Neap

Trial Examination 2023

VCE General Mathematics Units 1&2

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

Number of questions	Number of questions to be answered	Number of marks
40	40	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 21 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.

Instructions

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 book are **not** drawn to scale.

AREA OF STUDY 1

- Data analysis, probability and statistics

Question 1

Which one of the following pairs of variables are examples of the same type of data?

A.   the heights of students in a General Mathematics class and their postcodes

B.   the number of people at a concert and their gender

C.   education level and annual salary

D.   brand of hair dye and brand of shampoo

E.   a person's English grade and IQ test score

Question 2

A class of 18 General Mathematics students took a test. The following stem plot shows the students' *test scores*.

```
0 | 3
1 | 1
2 | 0 5 7 9
3 | 6 7 8 8 9
4 | 0 0 0 3 7
5 | 0 0
```
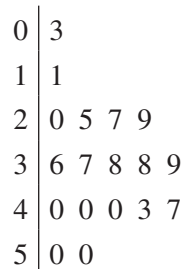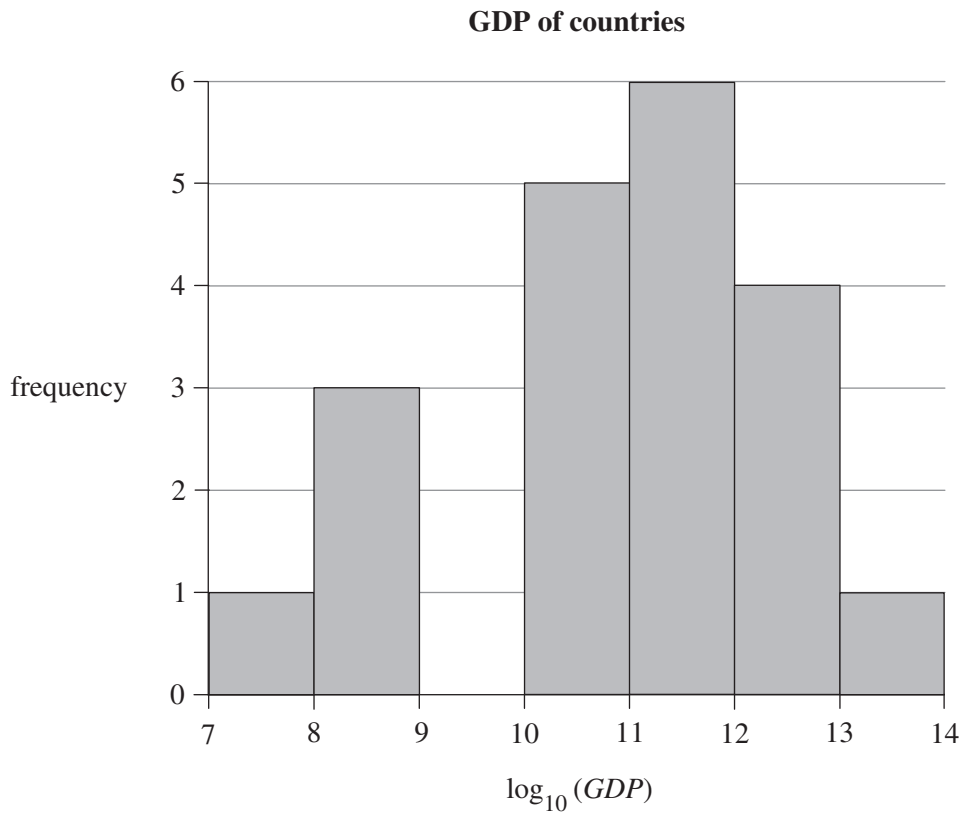
Key
4 | 2 = 42
$n = 18$

The *test score* of 3 is considered an outlier because 3 is

A.   less than 7.5.

B.   less than 13.

C.   less than 27.

D.   less than 40.

E.   less than 59.5.

Use the following information to answer Questions 3 and 4.

The histogram below shows the *gross domestic product* (*GDP*), in dollars, for a sample of 20 countries. It is plotted on a logarithmic (base 10) scale.

GDP of countries

Question 3

The percentage of countries with a *GDP* higher than $\$10^{10}$ is closest to
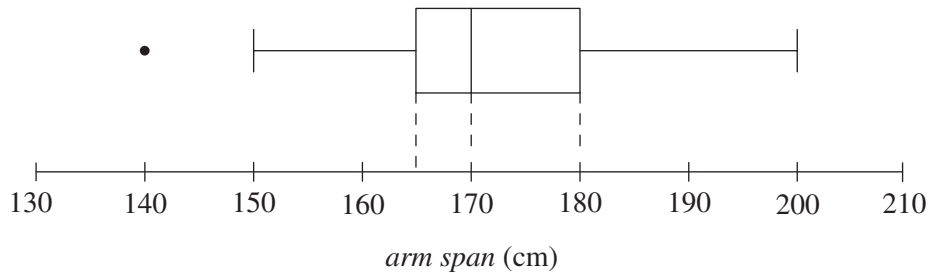
A. 5%

B. 20%

C. 25%

D. 55%

E. 80%

Question 4

The median *GDP* of the sample lies between

A. 10^7 and 10^8

B. 10^8 and 10^9

C. 10^9 and 10^{10}

D. 10^{10} and 10^{11}

E. 10^{11} and 10^{12}

Question 5

The following boxplot shows the distribution of the *arm spans*, in centimetres, for a sample of 50 students.
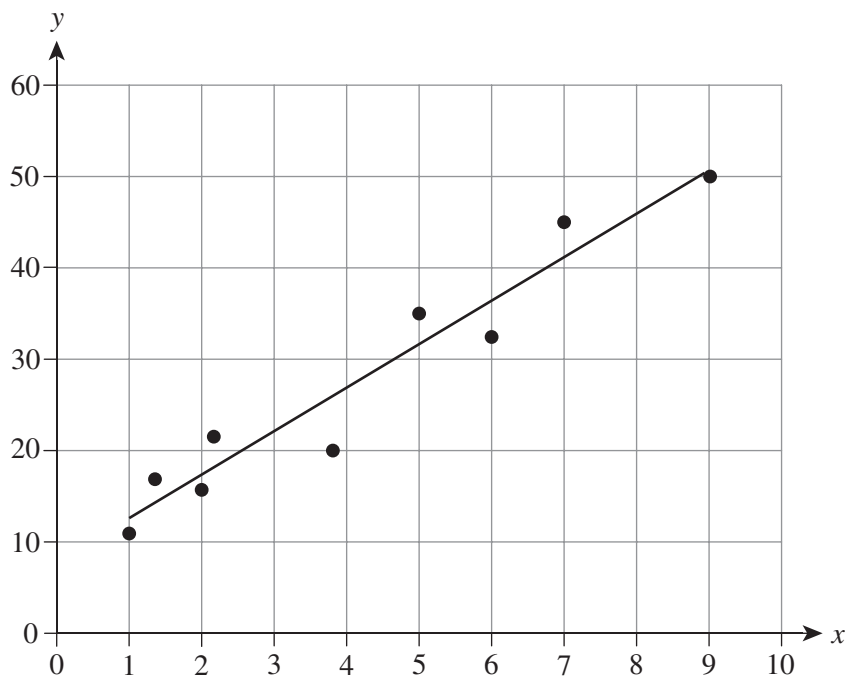

arm span (cm)

It is later found that an arm span of 175 cm was incorrectly recorded as 155 cm.

If the value is corrected to 175 cm, the only statistic that will **not** change is the

A.   mean.

B.   median.

C.   mode.

D.   range.

E.   interquartile range.
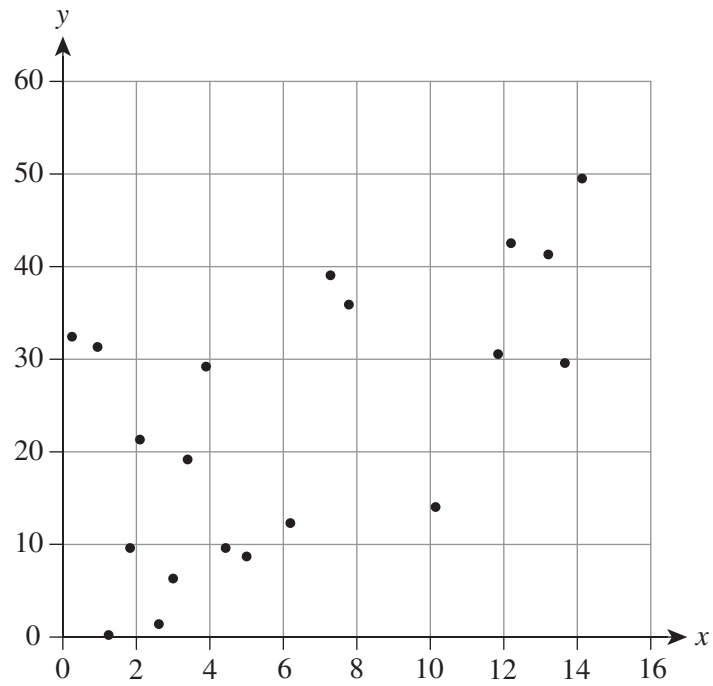
Question 6

A scatterplot is shown below.

Which one of the following equations best describes the line of good fit for this scatterplot?

A. $y = -4.76x - 7.85$

B. $y = -4.76x + 15.39$

C. $y = 4.76x + 7.85$

D. $y = 4.76x + 15.39$

E. $y = 15.39x - 4.76$

Question 7

A scatterplot is shown below.

The association between two variables in the scatterplot, in terms of strength and direction, can described as

A. strong and positive.

B. strong and negative.

C. moderate and positive.

D. moderate and negative.

E. weak and positive.

Use the following information to answer Questions 8 and 9.

Students at Generalville High School have conducted a study to investigate whether their scores on an IQ test will affect the scores they receive on their final Mathematics exam.

Question 8

Which one of the following statements is correct?

A.   The IQ test score is the response variable.

B.   The final exam score is the response variable.

C.   The number of students in the study is the response variable.

D.   Both the IQ test score and final exam score are response variables.

E.   Neither the IQ test score nor the final exam score are response variables.

Question 9

A student finds the line of good fit to be $y = 4.89 + 0.28x$.

If the explanatory variable is increased by 2, the response variable is expected to

A.   stay the same.

B.   decrease by 0.28.

C.   increase by 0.56.

D.   decrease by 4.89.

E.   increase by 9.78.

Question 10

It is found that there is a positive association between an individual's *time spent studying*, in hours, and their *exam result*. This association can be modelled by the equation

$$\textit{exam result} = 25 + 3.8 \times \textit{time spent studying}.$$

If Angela wants to get an exam result above 80, how many hours would she expect to spend studying?

A.   3.05

B.   14.47

C.   25

D.   28.8

E.   329

AREA OF STUDY 2

- Algebra, number and structure
- Discrete mathematics

Question 11

Consider the sequence shown below.

$$2, 6, 18, 54 \dots$$

Which one of the following recurrence relations could be used to describe the sequence?

A. $u_0 = 2, u_{n+1} = 3u_n$

B. $u_0 = 2, u_{n+1} = 2u_n + 2$

C. $u_0 = 2, u_{n+1} = u_n + 4$

D. $u_0 = 2, u_{n+1} = 4u_n - 2$

E. $u_0 = 2, u_{n+1} = u_n + n$

Question 12

A geometric sequence has a common ratio of 1.5 and a starting value of 2.

The sum of the first six terms of the sequence is

A. 15.1875

B. 25.3125

C. 32.0625

D. 36.5625

E. 41.5625

Question 13

John purchased a new car from a car dealership and used the dealership's financial plan. The contract states that John borrowed \$12 000 at 5% per annum simple interest with no repayment in the first three years.

How much does John owe after the first three years?

A. \$1800

B. \$12 000

C. \$12 600

D. \$13 800

E. \$18 000

Question 14

Wingyu bought a new printer for $350 and decided to depreciate her printer using the unit cost method. She expects that the value of the printer will go down by 0.002 cents for every page printed and estimates it will have a scrap value of $50.

How many pages will Wingyu be able to print before scrapping the printer?

A.   1500

B.   1750

C.   25 000

D.   150 000

E.   175 000

Question 15

A centimetre to kilometre scale from a map is shown below.

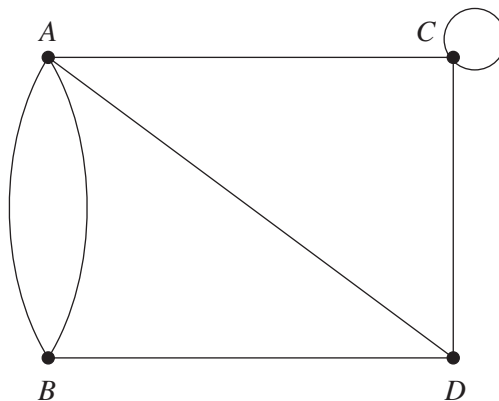| 0 km	50 km	100 km	150 km	200 km	250 km
0 cm	1 cm	2 cm	3 cm	4 cm	5 cm
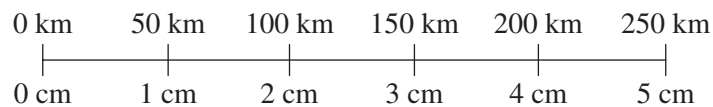
If the distance between town A and town B is 2.5 cm on the map, the actual distance between the towns, in kilometres, is

A.   25

B.   100

C.   125

D.   150

E.   175

Question 16

The graph below has vertices *A*, *B*, *C* and *D*.

The sum of the degrees of all four vertices is

A.   13

B.   14

C.   15

D.   16

E.   17

Question 17

The planar graph below is incomplete. It is known that the graph should have five vertices and five faces.
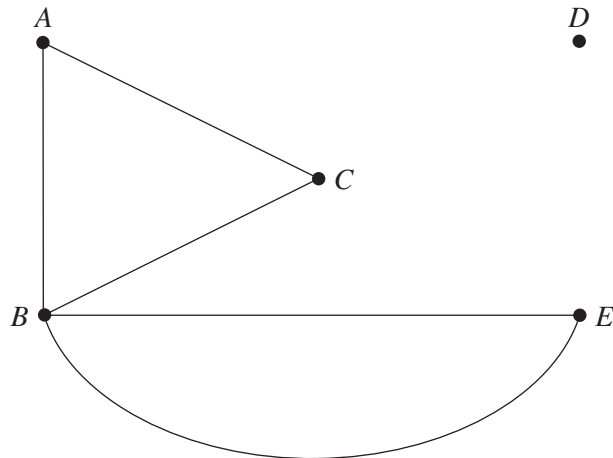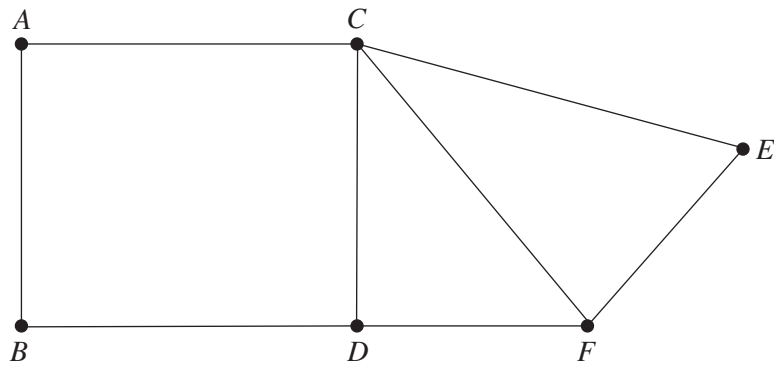

How many edges are missing from the graph?

A. 1

B. 2

C. 3

D. 4

E. 5

Question 18

A postman is responsible for delivering parcels to six towns. A network map of the six towns (*A–F*) is shown below. If a new road is built between two of the towns, the postman will then be able to start and finish his journey at the same town and only travel along each road once.
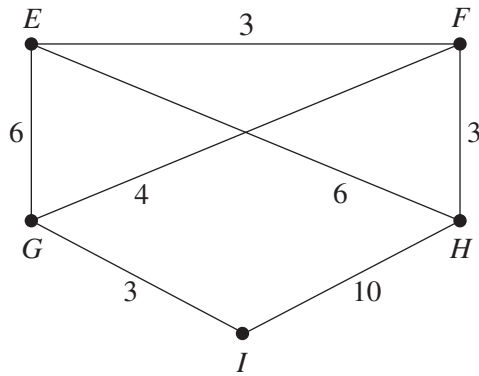

Which two towns should the new road be built between?

A. *A* and *F*

B. *B* and *E*

C. *C* and *E*

D. *B* and *D*

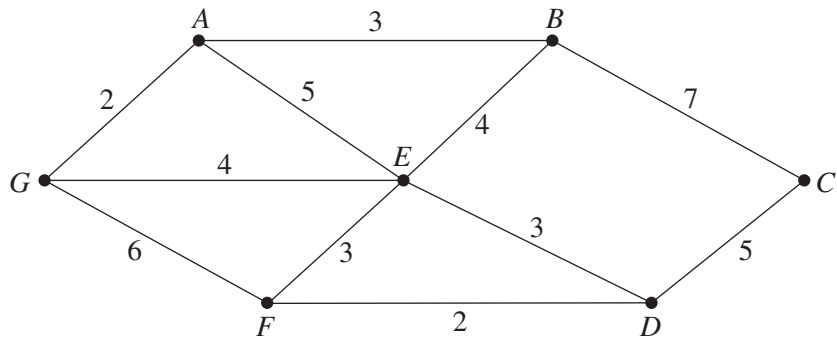**E.** *D* and *F*

Question 19

Consider the graph below.

What is the shortest path that has the same starting and finishing point and passes through each vertex exactly once?

A.   25
B.   26
C.   27
D.   28
E.   29

Question 20

Consider the network graph below.

The length of the minimum spanning tree is

A.   18
B.   19
C.   20
D.   21
E.   22

AREA OF STUDY 3

- Functions, relations and graphs

Question 21

If $x = 1$, $y = 2$ and $z = 3$, the solution of $2x - 2z + 2y$ is

A. -2

B. -1

C. 0

D. 1

E. 2

Question 22

The value of m in the equation $2m + 7 = 5m - 8$ is

A. 1

B. 2

C. 3

D. 4

E. 5

Question 23

It is known that the cost of hiring a vehicle, C, in dollars, has a linear relationship with the distance that the vehicle travels, d, in kilometres. There is a hiring fee of $250 that is charged even if the vehicle is not used.
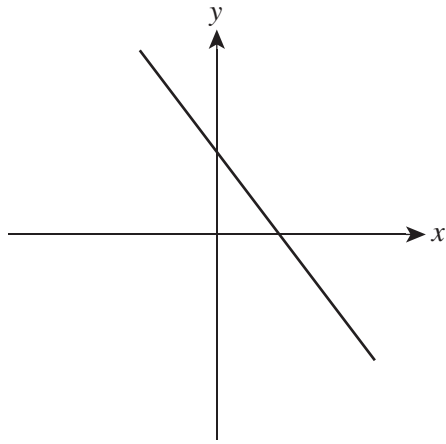
When the vehicle travels 50 km, the cost is $305.

Which one of the following equations models the relationship between C and d?

A. $C = 1.1d$

B. $C = 55d$

C. $C = 1.1 + 250d$

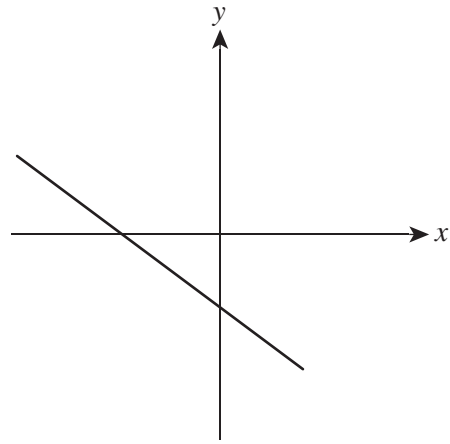D. $C = 250 + 1.1d$

E. $C = 350 + 1.1d$

Question 24

Which one of the following graphs best represents the equation $y = -\dfrac{199}{200}x + \dfrac{199}{201}$?
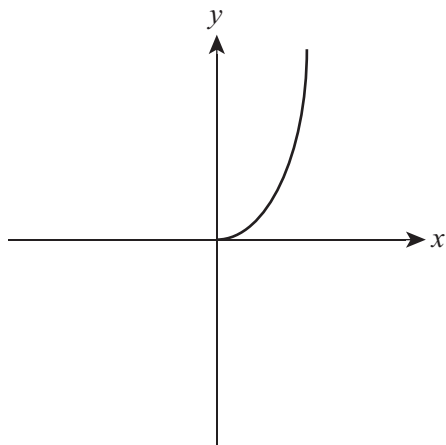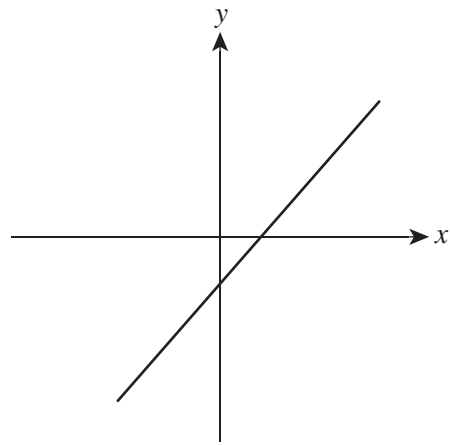
A.

B.

C.

D.

E.
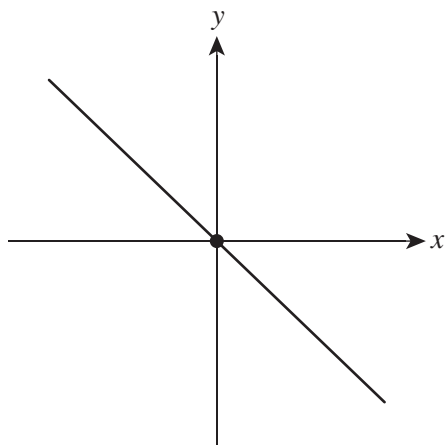
Question 25

A class of Business Management students are hosting a market at their school. Jason decides to host a stall that sells sausages and soft drinks. He spends $200 to stock his stall, and has calculated that he will break even if he sells 60 sausages and 55 soft drinks and lose $42.50 if he sells 45 sausages and 45 soft drinks.

The price of one sausage and one soft drink, respectively, at Jason's stall is

A. $1 and $2

B. $1.50 and $2

C. $8.50 and $6.89

D. $9 and $6

E. $11 and $10

Question 26

For the values shown in the table below, it is known that $y \propto x$.

x	0	0.5	1.5	2.5	3.5
y	0	1.25	3.75	6.25	8.75

The constant of variation is

A.   0.5

B.   1.5

C.   2

D.   2.5

E.   2.75

Question 27

Which one of the following graphs shows the inverse variation of *y* to *x*?

A.
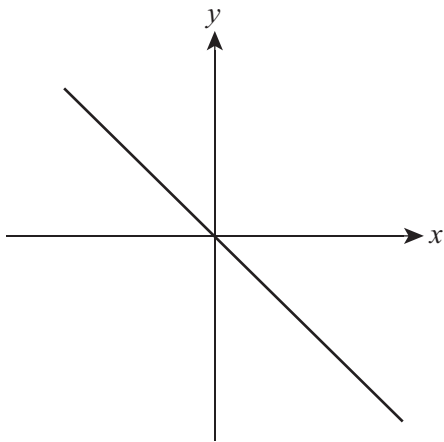
B.
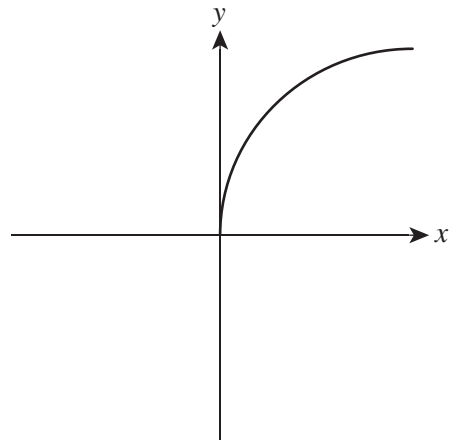
C.
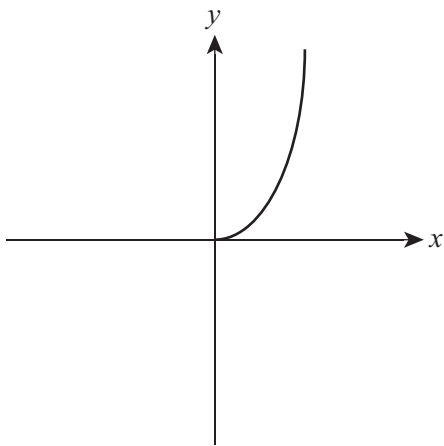
D.
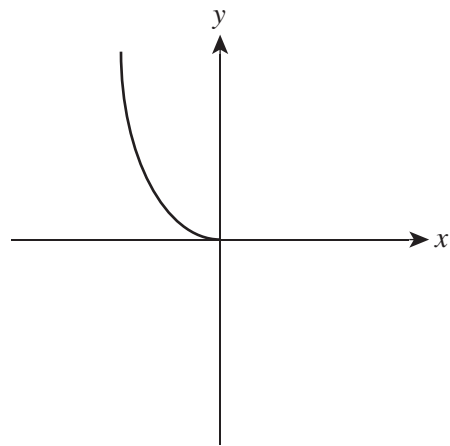
E.
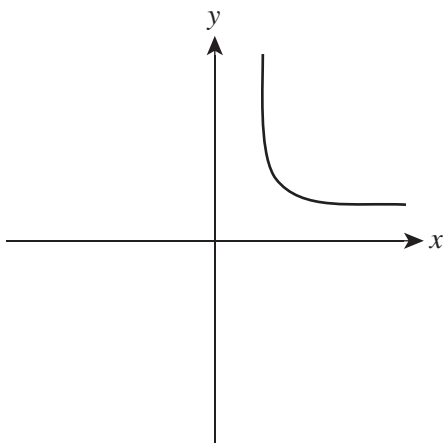
Question 28

It is known that the graph below can be linearised by applying an x^2 transformation.
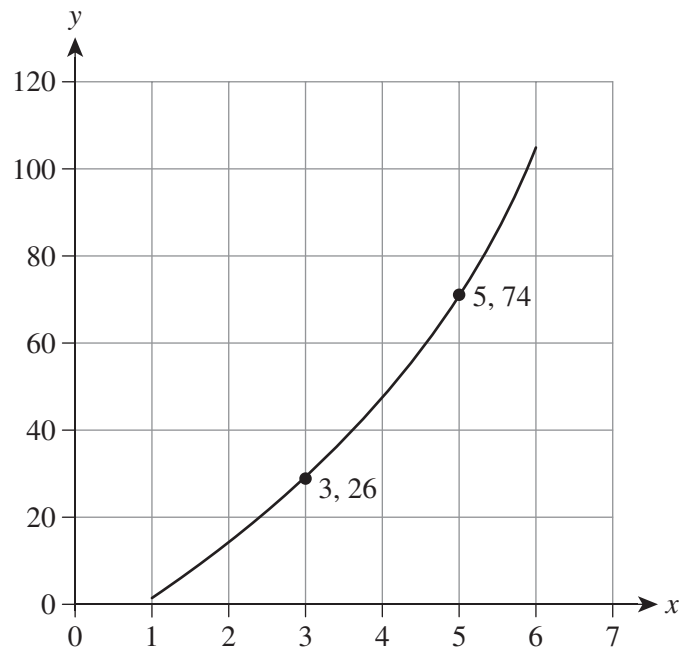
Which one of the following equations models the linearised graph?

A. $y = 0.04x^2 + 73$

B. $y = 3x^2 - 1$

C. $y = 12.5x^2 - 238.5$

D. $y = x^2 + 24$

E. $y = 2x^2 + 48$

Question 29

The magnitude of earthquakes is measured using a logarithmic (base 10) scale. A scientist is comparing an earthquake with a magnitude of 8.2 and an earthquake with a magnitude of 5.9.

How many times stronger is the earthquake with a magnitude of 8.2 than the earthquake with a magnitude of 5.9?

A.   2.3

B.   23

C.   199.53

D.   1185.46

E.   157 694 991

Question 30

Two pipes, *A* and *B*, can be used to fill a 120 L tank with water. The following information is known about the pipes.

- Filling the tank with pipe *A* only is 10 hours faster than filling the tank with pipe *B* only.
- After pipe *A* only is used to fill the tank for 10 hours, adding pipe *B* in addition to pipe *A* will fill the tank in a further six hours.
- The amount of time taken to fill the tank varies inversely to the capacity of the pipe.

How much water, in litres, is poured by pipes *A* and *B*, respectively, each hour?

A. 8 and 2

B. 7 and 3

C. 6 and 4

D. 5 and 4

E. 4 and 3

AREA OF STUDY 4

- Discrete mathematics
- Space and measurement

Question 31

For matrices A, B and C, the operation $C(A + B)$ is defined.

If matrix A is a 2×3 matrix and the number of rows in matrix C is the same as the number of columns in matrix B, then the order of matrix C is

A. 2×2

B. 2×3

C. 3×2

D. 3×3

E. any square matrix.

Question 32

Consider the 3×3 matrix A, where $a_{i,j}$ represents the element that is on row i and column j in matrix A.

If $a_{i,j} = i \times j - 1$, which one of the following is matrix A?

A. $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 3 & 5 \\ 2 & 5 & 8 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{bmatrix}$

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

D. $\begin{bmatrix} 2 & 5 & 8 \\ 1 & 3 & 5 \\ 0 & 1 & 2 \end{bmatrix}$

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

Question 33

The following network diagram illustrates the roads that join five regional towns, A, B, C, D and E.
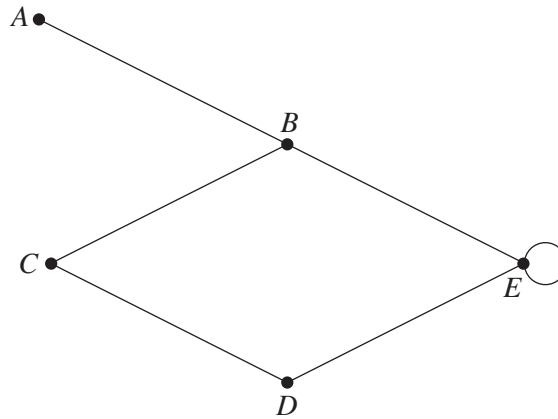
Which one of the following matrices represents the information in the network diagram?

A.

$$M = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \left[\begin{array}{ccccc} 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \end{array}\right]$$

B.

$$M = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \left[\begin{array}{ccccc} 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 2 \end{array}\right]$$

C.

$$M = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \left[\begin{array}{ccccc} 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 1 & 0 & 1 & 1 \end{array}\right]$$

D.

$$M = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \left[\begin{array}{ccccc} 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 1 \end{array}\right]$$

E.

$$M = \begin{array}{c} \\ A \\ B \\ C \\ D \\ E \end{array} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \left[\begin{array}{ccccc} 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 2 \end{array}\right]$$

Question 34

Consider the following communication matrix between five friends.

$$\begin{array}{c} & \text{From} \\ & \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \text{To} \begin{array}{c} A \\ B \\ C \\ D \\ E \end{array} & \begin{bmatrix} 0 & 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 & 0 \end{bmatrix} \end{array}$$

The matrix shows that A does not talk directly to E.

How many ways can A send a message to E via one intermediary?

A. 0

B. 1

C. 2

D. 3

E. 4

Question 35

Which one of the following matrices is a singular matrix?

A. $\begin{bmatrix} 5 & 2 \\ 7 & 3 \end{bmatrix}$

B. $\begin{bmatrix} 2 & -1 & 3 \\ 1 & 0 & 2 \\ -6 & 3 & 1 \end{bmatrix}$

C. $\begin{bmatrix} 2 & 1 \\ 5 & 3 \end{bmatrix}$

D. $\begin{bmatrix} 0 & -1 & 2 \\ 1 & 0 & 1 \\ 4 & 1 & 2 \end{bmatrix}$

E. $\begin{bmatrix} 5 & 3 & 1 \\ 2 & 6 & 8 \\ 1 & 0 & 0 \end{bmatrix}$

Question 36

A right-angled triangle is shown below.
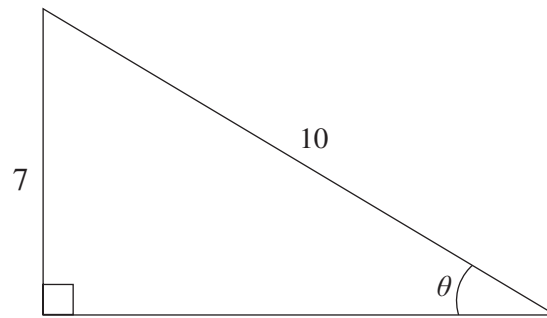
What is the value of $\cos(\theta)$?

A. $\dfrac{3}{5}$

B. $\dfrac{6}{\sqrt{51}}$

C. $\dfrac{\sqrt{51}}{10}$

D. $\dfrac{5}{3}$

E. $\dfrac{10}{\sqrt{51}}$

Question 37

In triangle ABC, it is known that $AB = 46$, $AC = 45$ and $BC = 5$.

Triangle JKL is similar to triangle ABC.

If the length of the shortest side in triangle JKL is 15, then the length of the longest side is

A.   9

B. $\dfrac{46}{3}$

C.   135

D.   138

E.   230

Question 38

The perimeter of a rectangular prism is 72 cm.

If the rectangular prism is 9 cm long and 6 cm wide, what is its height, in centimetres?

A.   3
B.   4
C.   12
D.   18
E.   21

Question 39

If all sides in a cube are halved, what percentage of the original volume is the new volume?

A.   6.25%
B.   12.5%
C.   25%
D.   50%
E.   75%

Question 40

A cone and a cylinder have the same volume. The ratio of the cone's base to the cylinder's base is 5 : 3.

If the cylinder has a height of 8 cm, the height of the cone, in centimetres, is

A.   4.8
B.   13.33
C.   14.4
D.   24
E.   40

END OF MULTIPLE-CHOICE QUESTION BOOKLET

VCE General Mathematics Units 1&2

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

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
25	A	B	C	D	E
26	A	B	C	D	E
27	A	B	C	D	E
28	A	B	C	D	E

29	A	B	C	D	E
30	A	B	C	D	E
31	A	B	C	D	E
32	A	B	C	D	E
33	A	B	C	D	E
34	A	B	C	D	E
35	A	B	C	D	E
36	A	B	C	D	E
37	A	B	C	D	E
38	A	B	C	D	E
39	A	B	C	D	E
40	A	B	C	D	E

Neap

Trial Examination 2023

VCE General Mathematics Units 1&2

Written Examinations 1 & 2

Formula Sheet

Instructions

This formula sheet is provided for your reference.

A question and answer booklet is provided with this formula sheet.

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

GENERAL MATHEMATICS FORMULAS

Data analysis

lower and upper fence in a boxplot	lower $\quad Q_1 - 1.5 \times IQR \qquad$ upper $\quad Q_3 + 1.5 \times IQR$
line of good fit	$y = a + bx$, where $b = r\dfrac{s_y}{s_x}$ and $a = \bar{y} - b\bar{x}$

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	$r_{\text{effective}} = \left[\left(1 + \dfrac{r}{100n} \right)^n - 1 \right] \times 100\%$

Matrices

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 $\det A \neq 0$

Networks and decision mathematics

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

Geometry and measurement

area of a triangle	$A = \dfrac{1}{2}bc\sin(\theta°)$
Heron's formula	$A = \sqrt{s(s-a)(s-b)(s-c)}, \qquad \text{where } s = \dfrac{1}{2}(a+b+c)$
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

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