



Trial Examination 2019

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 32 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** on your 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 2019 VCE Further Mathematics Units 3&4 Written Examination 1.

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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**

Consider the following set of data.

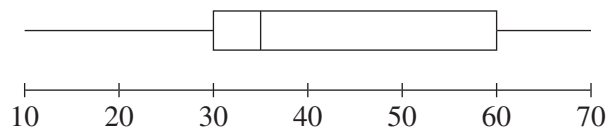
Age	Frequency
0–<10	5
10–<20	6
20–<30	1
30–<40	11

The median of this set of data is most likely to be

- A. 5
- B. 15
- C. 20
- D. 30
- E. 35

Question 2

A box plot of a data set is shown below.

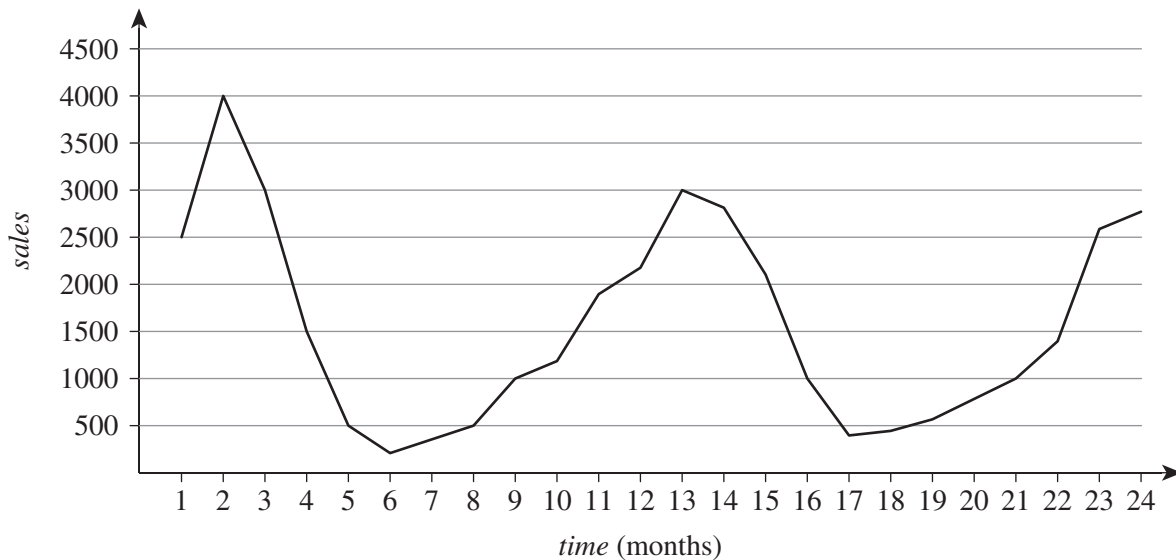


Which one of the following statements must be true?

- A. The IQR is 60.
- B. The median is 40.
- C. 10 is an outlier.
- D. 50% of the data is greater than 35.
- E. The mode is 35.

Use the following information to answer Questions 3 and 4.

The diagram below shows a company's sales over a two-year period.



Question 3

The diagram is best described as a

- A. scatterplot showing a weak linear trend pattern.
- B. time series showing a cyclic pattern.
- C. time series showing a seasonal pattern.
- D. line graph showing a seasonal pattern.
- E. line graph showing a cyclic pattern.

Question 4

In order to smooth the curve it would be best to

- A. use a five-point moving mean.
- B. use a three-point moving mean.
- C. calculate the z -values.
- D. draw a line of best fit.
- E. remove the outliers by finding the IQR.

Question 5

Consider the following set of data:

5, 28, 18, 16, 21, 24, 23, 26, 34

The five-figure summary for this set of data is

- A. 5, 17, 23, 27, 34.
- B. 5, 24, 21, 25, 34.
- C. 5, 10, 21.7, 29, 34.
- D. unable to be calculated because 5 is an outlier.
- E. unable to be calculated because both 5 and 34 are outliers.

Use the following information to answer Questions 6 and 7.

The bivariate relationship between the distance travelled in a car and the fuel remaining in its tank has the following descriptive statistics:

- The initial volume of fuel is 70 L.
- The car can travel 630 km on the initial volume of fuel.
- $r = -0.9$

Question 6

The linear relation between the fuel remaining and the distance travelled is given by

- A. fuel remaining = $-\frac{1}{9} \times$ distance travelled + 70
- B. fuel remaining = $70 - 0.9 \times$ distance travelled
- C. fuel remaining = $630 - 9 \times$ distance travelled
- D. distance travelled = $-9 \times$ fuel remaining + 70
- E. distance travelled = $630 \times$ fuel remaining - 70

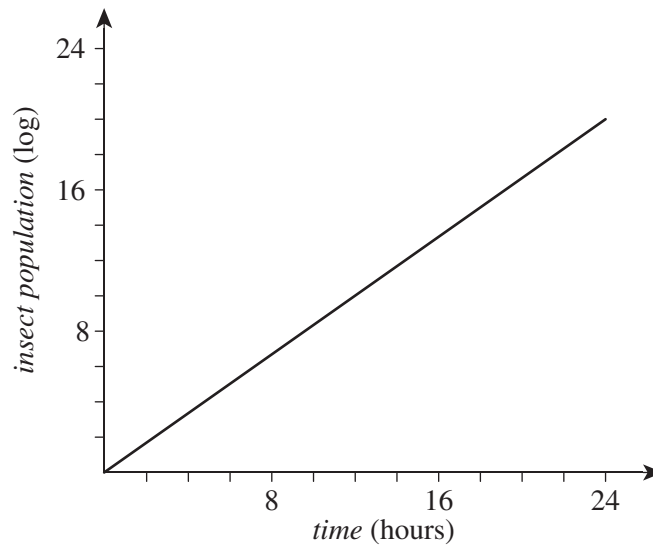
Question 7

It can be concluded that

- A. 81% of the change in the distance travelled is due to the change in fuel level.
- B. 81% of the change in the fuel level is due to the change in the distance travelled.
- C. 90% of the change in the distance travelled is due to the change in fuel level.
- D. 90% of the change in the fuel level is due to the change in the distance travelled.
- E. no cause and effect can be determined because the correlation coefficient is negative.

Question 8

The population of breeding insects is recorded each hour for one day. The results are shown in the graph below.



How many insects were there after 8 hours?

- A. 6
- B. 600
- C. 6000
- D. 10 000
- E. 1 000 000

Use the following information to answer Questions 9 and 10.

A group of people were observed for one hour and the amount of time they spent on their phones was recorded in the back-to-back stem-and-leaf plot below. The information has been further divided according to the age of the person.

<i>under 25</i>	<i>stem</i>	<i>over 25</i>
5 4 1 0 0	0	0 0 0 0 0 0 2 5 8
8 8 6 3 3 2	1	0 2 2 4 5 7
9 6 6 5 2 2 0	2	0 3 5
5 5 4 2	3	5
5	4	

$$3 \overline{)1} = 31$$

Question 9

Which one of the following is correct?

- A. Both sets of data are symmetrical.
- B. The range of the under 25s is the same as the longest time recorded on a phone.
- C. The IQR of the under 25s is greater than the IQR of the over 25s.
- D. The difference in the medians is 15.
- E. 45 is an outlier for the under 25s.

Question 10

Using only the raw data (ignore any potential outliers), the mean, median and mode of the over 25 data are closest to

- A. 10.4, 10 and 0.
- B. 10.4, 9 and 12.
- C. 10.4, 0 and 0.
- D. 2.6, 10 and 0.
- E. 2.6, 0 and 0.

Question 11

The seasonal index for the sale of chocolate in the month of June is 3.2.

Which one of the following is completely true?

- A. 320% of all the chocolate sold is sold in June.
- B. The seasonal indices for the other 11 months are all less than 3.1.
- C. There is a 220% increase in the average chocolate sales during June.
- D. 3.2% of the extra sales are caused due to it being June.
- E. The mean of the seasonal indices for the other months is 0.8.

Question 12

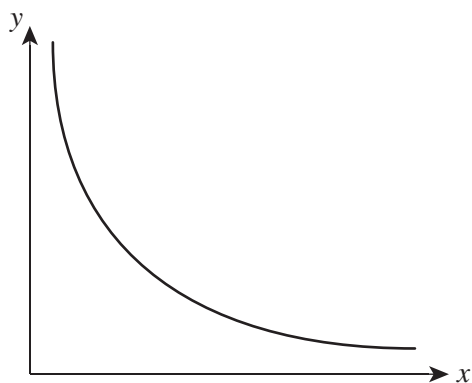
95% of 1 L milk containers had between 0.98 L and 1.02 L of milk. The volume of milk was distributed symmetrically.

The standard deviation is closest to

- A. 0.01
- B. 0.02
- C. 0.1
- D. 0.2
- E. 1

Question 13

Consider the graph below.



In order to transform this data into a linear graph,

- A. perform a four-point moving average.
- B. perform a three-point moving average.
- C. apply an x^2 transformation.
- D. apply a $\frac{1}{x}$ transformation.
- E. find the line of best fit.

Question 14

An experiment is set up to record the temperature of water every 10 seconds as it is heated by a Bunsen burner. The least square line temperature = $0.4 \times \text{time} + 15$ is found to apply to a set of data with $r = 0.95$.

The residual for the real data point (80, 50) is closest to

- A. -3
- B. 3
- C. 47
- D. 50
- E. 76

Question 15

After a $\log(x)$ transformation has been applied, it is found that $r = -0.7$, the gradient = -4.2 and the y -intercept = 32 .

The least squares regression equation is

- A. $y = 32 - 4.2x$
- B. $y = -0.7x + 32$
- C. $y = -0.7 + 32 \log(x)$
- D. $y = 32 - 4.2\log(x)$
- E. $y = 32 + 0.49 \log(x)$

Question 16

A classroom teacher told their class that their SAC results had a mean of 66% and a standard deviation of 18% . Dale was told his z -score was 1.7 .

Dale's raw score was closest to

- A. 31%
- B. 57%
- C. 84%
- D. 86%
- E. 97%

Recursion and financial modelling**Question 17**

The series $24, -12, 6, -3 \dots$ is best described by

- A. $t_{n+1} = -\frac{1}{2}t_n$
- B. $t_{n+1} = \frac{1}{2}t_n$
- C. $t_{n+1} = -\frac{1}{2}t_n; t_1 = 24$
- D. $t_{n+1} = \frac{1}{2}t_n; t_1 = 24$
- E. $t_n = -2t_{n+1}; t_1 = 24$

Question 18

The terms t_1 and t_3 generated by the recurrence relation $t_{n+1} = 3t_n - 4, t_0 = 4$ are

- A. 4, 20
- B. 4, 56
- C. 8, 40
- D. 8, 56
- E. 16, 160

Question 19

A video of a cat sneezing goes viral, with the number of hits increasing by 42% every day for the first ten days. The number of hits on day zero was 1000.

Which one of the following relationships accurately describes the total number of hits on day $n + 1$ given the number on day n ?

- A. $t_{n+1} = 42t_n + 1000; t_0 = 1000$
- B. $t_n = 1.42n; t_0 = 1000$
- C. $t_{n+1} = 1.42n; t_0 = 1000$
- D. $t_{n+1} = 1.42t_n; t_0 = 1000$
- E. $t_{n+1} = 42t_n; t_0 = 1000$

Question 20

Juan is earning 2.3% per annum interest compounding monthly on his savings of \$20 000.

Which one of the following expressions could be used to calculate his account balance after three years?

A. $T_3 = 20\,000 \times \left(1 + \frac{2.3}{100}\right)^{3 \times 12}$

B. $T_3 = (20\,000 \times (1 + 1.023))^{36}$

C. $T_3 = 20\,000 \times \left(1 + \frac{1.19}{100}\right)^3$

D. $T_3 = \frac{20\,000 \times \frac{2.3}{12} \times 36}{100}$

E. $T_3 = 20\,000 \times \left(\frac{2.3}{12}\right)^{3 \times 12}$

Question 21

Pimchiyada buys a new car for \$38 500. After one year it has depreciated by a flat 20% and for the following years it depreciates at 10% on the value of the car.

An expression to calculate the car's value after n years is

A. $t_n = (38\,500 \times 0.8)^{(n-1)}$

B. $t_n = 30\,800 \times 0.9^n$

C. $t_n = (38\,500 \times 0.8) \times 0.9^{(n-1)}$

D. $t_n = 30\,800 \times 0.8^{(n-1)}$

E. $t_n = (38\,500 \times 0.9) \times 0.8^{(n-1)}$

Question 22

Pin invests \$50 000 at 3% per annum. She withdraws \$5000 each year for expenses.

Which one of the following relationships accurately describes the total value after n years?

A. $t_{n+1} = t_n \times 0.03 - 5000, t_0 = 50\,000$

B. $t_{n+1} = t_n \times 0.03 + 5000, t_0 = 50\,000$

C. $t_{n+1} = t_n \times 1.03 - 5000, t_0 = 50\,000$

D. $t_{n+1} = t_n \times 1.03 + 5000, t_0 = 50\,000$

E. $t_n = 50\,000 \times 1.03^n - 5000n$

Question 23

A new \$35 000 boat is bought using hire purchase. The terms are over four years with a flat interest rate of 8% per annum and an initial deposit of 25%.

The total cost of the boat is closest to

- A. \$34 650
- B. \$43 400
- C. \$44 463
- D. \$46 200
- E. \$54 950

Question 24

After five years of monthly repayments of \$1190, an initial \$173 000 mortgage over twenty years now has a balance owing \$145 645. The interest is charged monthly.

The interest rate is closest to

- A. 2.5% per annum.
- B. 3.5% per annum.
- C. 4.5% per annum.
- D. 5.5% per annum.
- E. 6.5% per annum.

END OF SECTION A

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** show the module chosen by marking the appropriate box.

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

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

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Module 1 – Matrices

Before answering these questions, you must **mark** the ‘Matrices’ box on the answer sheet for multiple-choice questions.

Question 1

Consider the matrix below.

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} M \\ E \\ R \\ I \\ T \end{bmatrix}$$

The matrix product is

A. $\begin{bmatrix} T \\ I \\ M \\ E \\ R \end{bmatrix}$

B. $\begin{bmatrix} R \\ E \\ M \\ I \\ T \end{bmatrix}$

C. $\begin{bmatrix} M \\ E \\ R \\ I \\ T \end{bmatrix}$

D. $\begin{bmatrix} M \\ I \\ T \\ R \\ E \end{bmatrix}$

E. $\begin{bmatrix} T \\ R \\ I \\ M \\ E \end{bmatrix}$

Question 2

Which one of the following matrix equations has **no** unique solutions?

A. $\begin{bmatrix} 3 & -6 \\ 2 & 4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 5 \\ 3 \end{bmatrix}$

B. $\begin{bmatrix} -3 & -6 \\ 2 & -4 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 2 \\ 10 \end{bmatrix}$

C. $\begin{bmatrix} 6 & 9 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -5 \\ 6 \end{bmatrix}$

D. $\begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 6 \\ 2 \end{bmatrix}$

E. $\begin{bmatrix} 9 & 3 \\ 3 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -4 \\ 7 \end{bmatrix}$

Question 3

Let $A = \begin{bmatrix} 3 & 4 \\ 2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.

The matrix product of $A^T B$ is equal to

A. $\begin{bmatrix} 15 & 22 \\ 11 & 16 \end{bmatrix}$

B. $\begin{bmatrix} -9 & -10 \\ 7 & 8 \end{bmatrix}$

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

D. $\begin{bmatrix} 9 & 14 \\ 13 & 20 \end{bmatrix}$

E. $\begin{bmatrix} 11 & 8 \\ 25 & 18 \end{bmatrix}$

Question 4

Let $Q = \begin{bmatrix} 2 & 4 \\ 3 & 3 \\ 4 & 6 \end{bmatrix}$.

The element in row i and column j of Q is m_{ij} .

The elements of M are determined by the rule

A. $Q_{ij} = 2i + j - 1$

B. $Q_{ij} = i + j$

C. $Q_{ij} = i + j + 2$

D. $Q_{ij} = i + 2j - 1$

E. $Q_{ij} = i + 2j + 1$

Question 5

Alex, Beatrice, Claire and Dan work for an organisation. They can communicate with each other in the following ways:

- Alex can communicate directly with Claire and Dan.
- Beatrice can communicate directly with Claire.

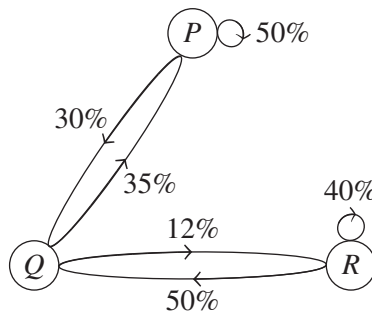
Once both one-step and two-step communication links are totalled, how many of these links would be redundant communication links?

- A. 0
- B. 4
- C. 6
- D. 8
- E. 9

Question 6

Customers on a local street were asked about where they did their grocery shopping over a two-week period. Customers could choose from Price Busters (*P*), Quick Value (*Q*) and Ricky's Bargains (*R*).

An incomplete transition diagram shows how consumers changed their preferences from week to week.



Which one of the following matrices correctly interprets the data from the transition diagram?

- A.
$$\begin{matrix} & P & Q & R \\ \begin{bmatrix} 0.5 & 0.35 & 0.15 \\ 0.3 & 0.2 & 0.5 \\ 0.48 & 0.12 & 0.4 \end{bmatrix} & P \\ & Q \\ & R \end{matrix}$$
- B.
$$\begin{matrix} & P & Q & R \\ \begin{bmatrix} 0.5 & 0.35 & 0.1 \\ 0.3 & 0.53 & 0.5 \\ 0.2 & 0.12 & 0.4 \end{bmatrix} & P \\ & Q \\ & R \end{matrix}$$
- C.
$$\begin{matrix} & P & Q & R \\ \begin{bmatrix} 50 & 35 & 15 \\ 30 & 20 & 50 \\ 48 & 12 & 40 \end{bmatrix} & P \\ & Q \\ & R \end{matrix}$$
- D.
$$\begin{matrix} & P & Q & R \\ \begin{bmatrix} 50 & 35 & 10 \\ 30 & 53 & 50 \\ 20 & 12 & 40 \end{bmatrix} & P \\ & Q \\ & R \end{matrix}$$
- E.
$$\begin{matrix} & P & Q & R \\ \begin{bmatrix} 0.5 & 0.3 & 0.2 \\ 0.35 & 0.53 & 0.12 \\ 0.1 & 0.5 & 0.4 \end{bmatrix} & P \\ & Q \\ & R \end{matrix}$$

Question 7

A survey was carried out on 60 000 fans of the Mitres football team about their attendance at games in the previous two seasons. The fans were categorised into either non-attendees (N), casual attendees (C) or members (M).

This can be represented by the transition matrix shown below.

$$\begin{array}{ccc} & N & C & M \\ \begin{bmatrix} 0.6 & 0.3 & 0.2 \\ 0.3 & 0.5 & 0.2 \\ 0.1 & 0.2 & 0.6 \end{bmatrix} & N \\ & C \\ & M \end{array}$$

In the long run, it is true that

- A. more fans will be members than casual attendees.
- B. more fans will see no games than either members or casual attendees.
- C. there will be fewer than 15 000 members.
- D. the number of casual attendees and members will be the same.
- E. all fans stay in the same category.

Question 8

The Mitres football team have a youth (Y), reserve (R) and first (F) squad. They also have players leave the club each season (L). Movement of the players between the squads from the start to the end of the season can be represented by the transition matrix shown below.

$$\begin{array}{cccc} & Y & R & F & L \\ T = \begin{bmatrix} 0.5 & 0 & 0 & 0 \\ 0.3 & 0.5 & 0.3 & 0 \\ 0.1 & 0.3 & 0.5 & 0 \\ 0.1 & 0.2 & 0.2 & 1 \end{bmatrix} & Y \\ & R \\ & F \\ & L \end{array}$$

The matrix below shows the number of players in each squad.

$$S = \begin{bmatrix} 30 \\ 25 \\ 25 \\ 0 \end{bmatrix}$$

The club aims to keep the numbers in each squad the same each season. At the end of the season the club can even recruit or release players to maintain numbers at the same level as the start of the season.

For this to happen, which of the following statements is **not** true?

- A. The club will need to recruit 15 youth players.
- B. There will be 67 players left at the club after the season.
- C. The club will need to recruit 2 first team players.
- D. The club will need to release 4 reserve players.
- E. The club will need to recruit 13 players in total.

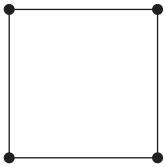
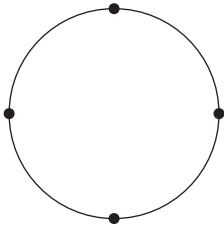
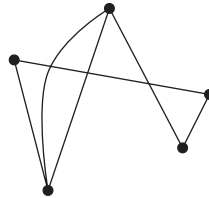
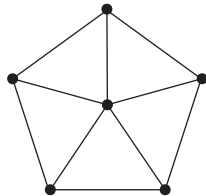
END OF MODULE 1

Module 2 – Networks and decision mathematics

Before answering these questions, you must **mark** the ‘Networks and decision mathematics’ box on the answer sheet for multiple-choice questions.

Question 1

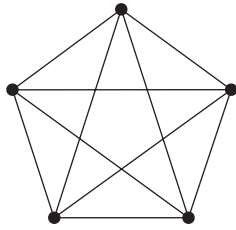
Which one of the following is **not** a simple graph?

A.**B.****C.****D.****E.**

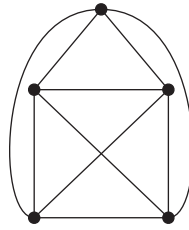
Question 2

Which one of the following graphs is planar?

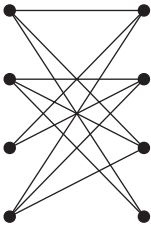
A.



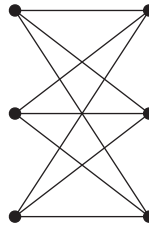
B.



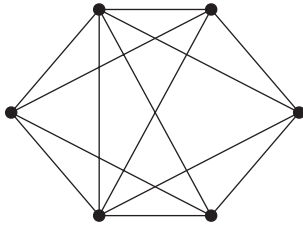
C.



D.

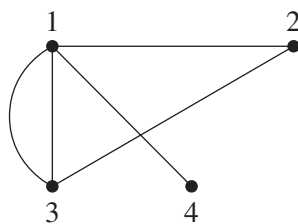


E.



Question 3

Consider the graph shown below.



Which one of the following adjacency matrices corresponds to the above graph?

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

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

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

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

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

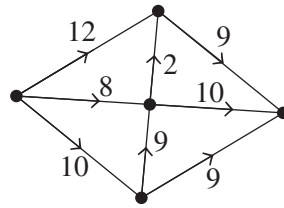
Question 4

How many edges will a complete graph with 8 vertices have?

- A. 15
- B. 21
- C. 28
- D. 32
- E. 56

Question 5

The directed graph below shows the flow of water, in litres per minute, in a system of pipes connecting the source to the sink.

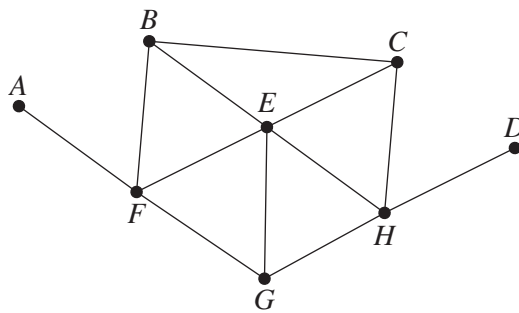


The maximum flow through the network, in litres per minute, would be

- A. 27
- B. 28
- C. 30
- D. 33
- E. 38

Question 6

Consider the graph shown below.



Which one of the following actions would **not** create a Eulerian trail in the graph above?

- A. Remove edge EG .
- B. Add edge AD .
- C. Remove edge EG and add edge DG .
- D. Remove edge EG and add edge AD .
- E. Add edge AB and BD .

Question 7

Alison, Bonnie, Clive and Doug are working on a university project and need to allocate four tasks between them. The expected times to complete the tasks (in hours) are shown in the table below.

	Task 1	Task 2	Task 3	Task 4
Alison	10	12	11	6
Bonny	8	14	12	8
Clive	8	12	10	10
Doug	12	10	8	10

If the minimum time allocation is to be satisfied, who could be allocated to task 2?

- A. Alison
- B. Alison or Doug
- C. Alison or Clive
- D. Clive or Doug
- E. Doug

Question 8

A project requires eleven activities (A – K) to be completed. The duration, in days, and the immediate predecessor(s) of each activity are shown in the table below.

Activity	Preceding activities	Duration (days)
A	-	4
B	-	5
C	-	8
D	C	6
E	C	8
F	A, B	7
G	B, D	4
H	B, D	2
I	E, H	5
J	F, G, I	3
K	J	5

Which one of the following statements is **not** true?

- A. The latest start time of activity G is 17 days.
- B. Activity F has a float time of 9 days.
- C. There is only one critical path.
- D. The earliest finish time of the project is 29 days.
- E. There will be one dummy activity.

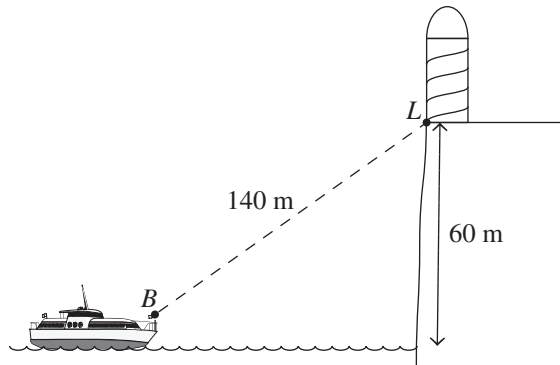
END OF MODULE 2

Module 3 – Geometry and measurement

Before answering these questions, you must **mark** the ‘Geometry and measurement’ box on the answer sheet for multiple-choice questions.

Use the following information to answer Questions 1 and 2.

The distance between a lighthouse (L) and a boat (B) is 140 m. The lighthouse is on top of a cliff 60 m above sea level.

**Question 1**

The distance from the boat to the cliff is closest to

- A. 8.9 m
- B. 126.4 m
- C. 126.5 m
- D. 152.3 m
- E. 152.4 m

Question 2

The angle of depression of the boat from the lighthouse to the nearest degree is

- A. 23°
- B. 25°
- C. 42°
- D. 64°
- E. 65°

Question 3

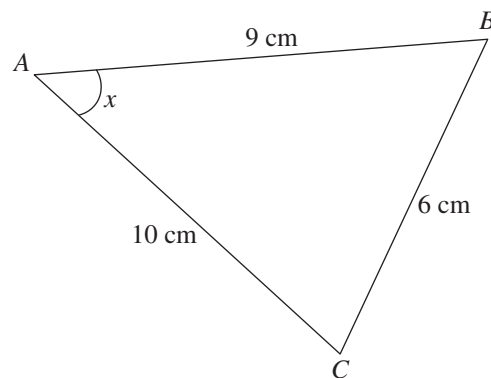
The 2019 Champions League Final will take place in Madrid, which is located at a latitude of 40°N and a longitude of 3°W . The final is due to begin at 8 pm local time. John plans to watch the match live, starting at 2 pm in his location on the same day.

The longitude of his location is

- A. 87°E
- B. 93°E
- C. 27°W
- D. 87°W
- E. 93°W

Question 4

Consider the triangle shown below.

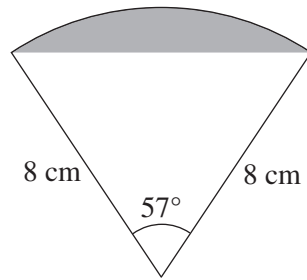


Which one of the following would determine the correct value of x ?

- A. $\cos^{-1}\left(\frac{9^2 + 10^2 - 6^2}{2 \times 9 \times 10}\right)$
- B. $\sin^{-1}\left(\frac{6}{10}\right)$
- C. $\cos^{-1}\left(\frac{9}{10}\right)$
- D. $\cos^{-1}\left(\frac{9^2 + 10^2 - 6^2}{6 \times 9 \times 10}\right)$
- E. $\cos^{-1}\left(\frac{6^2 + 9^2 - 10^2}{2 \times 6 \times 9}\right)$

Question 5

The diagram below shows a sector of a circle.

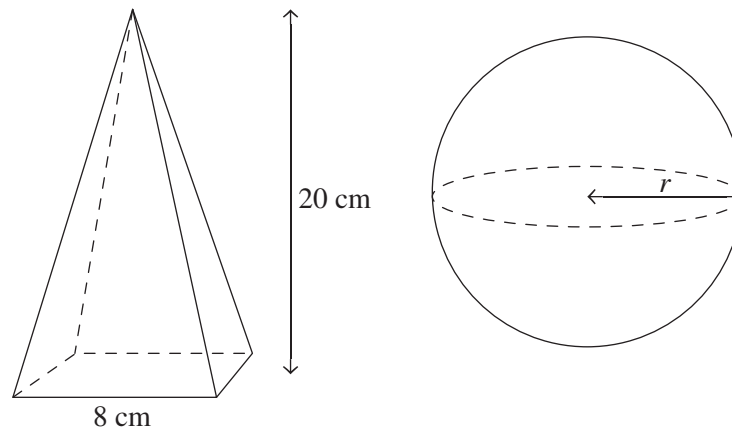


The shaded area is closest to

- A. 1 cm^2
- B. 4 cm^2
- C. 5 cm^2
- D. 27 cm^2
- E. 32 m^2

Question 6

The gold square-based pyramid shown below is to be melted down and a sphere of identical volume is to be formed from the melted gold.

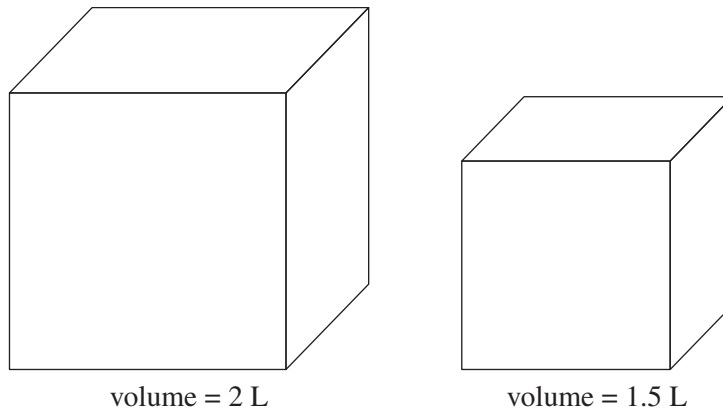


The radius of this sphere would be closest to

- A. 4.6 cm
- B. 4.7 cm
- C. 6.3 cm
- D. 10.0 cm
- E. 10.1 cm

Question 7

Olive oil is stored in cuboid metal containers, as shown in the diagram below.



They are mathematically similar. The larger container holds 2 L in volume and the smaller container holds 1.5 L in volume. The surface area of the larger metal container is 1000 cm^2 .

The surface area of the smaller container would be closest to

- A. 500 cm^2
- B. 750 cm^2
- C. 825 cm^2
- D. 908 cm^2
- E. 909 cm^2

Question 8

An orientation challenge has three checkpoints: *A*, *B* and *C*. The bearing of *B* from *A* is 115° and the bearing of *C* from *A* is 165° . The distance from *A* to *C* is 5 km and the distance from *B* to *C* is 8 km.

The bearing of *C* from *B* is closest to

- A. 29°
- B. 266°
- C. 271°
- D. 331°
- E. 336°

END OF MODULE 3

Module 4 – Graphs and relations

Before answering these questions, you must **mark** the ‘Graphs and relations’ box on the answer sheet for multiple-choice questions.

Question 1

The linear equation of the line that passes through the point (2, 3) with a y-intercept of 4 is

- A. $y = -\frac{x}{3} + 4$
- B. $y = \frac{x}{4} + 2$
- C. $y + 2x - 8 = 0$
- D. $2y + x - 8 = 0$
- E. $2y - x = 8$

Question 2

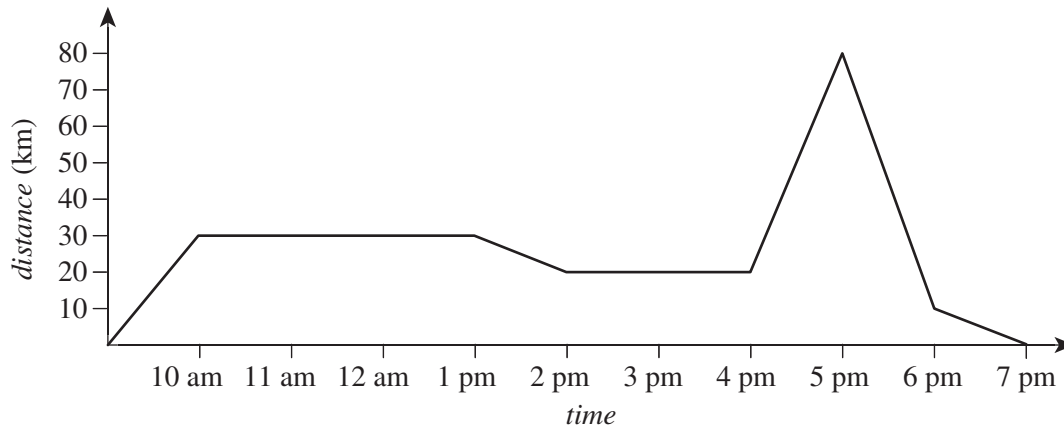
A manufacturer produces both water skis and snow skis. They must produce at least three times the number of snow skis as water skis. Let x be the number of snow skis made and y be the number of water skis made.

Which one of the following systems of inequalities best represents this situation?

- A. $x \geq 3y$
- B. $y \geq 3x$
- C. $x > 0, y > 0$ and $x \geq 3y$
- D. $x \geq 0, y \geq 0$ and $x \geq 3y$
- E. $x \geq 0, y \geq 0$ and $y \geq 3x$

Question 3

The following distance–time graph shows the distance between Rumesh and his home during the day.

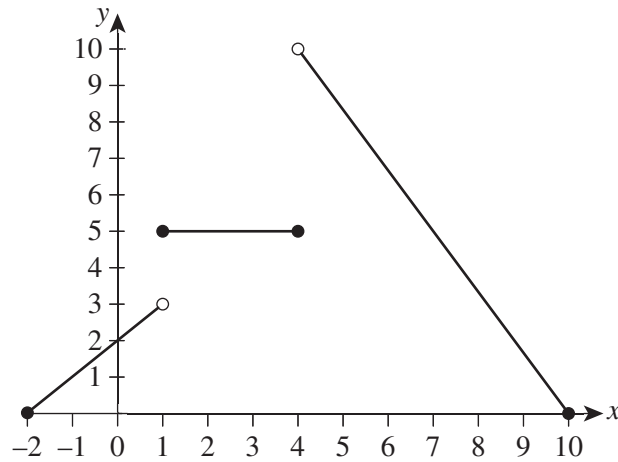


Between what times is Rumesh travelling the fastest?

- A. 9 am–10 am
- B. 1 pm–2 pm
- C. 2 pm–4 pm
- D. 4 pm–5 pm
- E. 5 pm–6 pm

Question 4

Consider the graph shown below.



The equation of this step graph is

A.
$$y = \begin{cases} x + 2, & -2 < x < 1 \\ 5, & 1 \leq x \leq 4 \\ -\frac{5}{3}x + \frac{50}{3}, & 4 < x \leq 10 \end{cases}$$

B.
$$y = \begin{cases} x + 2, & -2 \leq x < 1 \\ x, & 1 \leq x \leq 4 \\ -\frac{5}{3}x + \frac{50}{3}, & 4 < x \leq 10 \end{cases}$$

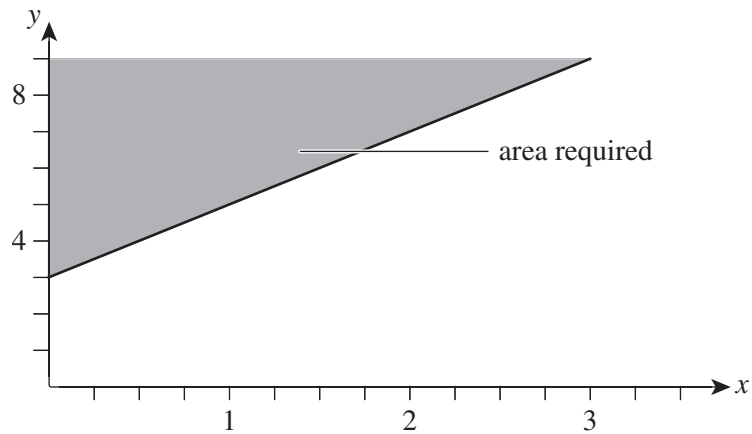
C.
$$y = \begin{cases} x, & -2 \leq x < 1 \\ 5, & 1 \leq x \leq 4 \\ -\frac{5}{3}x + \frac{50}{3}, & 4 < x \leq 10 \end{cases}$$

D.
$$y = \begin{cases} x + 2, & -2 \leq x < 1 \\ 5, & 1 \leq x \leq 4 \\ -\frac{5}{3}x + \frac{50}{3}, & 4 < x \leq 10 \end{cases}$$

E.
$$y = \begin{cases} x + 2, & -2 \leq x < 1 \\ 5, & 1 \leq x \leq 4 \\ -\frac{5}{3}x + \frac{50}{3}, & 4 < x < 10 \end{cases}$$

Question 5

Consider the inequality graph below.

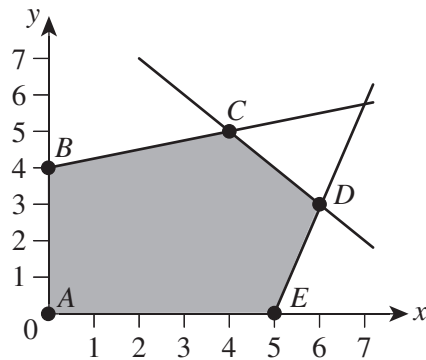


The equation of this inequality is

- A. $y \geq 2x + 3$
- B. $y > 2x + 3$
- C. $y \leq 2x + 3$
- D. $y < 2x + 3$
- E. $y \geq 3x + 2$

Question 6

The shaded region below represents the feasible region for a linear programming problem. The objective function, Z , is $Z = 4x + 3y$.

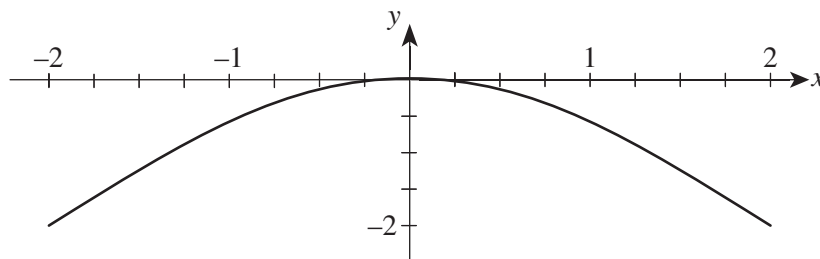


Which point is the optimal (maximal) solution?

- A. (0, 0)
- B. (0, 4)
- C. (4, 5)
- D. (6, 3)
- E. (5, 0)

Question 7

A tunnel is to be drilled under a road to create a safe crossing for animals. The equation of the roof of the tunnel is $y = -\frac{x^2}{k}$. The curve finishes at the points $(-2, -2)$ and $(2, -2)$.



The value of k is

- A. -2
- B. 0
- C. $\frac{1}{2}$
- D. 1
- E. 2

Question 8

The local bakery has a sale on meat pies and sausage rolls. Alex buys 20 meat pies and 15 sausage rolls at a cost of \$138. Bernice buys 6 meat pies and 10 sausage rolls at a cost of \$59.

How much does it cost Candice to buy 8 meat pies and 12 sausage rolls?

- A. \$68
- B. \$72.60
- C. \$74.40
- D. \$74.80
- E. \$84

END OF MULTIPLE-CHOICE QUESTION BOOKLET