

Trial Examination 2021

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 and answer booklet of 25 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 2021 VCE Further Mathematics Units 3&4 Trial Examination.

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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.

0, 0, 0, 2, 2, 2, 4, 4, 6, 6, 6, 8, 8, 8, 8, 8

Which one of the following operations could be used to calculate the mean of the set of data above?

- A. $\frac{2+2+2+4+4+6+6+6+8+8+8+8+8}{13}$
- B. $\frac{0+0+0+2+2+2+4+4+6+6+6+8+8+8+8}{5}$
- C. $\frac{3 \times 0 + 2 \times 3 + 4 \times 2 + 3 \times 6 + 8 \times 5}{13}$
- D. $\frac{3 \times 2 + 2 \times 4 + 3 \times 6 + 5 \times 8}{16}$
- E. $\frac{3 \times 2 + 2 \times 4 + 3 \times 6 + 5 \times 8}{5}$

Question 2

Consider the set of data in Table 1.

Table 1

x	f
$0 - < 10$	3
$10 - < 20$	5
$20 - < 30$	8
$30 - < 40$	4

The mode of this data set could be

- A. 5.
- B. 8.
- C. 25.
- D. any number between 20 and 29.
- E. any number between 0 and 39.

Question 3

A data set has the five-number summary shown below.

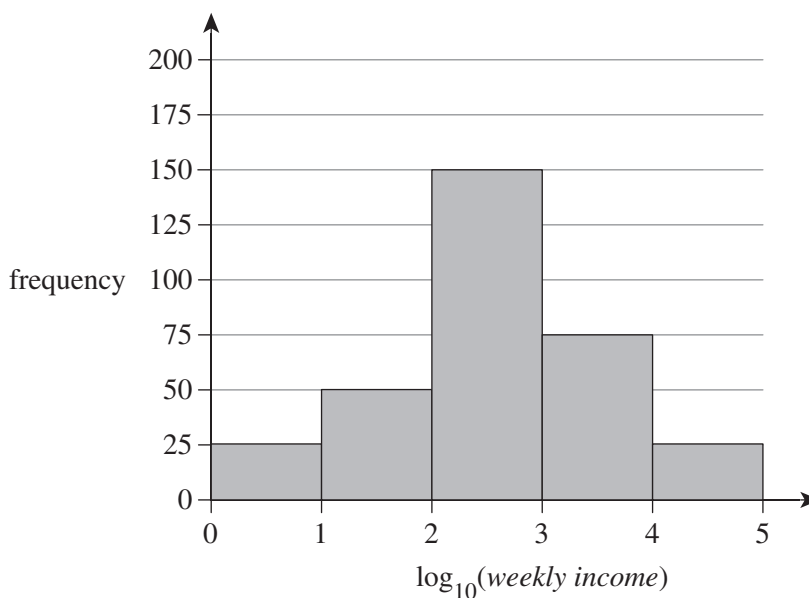
0, 7, 20, 21, 52

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

- A. The IQR is 14.
- B. The median is 20.
- C. 52 is an outlier.
- D. The mean is more than 20.
- E. The mode is between 21 and 52.

Question 4

The median *weekly income* is recorded for a population. The frequency is plotted on a $\log_{10}$ scale, as shown in the following histogram.



The number of people that earn less than \$1000 per week is

- A. 3
- B. 50
- C. 75
- D. 150
- E. 225

Use the following information to answer Questions 5 and 6.

The frog population of a pond is counted over the course of one year. The data is shown in Table 2.

Table 2

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Population	32	28	27	24	20	19	19	18	26	34	40	41

Question 5

The three-point moving mean centred on May is closest to

- A. 5
- B. 20
- C. 21
- D. 24, 20, 19
- E. 26.3

Question 6

The best graph to display the data in Table 2 would be a

- A. frequency table.
- B. histogram.
- C. residual plot.
- D. time series plot.
- E. scatterplot.

Question 7

The members of a local tennis club were surveyed about their preferences for the club's end-of-year event. The choice was between an all-age tournament or a club picnic. The results of the survey are shown in Table 3.

Table 3

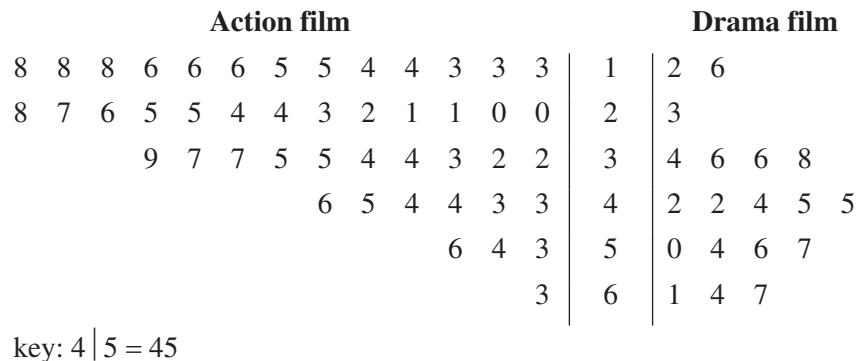
	Junior member		Adult member		Senior member		Total
	Tournament	Picnic	Tournament	Picnic	Tournament	Picnic	
Female	43	17	24	38	14	50	186
Male	56	4	40	28	12	40	180
Total	99	21	64	66	26	90	

Which one of the following statements is true?

- A. The club has more male members than female members.
- B. More members voted for a picnic than voted for a tournament.
- C. The adult membership is the largest of the three groups.
- D. There is a total of 364 members.
- E. There are 64 male adult members.

Question 8

The following back-to-back stem plot represents the ages of attendees at two different films.



Which one of the following statements is correct?

- A. The range of the action film attendees is greater than the range of the drama film attendees.
- B. The mean age of the drama film attendees was 44.
- C. The ages of the action film attendees are positively skewed.
- D. There were more attendees over the age of 30 at the drama film than the action film.
- E. The mode of the age of the action film attendees is lower than the mode of the age of the drama film attendees.

Question 9

Consider the following data set.

-30, -20, -10, 10, 30, 30, 30, 35, 40, 50, 50, 65, 70, 70, 75, 80, 140

The descriptive statistics that best represent the central tendency and spread of the data set are

- A. mean and standard deviation.
- B. mean and IQR.
- C. median and standard deviation.
- D. median and IQR.
- E. mode and IQR.

Question 10

The equation for a line of best fit in a linear model is calculated using the two points (10, 218) and (50, 90).

The equation of the line of best fit is

- A. $y = 218 - 3.2x$
- B. $y = 250 + 3.2x$
- C. $y = 250 - 0.312x$
- D. $y = 250 + 0.312x$
- E. $y = 250 - 3.2x$

Question 11

Sales of chocolate peak during the cooler half of the year and drop off during the warmer half of the year. The seasonal index for the sale of chocolate in the cooler half of the year is 1.6.

Which one of the following statements is true?

- A. 60% of sales occur in the cooler half of the year.
- B. The seasonal index for the warmer half of the year is 2.4.
- C. There is an increase in the average sales during the cooler half of the year.
- D. The cooler half of the year causes 36% of the extra sales.
- E. Sales are reduced by 40% in the warmer half of the year.

Question 12

The weight of packets of chips labelled 200 g is normally distributed with a mean of 210 and standard deviation of 5 g.

In a box containing 1000 packets of chips, the number of packets of chips that would be expected to weigh below 200 g is

- A. 0
- B. 2.5
- C. 15
- D. 20
- E. 25

Question 13

The equation of the least squares line of $y = 34 + 3.5x$ is calculated for a set of experimental data.

The residual for the real data point (80, 320) is closest to

- A. -10
- B. -6
- C. 6
- D. 10
- E. 25

Question 14

After a $\frac{1}{x}$ transformation of a particular equation, the following values are found.

- $r = -0.7$
- gradient $= -2.1$
- y-intercept $= 14.6$

The equation of the least squares line is

- A. $y = 14.6 - 0.7x$
- B. $y = 14.6 - 2.1x$
- C. $y = 2.1 + 14.6x$
- D. $y = 14.6 - \frac{1}{x}$
- E. $y = 14.6 - \frac{2.1}{x}$

Question 15

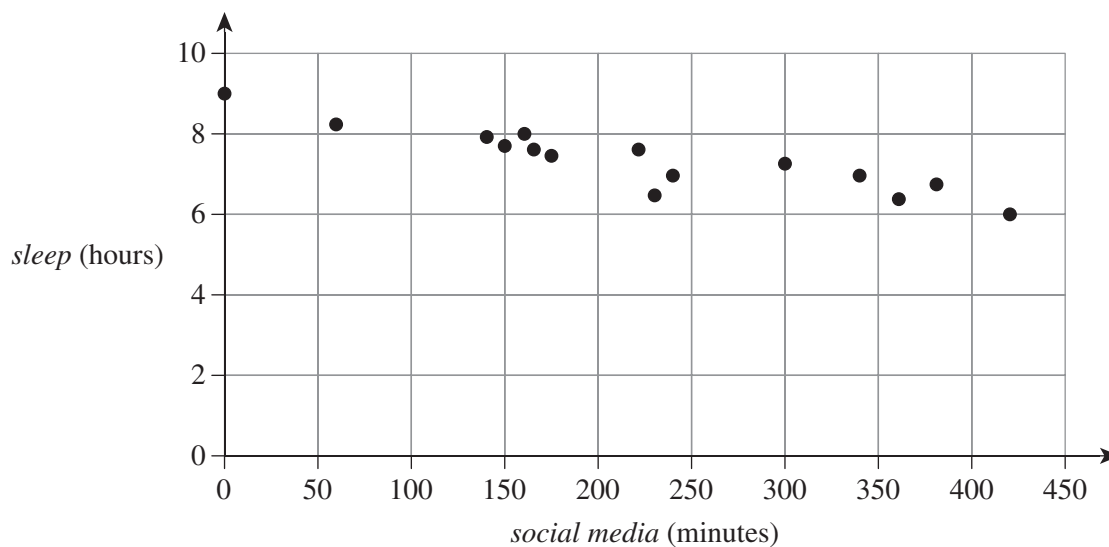
The weight of a cereal packet is normally distributed with $\bar{x} = 250$ g and $S_x = 10$ g. One box is chosen at random from the assembly line and is found to have $z = 0.8$.

The weight of the cereal packet is closest to

- A. 230 g
- B. 240 g
- C. 250 g
- D. 260 g
- E. 270 g

Question 16

A bivariate study into the effect of using *social media* after 7 pm on the hours of *sleep* was conducted for a group of fifteen 18-year-olds. The hours of *sleep* and the minutes on *social media* after 7 pm were recorded on a given day. The data produced is recorded on the following scatterplot.



The summary statistics are shown in Table 4.

Table 4

	<i>Social media (minutes)</i>	<i>Sleep (hours)</i>
Mean	222.8	7.4
Standard deviation	115.6	0.78
$r^2 = 0.81$		

For this group of 18-year-olds, for each additional minute spent on *social media*, their amount of *sleep*

- A. decreased by an average of 0.006 minutes.
- B. decreased by an average of 8.75 minutes.
- C. decreased by an average of 21.6 seconds.
- D. increased by an average of 0.006 hours.
- E. increased by an average of 0.36 minutes.

Recursion and financial modelling**Question 17**

The series 2, 8, 32, 128 ... n is best described by

- A. $t_{n+1} = 4t_n$
- B. $t_{n+1} = t_n + 6$
- C. $t_n = 4t_{n+1}, t_1 = 0$
- D. $t_{n+1} = 4t_n, t_1 = 2$
- E. $t_n = 4t_{n+1}, t_1 = 2$

Question 18

The terms t_1 and t_3 are generated by the recurrence relation $t_{n+1} = -2t_n + 20, t_0 = 5$.

The terms t_1 and t_3 are, respectively,

- A. 5 and 10.
- B. 10 and 0.
- C. 15 and -10.
- D. 20 and -20.
- E. 10 and 20.

Question 19

A step ladder is constructed with 6 rungs and a top plate, as shown in the following diagram. The width of each rung is 90% of the width of the rung below it. The bottom rung is 80 cm wide.



The width of the top rung, rounded to one decimal place, is

- A. 42.5 cm
- B. 42.6 cm
- C. 45.2 cm
- D. 47.2 cm
- E. 47.3 cm

Question 20

Nui is earning 3.5% of interest per annum, compounding monthly, on her savings of \$20 000.

Which one of the following expressions calculates the interest earned on her account after 2 years?

- A. $I = 20\,000 \left(1 + \frac{3.5}{12} \right)^{24}$
- B. $I = 20\,000 \left(1 + \frac{3.5}{12} \right)^2$
- C. $I = 20\,000 \left(1 + \frac{3.5}{12} \right)^2 - 20\,000$
- D. $I = 20\,000 \left(1 + \frac{3.5}{12} \right)^{24} - 20\,000$
- E. $I = 20\,000 \left(1 + \frac{3.5}{12} \right)^2 - 20\,000$

Question 21

A weather bureau buys a new radar machine for a cost of \$2 450 000. The radar machine will be used for 10 years before being replaced, and it will be sold for \$50 000 at the end of the 10 years.

The value of the radar machine after n years, using unit depreciation, is

- A. $2\,450\,000 - 240\,000n$
- B. $2\,450\,000 + 240\,000n$
- C. $2\,400\,000 - 240\,000n$
- D. $2\,400\,000 + 240\,000n$
- E. $2\,450\,000 + \frac{2\,450\,000n}{100}$

Question 22

Consider the equation $A = 10000 \times 1.06^5$.

If this equation represents an investment, what is the principal, the interest rate per annum and the length of the investment in years?

	Principal	Interest rate per annum	Length of investment
A.	$P = 10000$	$R = 6$	$t = 5$ years
B.	$P = 10000$	$R = 1.06$	$t = 5$ years
C.	$P = 10000$	$r = 6$	$t = 60$ months
D.	$P = 10000$	$r = 6$	$t = 5$ years
E.	$P = 10000$	$r = 1.06$	$t = 5$ years

Question 23

Avril has \$100 000 to invest and is considering two investment options.

- Option 1 returns 4.05% of interest per annum, compounding daily, for two years.
- Option 2 returns 4.09% of interest per annum, compounding monthly, for up to three years.

To the nearest dollar, the option that will have the higher balance after two years is

- A. option 1 by \$58.
- B. option 1 by \$72.
- C. option 2 by \$58.
- D. option 2 by \$72.
- E. option 2 by \$4598.

Question 24

An investment diamond is bought for a cash price of \$4500. After a ten-year period, it is sold for \$6000.

Allowing for an average inflation rate of 1.8% per annum, what is the percentage profit or loss on the investment?

- A. profit of \$620
- B. profit of \$1500
- C. profit of 13.8%
- D. profit of 33.3%
- E. loss of 88%

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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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.

Use the following information to answer Questions 1–8.

$$A = \begin{bmatrix} 4 & 6 \\ 2 & 7 \\ 3 & 4 \end{bmatrix} \quad B = \begin{bmatrix} -1 & 4 \\ -3 & 7 \end{bmatrix} \quad C = \begin{bmatrix} 2 & 1 \\ 0 & \frac{1}{2} \end{bmatrix} \quad D = \begin{bmatrix} 2 & 3 & 4 \\ 1 & 0 & 1 \end{bmatrix}$$

Question 1

The order of matrix A is

- A. 2×3
- B. 6
- C. 3×2
- D. 3×3
- E. 26

Question 2

$B + C$ is equal to

- A. $\begin{bmatrix} 1 & 5 \\ -3 & 7.5 \end{bmatrix}$
- B. $\begin{bmatrix} 3 & 5 \\ -3 & 7.5 \end{bmatrix}$
- C. $\begin{bmatrix} -3 & 3 \\ -3 & 6.5 \end{bmatrix}$
- D. $\begin{bmatrix} 1 & 3 \\ -3 & 7.5 \end{bmatrix}$
- E. $\begin{bmatrix} 1 & 5 \\ -3 & 6.5 \end{bmatrix}$

Question 3

Which one of the following matrix products is defined?

- A. D^2
- B. $AD + 2A$
- C. DB
- D. $(AD)^2$
- E. $(AB)^2$

Question 4

The determinant of C is

- A. -2
- B. -1
- C. 0
- D. 1
- E. 2

Question 5

To sum the columns of matrix A , the matrix calculation needed is

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

B. $A \times \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$

C. $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \times A$

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

E. $\begin{bmatrix} 0 & 0 & 0 \end{bmatrix} \times A$

Question 6

When multiplied by A , the scalar that equals $\begin{bmatrix} 6 & 9 \\ 3 & 10.5 \\ 4.5 & 6 \end{bmatrix}$ is

- A. 1
- B. 1.25
- C. 1.5
- D. 1.75
- E. 2

Question 7 B^{-1} is equal to

A. $\frac{1}{5} \begin{bmatrix} -7 & -4 \\ 3 & 1 \end{bmatrix}$

B. $\frac{1}{5} \begin{bmatrix} 7 & -4 \\ 3 & -1 \end{bmatrix}$

C. $\frac{1}{5} \begin{bmatrix} 7 & 4 \\ -3 & -1 \end{bmatrix}$

D. $\frac{1}{5} \begin{bmatrix} 7 & -3 \\ 4 & -1 \end{bmatrix}$

E. $\frac{1}{5} \begin{bmatrix} 7 & -4 \\ -3 & -1 \end{bmatrix}$

Question 8

Consider the equation $S_{n+1} = \begin{bmatrix} 0.1 & 0.2 & 0.4 \\ 0.2 & 0.5 & 0.1 \\ 0.7 & 0.3 & 0.5 \end{bmatrix} S_n + B$, where $S_1 = \begin{bmatrix} 1100 \\ 1000 \\ 900 \end{bmatrix}$.

If $S_{n+1} = S_n$, B is

A. $\begin{bmatrix} -1000 \\ 1000 \\ 2000 \end{bmatrix}$

B. $\begin{bmatrix} 670 \\ 810 \\ 1970 \end{bmatrix}$

C. $\begin{bmatrix} 430 \\ 190 \\ -620 \end{bmatrix}$

D. $\begin{bmatrix} -430 \\ -190 \\ 620 \end{bmatrix}$

E. $\begin{bmatrix} 837 \\ 691 \\ 1472 \end{bmatrix}$

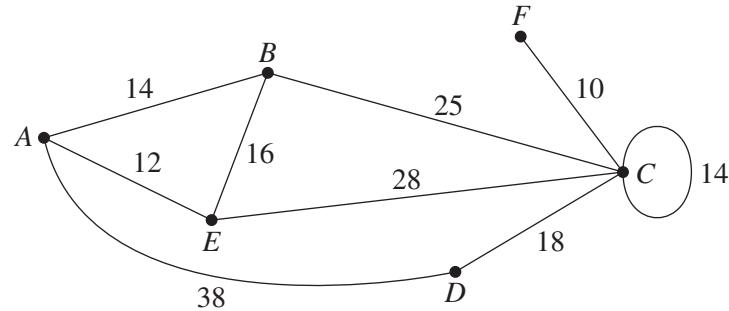
END OF MODULE 1

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.

Use the following information to answer Questions 1–3.

The following diagram shows the travel time, in minutes, to walk along paths that link picnic areas in a national park.

**Question 1**

Deg(C) is equal to

- A. 3
- B. 4
- C. 5
- D. 6
- E. 86

Question 2

The shortest number of minutes to walk from A to C is

- A. 39
- B. 40
- C. 48
- D. 53
- E. 56

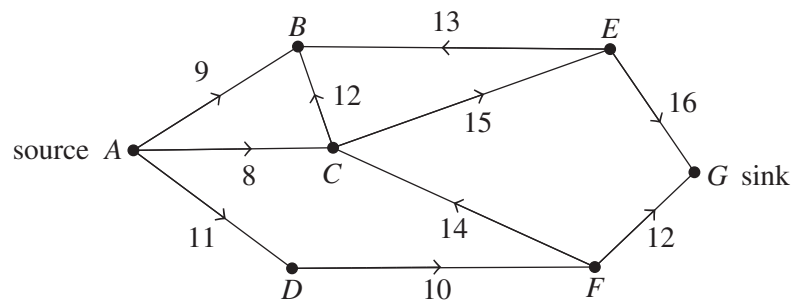
Question 3

The number of faces in this network is

- A. 3
- B. 4
- C. 5
- D. 6
- E. 7

Question 4

Consider the following network.

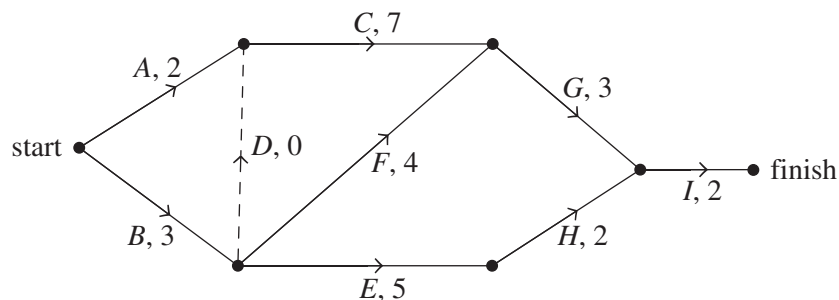


The maximum flow of this network is

- A. 18
- B. 24
- C. 25
- D. 27
- E. 28

Use the following information to answer Questions 5–8.

The following network shows a series of tasks, including the number of days that each task takes to complete.

**Question 5**

The minimum number of days required to complete the project is

- A. 12
- B. 13
- C. 14
- D. 15
- E. 16

Question 6

The earliest possible start time for task C is after

- A. 2 days.
- B. 3 days.
- C. 4 days.
- D. 9 days.
- E. 10 days.

Question 7

The float time on task F is

- A. 2
- B. 3
- C. 4
- D. 5
- E. 6

Question 8

Which one of the following changes would reduce the overall completion time by the maximum amount?

- A. Reduce task C by 3 days.
- B. Reduce task E by 3 days.
- C. Reduce task F by 3 days.
- D. Reduce task G by 2 days.
- E. Reduce task H by 2 days.

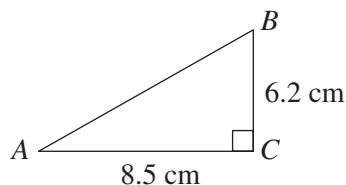
END OF MODULE 2

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.

Use the following information to answer Questions 1–3.

The following diagram shows a right-angled triangle.

**Question 1**

The length of side AB , rounded to three significant figures, is

- A. 3.83
- B. 10.5
- C. 10.521
- D. 110
- E. 111

Question 2

The size of $\angle ABC$, rounded to one decimal place, is

- A. 36.1°
- B. 43.2°
- C. 46.8°
- D. 53.8°
- E. 53.9°

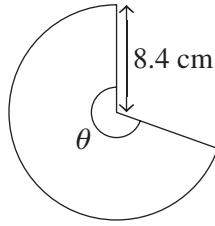
Question 3

If the length of each side of the triangle ABC were increased by a scale factor of 1.75, the area of the triangle would increase by a scale factor of

- A. 1.75
- B. 3.0625
- C. 3.5
- D. 5.25
- E. 12.25

Question 4

The area of the following shape is 132 cm^2 .

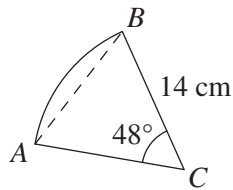


The value of θ is closest to

- A. 0.59°
- B. 146°
- C. 214.37°
- D. 214.38°
- E. 1800.7°

Use the following information to answer Questions 5 and 6.

Consider the following diagram.

**Question 5**

The length of arc AB is closest to

- A. 5 cm
- B. 6 cm
- C. 11 cm
- D. 12 cm
- E. 21 cm

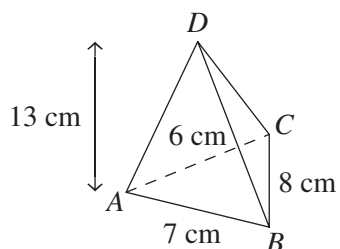
Question 6

The shortest distance from C to the chord AB is

- A. 0.91 cm
- B. 9.37 cm
- C. 12.79 cm
- D. 15.32 cm
- E. 20.92 cm

Question 7

Consider the following triangular pyramid. The height of the pyramid is 13 cm.

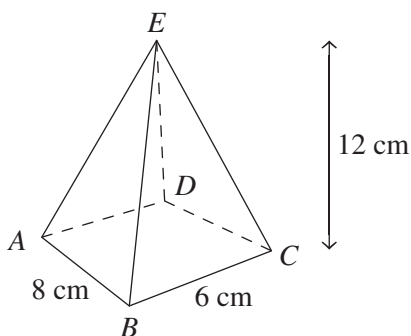


The area of base ABC is closest to

- A. 14 cm^2
- B. 20 cm^2
- C. 42 cm^2
- D. 239 cm^2
- E. 413 cm^2

Question 8

Consider the following rectangular pyramid. The height of the pyramid is 12 cm.



The volume of the pyramid is

- A. 96 cm^3
- B. 144 cm^3
- C. 192 cm^3
- D. 288 cm^3
- E. 576 cm^3

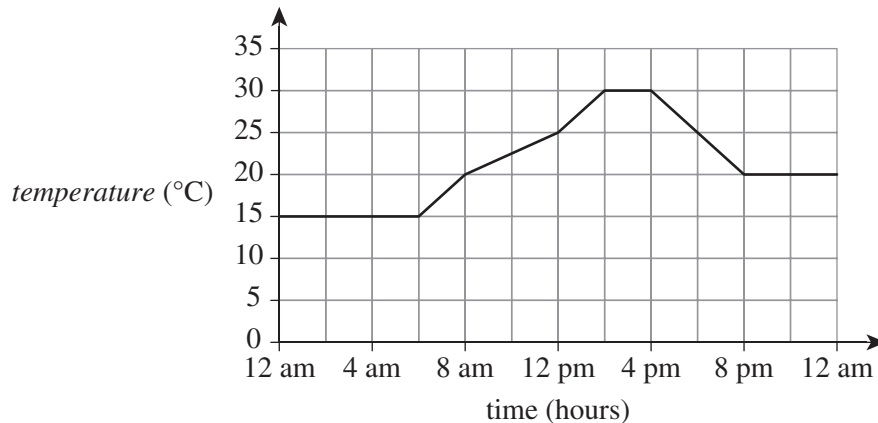
END OF MODULE 3

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

The following graph shows the air *temperature* ($^{\circ}\text{C}$) during a 24-hour period.



For how many hours was the *temperature* ($^{\circ}\text{C}$) less than 25°C ?

- A. 6
- B. 8
- C. 10
- D. 12
- E. 18

Question 2

The linear equation of the line with an x -intercept of 5 and y -intercept of 15 is

- A. $y + 3x - 15 = 0$
- B. $y = -\frac{x}{3} + 15$
- C. $3y + x - 45 = 0$
- D. $y = 3x + 15$
- E. $y = -3x - 15$

Question 3

A small kiosk by the beach sells drinks and ice-creams. They must stock at least twice the number of drinks as ice-creams. The maximum number of drinks that can be stored is 600.

Let x be the number of drinks stored.

Let y be the number of ice-creams stored.

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

- A. $x \geq 2y$
- B. $y \geq 2x$
- C. $x > 0, y > 0$ and $x \geq 2y$
- D. $x \leq 600, y \geq 0$ and $x \geq 2y$
- E. $x \geq 0, x \leq 600, y \geq 0$ and $x \geq 2y$

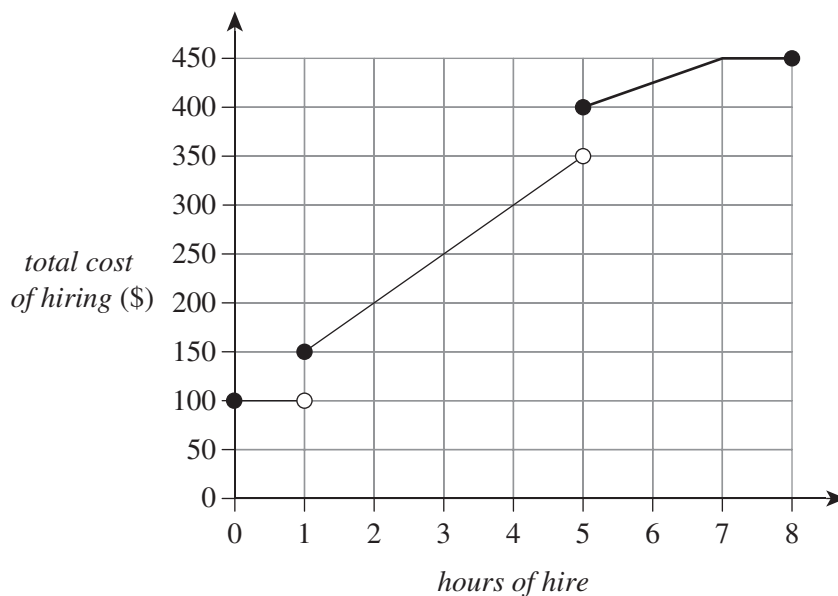
Question 4

A company that rents out mechanical diggers has a fixed delivery and pick-up charge, plus a varying charge depending upon the hours of use of the digger.

Let $c = \text{total cost of hiring (\$)}$ for x hours.

Let $x = \text{hours of hire}$.

The following graph represents a possible price structure for renting out a digger.



The rental cost structure that this step graph represents is

A. $c = 100 \quad 0 \leq x < 1$

B. $c = \begin{cases} 100 & 0 \leq x < 1 \\ 50x + 100 & 1 \leq x < 5 \end{cases}$

C. $c = \begin{cases} 100 & 0 \leq x \leq 1 \\ 50x + 100 & 1 \leq x < 5 \\ 25x + 275 & 5 \leq x < 7 \end{cases}$

D. $c = \begin{cases} 100 & 0 \leq x \leq 1 \\ 50x + 100 & 1 \leq x < 5 \\ 25x + 275 & 5 \leq x < 7 \\ 450 & 7 \leq x \leq 8 \end{cases}$

E. $c = \begin{cases} 100 & 0 \leq x < 1 \\ 50x + 100 & 1 \leq x < 5 \\ 25x + 275 & 5 \leq x < 7 \\ 450 & 7 \leq x \leq 8 \end{cases}$

Question 5

The inequalities below were used to define the feasible region for a linear programming question.

$$0 < y < 5$$

$$0 < x < 8$$

$$3y + x - 12 \leq 0$$

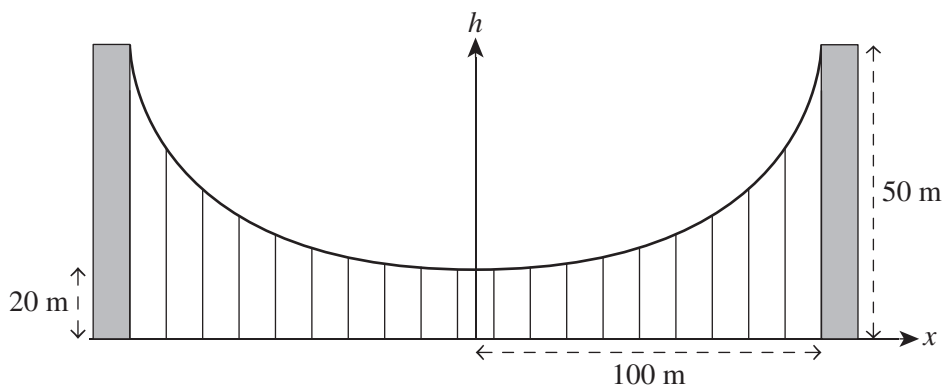
Which one of the following points lies within the feasible region?

- A. (0, 0)
- B. (1, 4)
- C. (9, 1)
- D. (5, 1)
- E. (8, 0)

Question 6

A 200 m long suspension bridge is held up by steel chains, as shown in the following diagram.

The equation for the height of the curve above the road, h , is in the form $h = ax^2 + b$, where x is the distance from the centre of the bridge.



The equation for the height of the curve above the road is

- A. $h = 0.3x^2 + 20$
- B. $h = 0.03x^2 + 20$
- C. $h = 0.003x^2 + 20$
- D. $h = 0.03x^2 + 50$
- E. $h = 0.003x^2 + 50$

Question 7

The point (10, 45) lies on a curve with the general formula, $y = kx^2$.

The value of k is closest to

- A. 0.22
- B. 0.45
- C. 4.5
- D. 45
- E. 450

Question 8

The cost of an adult ticket is different to the cost of a child ticket to a basketball game. A group of three adults and two children pays \$600 for admission to the basketball game. A group of five adults pays \$700 total for admission.

The combined cost for one adult ticket and one child ticket to the basketball game is

- A. \$90
- B. \$120
- C. \$140
- D. \$230
- E. \$300

END OF MULTIPLE-CHOICE QUESTION BOOKLET



Trial Examination 2021

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

Core – Recursion and financial modelling

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

Module 1 – Matrices

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

Module 2 – Networks and decision mathematics

Euler's formula	$v + f = e + 2$
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Module 3 – Geometry and measurement

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

Module 4 – Graphs and relations

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

END OF FORMULA SHEET

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
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Use pencil only

Core: Data analysis 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

Core: Recursion and financial modelling ONE ANSWER PER LINE

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

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

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