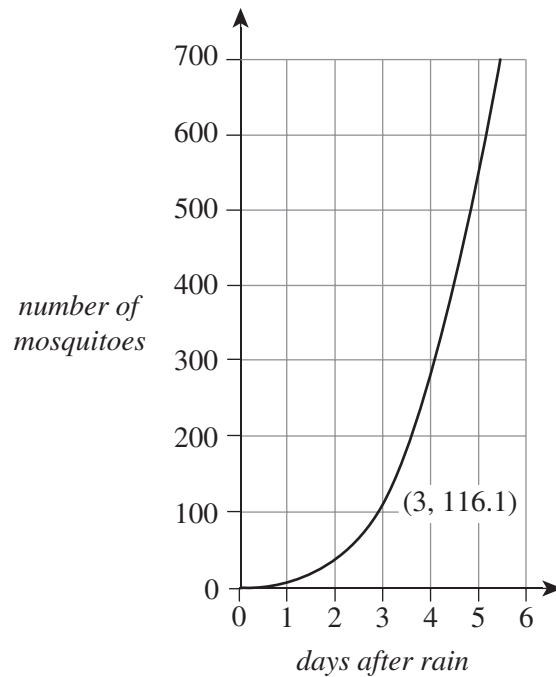
Question 7

The average increase in the number of mosquitoes over the first three days is closest to

A. 3

B. 4.3

C. 33.3

D. 38.7

E. 116.1

Question 8

The graph is assumed to be in the form $y = kx^3$.

Given the point shown in the graph, the value of k is

A. 3

B. 4.3

C. 12.9

D. 38.7

E. 89.1

END OF MULTIPLE-CHOICE QUESTION BOOKLET

FM34_Ex1_QB_2022

Neap

Trial Examination 2022

VCE Further Mathematics Units 3&4

Written Examinations 1 & 2

Formula Sheet

Instructions

This formula sheet is provided for your reference.

A multiple-choice question booklet and a question and answer booklet are provided with this formula sheet.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

FURTHER MATHEMATICS FORMULAS

Core – Data analysis

standardised score	$z = \dfrac{x - \bar{x}}{s_x}$
lower and upper fence in a boxplot	lower $\quad Q_1 - 1.5 \times IQR \qquad$ upper $\quad Q_3 + 1.5 \times IQR$
least squares line of best fit	$y = a + bx$, where $b = r\dfrac{s_y}{s_x}$ and $a = \bar{y} - b\bar{x}$
residual value	residual value = actual value − predicted value
seasonal index	seasonal index $= \dfrac{\text{actual figure}}{\text{deseasonalised figure}}$

Core – Recursion and financial modelling

first-order linear recurrence relation	$u_0 = a, \qquad u_{n+1} = bu_n + c$
effective rate of interest for a compound interest loan or investment	$r_{\text{effective}} = \left[\left(1 + \dfrac{r}{100n}\right)^n - 1 \right] \times 100\%$

Module 1 – Matricies

determinant of a 2×2 matrix	$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}, \qquad \det A = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$
inverse of a 2×2 matrix	$A^{-1} = \dfrac{1}{\det A}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}, \qquad$ where $\det A \neq 0$
recurrence relation	$S_0 = $ intital state, $\qquad S_{n+1} = TS_n + B$

Module 2 – Networks and decision mathematics

Euler's formula	$v + f = e + 2$

Module 3 – Geometry and measurement

area of a triangle	$A = \dfrac{1}{2}bc\sin(\theta°)$
Heron's formula	$A = \sqrt{s(s-a)(s-b)(s-c)},$ where $s = \dfrac{1}{2}(a+b+c)$
sine rule	$\dfrac{a}{\sin(A)} = \dfrac{b}{\sin(B)} = \dfrac{c}{\sin(C)}$
cosine rule	$a^2 = b^2 + c^2 - 2bc\cos(A)$
circumference of a circle	$2\pi r$
length of an arc	$r \times \dfrac{\pi}{180} \times \theta°$
area of a circle	πr^2
area of a sector	$\pi r^2 \times \dfrac{\theta°}{360}$
volume of a sphere	$\dfrac{4}{3}\pi r^3$
surface area of a sphere	$4\pi r^2$
volume of a cone	$\dfrac{1}{3}\pi r^2 h$
volume of a prism	area of base $\times$ height
volume of a pyramid	$\dfrac{1}{3} \times$ area of base $\times$ height

Module 4 – Graphs and relations

gradient (slope) of a straight line	$m = \dfrac{y_2 - y_1}{x_2 - x_1}$
equation of a straight line	$y = mx + c$

END OF FORMULA SHEET

Neap

Trial Examination 2022

VCE Further Mathematics Units 3&4

Written Examination 1

Multiple-choice Answer Sheet

Student's Name: _____

Teacher's Name: _____

Instructions

Use a **pencil** for **all** entries. If you make a mistake, **erase** the incorrect answer – **do not** cross it out.
Marks will **not** be deducted for incorrect answers.
No mark will be given if more than **one** answer is completed for any question.

All answers must be completed like this example: A B C D E

Use pencil only

Core: Data analysis
ONE ANSWER PER LINE

Core: Recursion and financial modelling
ONE ANSWER PER LINE

1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E

9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E
14	A	B	C	D	E
15	A	B	C	D	E
16	A	B	C	D	E

17	A	B	C	D	E
18	A	B	C	D	E
19	A	B	C	D	E
20	A	B	C	D	E
21	A	B	C	D	E
22	A	B	C	D	E
23	A	B	C	D	E
24	A	B	C	D	E

Continues over page

Answer TWO modules. Show modules answered by shading the appropriate box and writing the name of the module in the box provided.

Use pencil only

Module:

☐ **Matrices**

☐ **Networks and decision mathematics**

☐ **Geometry and measurement**

☐ **Graphs and relations**

Module:

Module:

☐ **Matrices**

☐ **Networks and decision mathematics**

☐ **Geometry and measurement**

☐ **Graphs and relations**

Module:

ONE ANSWER PER LINE

	A	B	C	D	E
1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E

ONE ANSWER PER LINE

	A	B	C	D	E
1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E