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Year 12 *Trial Exam Paper*

2017

FURTHER MATHEMATICS

Written examination 1

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

STUDENT NAME:

MULTIPLE-CHOICE QUESTION BOOK

Structure of book

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 book of 43 pages.
- Formula sheet.
- Answer sheet for multiple-choice questions.
- Working space is provided throughout the book.

Instructions

- Write your **name** in the space provided above and on the multiple-choice answer sheet.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

At the end of the examination

- You may keep this question book.

Students are NOT permitted to bring mobile phones or any other unauthorised electronic devices into the 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 book are **not** drawn to scale.

Data analysis

Use the following information to answer Questions 1–3.

The canteen manager at a secondary school collected students' preferred lunch choices prior to the school Athletics carnival.

The number of students from each sporting house (yellow, green, blue and purple) who selected each lunch option is shown in the two-way table below.

Lunch choice	**Sporting house**			
	Yellow	**Green**	**Blue**	**Purple**
pizza	82	76	52	51
pie	76	64	47	49
salad roll	63	58	54	43
sushi	71	63	61	48
Total	292	261	214	191

Question 1

The **percentage** of students in Green house who selected a salad roll for their lunch is closest to

A. 5%

B. 20%

C. 21%

D. 22%

E. 25%

Question 2

The variables *Sporting house* (Yellow, Green, Blue, Purple) and *Lunch choice* (pizza, pie, salad roll, sushi) are

A. both nominal variables.

B. both ordinal variables.

C. a nominal variable and an ordinal variable respectively.

D. an ordinal variable and a nominal variable respectively.

E. an ordinal variable and a discrete variable respectively.

Question 3

The most suitable graphical tool to display the data shown in the two-way table would be a

A. back-to-back stem plot.

B. histogram.

C. dot plot.

D. scatterplot.

E. segmented bar chart.

Question 4

The stem plot below displays the amount of money spent at the school canteen, per week, by a sample of 34 students.

money spent **key: 3|5 = $3.50**

3	2 3 3 4 4 4
3	5 5 6 7
4	
4	6 6 6 7 9
5	1 2 2 3 4
5	5 5 7 9 9
6	0 1 1 2 4
6	7 7 9
7	2

The median amount of money spent at the canteen per week is

A. $2.00

B. $2.20

C. $4.60

D. $5.20

E. $5.25

Use the following information to answer Questions 5 and 6.

The weights of female students in Year 9 at a particular secondary school are approximately normally distributed with a mean of 54.6 kg and a standard deviation of 6.2 kg.

Question 5

There are 186 Year 9 females at the secondary school.

The expected number of Year 9 females with weights between 42.2 kg and 73.2 kg is closest to

A. 97

B. 126

C. 177

D. 181

E. 185

Question 6

A particular Year 9 student, Caterina, has a standardised weight of $z = -1.24$. Her actual weight, rounded to the nearest kg, is

A. 46 kg

B. 47 kg

C. 50 kg

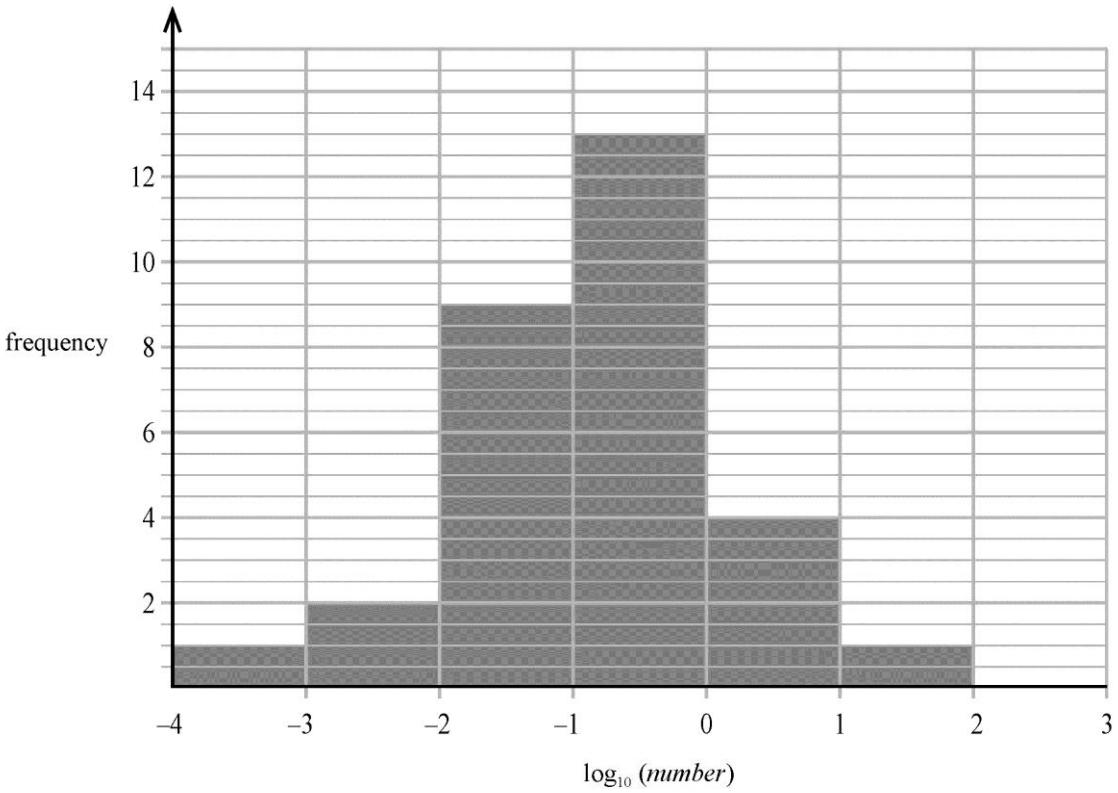
D. 53 kg

E. 56 kg

Question 7

The histogram below shows the distribution of a data set that has been plotted on a **$\log_{10}$** scale.

Based on the histogram, the percentage of data values less than 0.01 is closest to



A. 3%

B. 10%

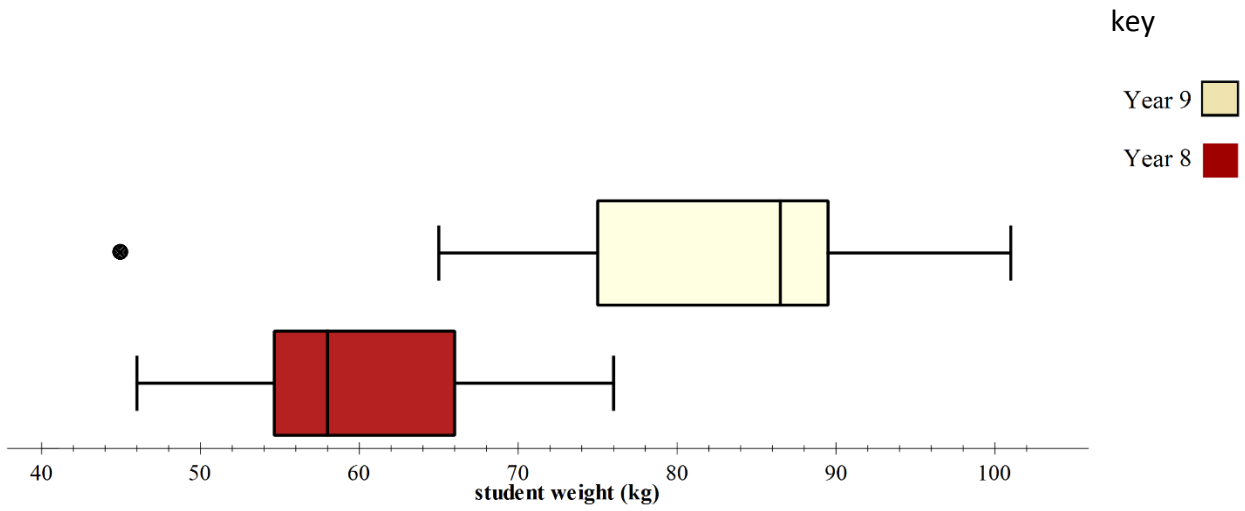
C. 43%

D. 86%

E. 96%

Question 8

The following boxplots show the weights of male students in both Year 8 and 9.



Which of the following statements is **not** true with regard to the weights of Year 8 and 9 male students?

A. Less than 75% of male Year 9 students weigh more than the heaviest male student in Year 8.

B. The distribution of Year 9 male students is negatively skewed with an outlier.

C. The variation in weights for Year 8 male students has a similar variance to the distribution of Year 9 male students.

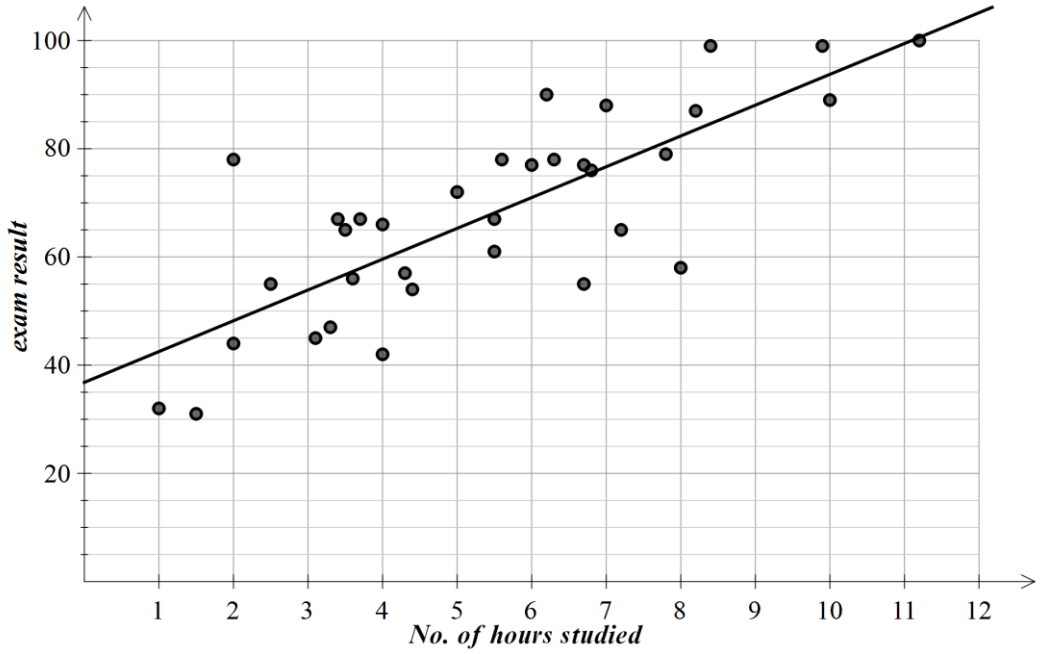
D. The mean would be an appropriate measure of centre for the distribution of Year 8 students due to the fact that the distribution does not contain an outlier.

E. The distribution for Year 8 male students is positively skewed, with a median at 58 kg.

Use the following information to answer Questions 9–11.

The scatterplot below shows the exam results as a percentage (*exam result*) plotted against the number of hours spent studying in the week immediately preceding the exam (*No. of hours studied*).

A least squares regression line has been fitted to the data.



The equation for this least squares regression line is

$$\textit{exam result} = 36.8 + 5.7 \times \textit{No. of hours studied}$$

Pearson's correlation coefficient is $r = 0.7883$.

Question 9

Given the information above, which of the following statements is **not** true?

A. The value of the coefficient of determination is close to 0.62

B. On average, as the number of hours studied increases by 1, the exam result increases by 5.7%.

C. 78.8% of the variation in exam result can be explained by the variation in number of hours studied.

D. Ignoring any outliers, the association between number of hours studied and exam result can be described as strong, positive and linear.

E. On average, when a student has studied for 0 hours in the week preceding their exam, they will receive an exam result of 36.8%.

Question 10

Belinda studied for a total of 7.6 hours in the week preceding her exam and achieved an exam result of 75%. Using the least squares line, the residual value for Belinda's exam result is closest to

A. –389

B. –5

C. 5

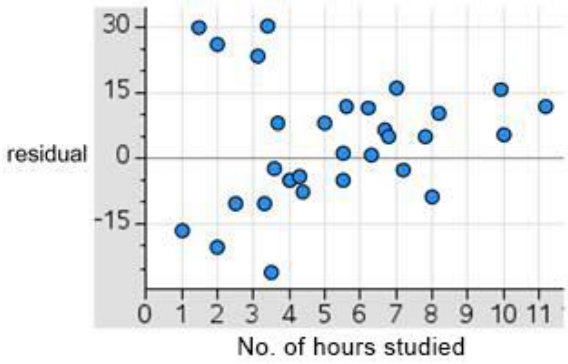
D. 80

E. 389

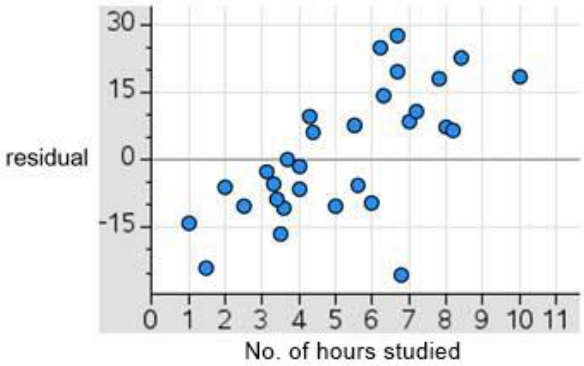
Question 11

Which of the following could be the residual plot for the relationship between number of hours studied and exam result scores?

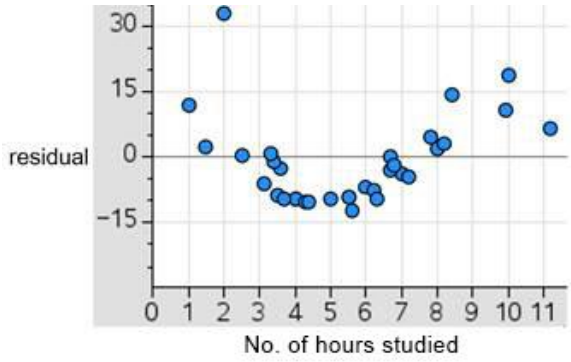
A.



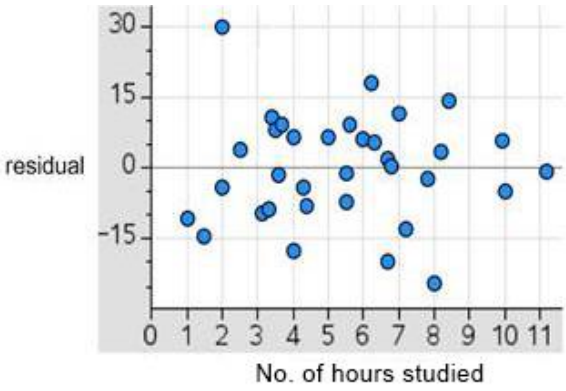
B.



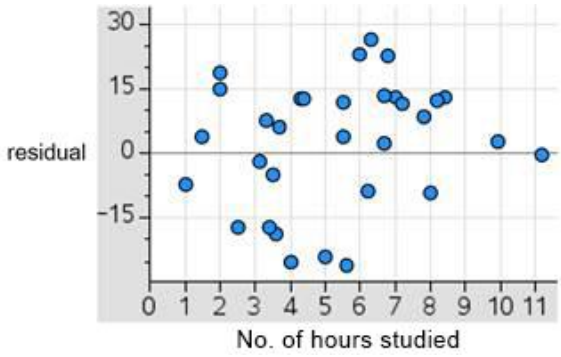
C.



D.

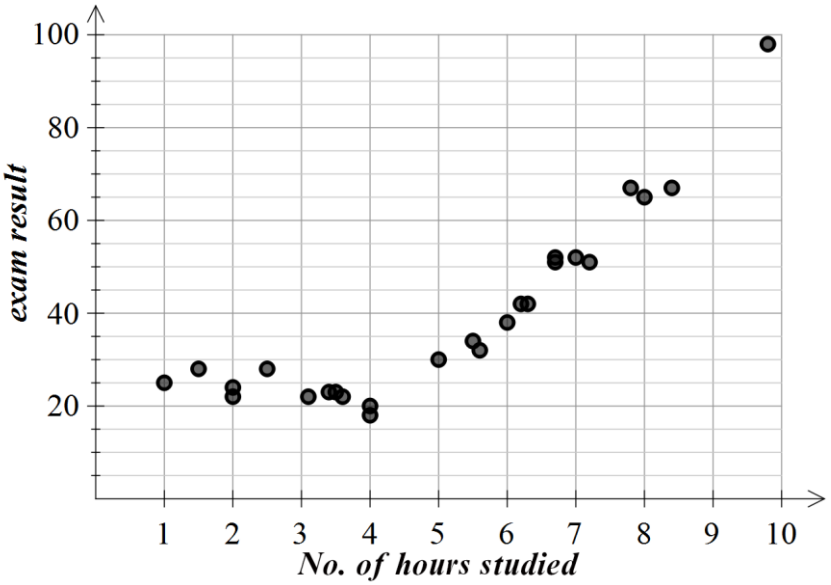


E.



Question 12

The table below gives the exam results and number of hours spent studying for a different group of students.
A non-linear scatterplot for this data is also shown.



No. of hours studied	Exam result
4	18
5	30
6	38
1	25
2	22
2	24
2.5	28
3.6	22
4	20
7	52
8	65
9.8	98
3.4	23
5.6	32
7.8	67
6.2	42
3.1	22
1.5	28
6.3	42
7.2	51
3.5	23
6.7	52
8.4	67
6.7	52
8.4	67
6.7	51
5.5	34

A **squared transformation** will be applied to the variable *No. of hours studied* and can be used to linearise the scatterplot.

The equation of the least squares regression line for this squared transformation is closest to

A. $(\textit{exam result})^2 = 15.4 + 0.76 \times \textit{no. hours studied}$

B. $\textit{exam result} = 0.76 + 15.4 \times (\textit{no. of hours studied})^2$

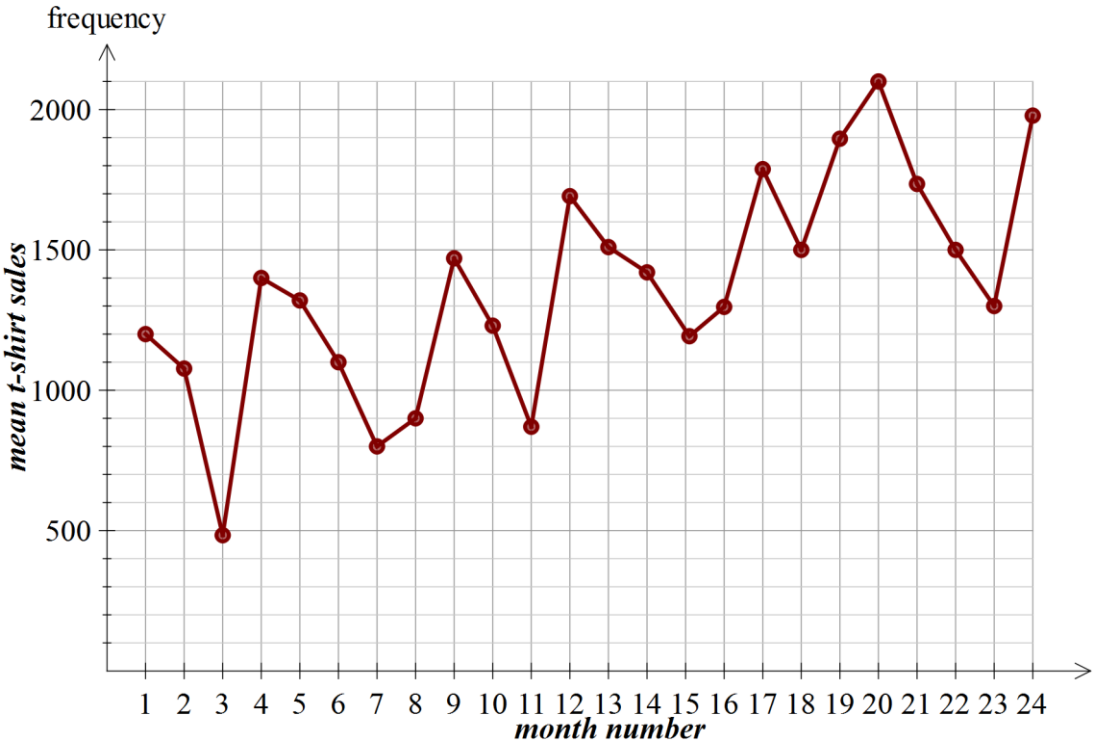
C. $\textit{exam result} = 15.4 + 0.76 \times \textit{no. of hours studied}$

D. $(\textit{No. of hours studied})^2 = 15.4 + 0.76 \times \textit{exam result}$

E. $\textit{exam result} = 15.4 + 0.76 \times (\textit{no. hours studied})^2$

Question 13

Consider the time series plot below.



The pattern in the time series plot shown above can be best described as having

A. irregular fluctuations only.

B. an increasing trend with seasonality.

C. an increasing trend with irregular fluctuations.

D. an increasing trend with cycles evident.

E. structural change.

Use the following information to answer Questions 14–16.

The table below shows the long-term average number of customers utilising a drive-through coffee booth for each day of the week.

Also shown are the seasonal indices for Monday, Wednesday, Friday, Saturday and Sunday.

	Day of the week						
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
Long-term average	1820	1700	1467	1476	1765	1239	1348
Seasonal index	1.18		0.95		1.14	0.80	0.87

Question 14

The seasonal index for Sunday is 0.87

This tells us that, on average, the number of coffees sold on a Sunday is

A. 87% of the coffee sales for the week.

B. 87% less than the daily average for coffee sales.

C. 87% more than the daily average for coffee sales.

D. 13% more than the daily average for coffee sales.

E. 13% less than the daily average for coffee sales.

Question 15

The seasonal index for Tuesday is missing.

The correct calculation to find the seasonal index for Tuesday is

A. $1\,545 \div 1\,700$

B. $1\,700 \div 1\,545$

C. $(7 - (1.18 - 0.95 - 1.14 - 0.80 - 0.87)) \div 2$

D. $1\,700 \div 10\,815$

E. $1\,700 \div 7$

Question 16

In the final week of the school term the actual sales for coffee on a Friday were 1825.

The deseasonalised number of coffee sales for the last Friday of the term was closest to

A. 247

B. 1600

C. 1765

D. 2011

E. 12 600

Recursion and financial modelling

Question 17

Consider the following recurrence relation.

$$A_0 = 3, \qquad A_{n+1} = -2A_n + 3$$

The first four terms of this recurrence relation are

A. –3, 9, –15, 33, …

B. 3, –3, 9, –15, …

C. 3, –12, 18, –42, …

D. –12, 18, –42, 78, …

E. 3, –3, 21, 45, …

Question 18

Which of the following recurrence relations represents geometric decay?

A. $C_0 = 100, \qquad C_{n+1} = 0.84 \times C_n + 100$

B. $C_0 = 100, \qquad C_{n+1} = 1.684 \times C_n$

C. $C_0 = 100, \qquad C_{n+1} = 0.684 \times C_n$

D. $C_0 = 100, \qquad C_{n+1} = 1.684 \times C_n + 25$

E. $C_0 = 100, \qquad C_{n+1} = C_n + 345$

Question 19

Jessica invests $10 000 in a savings account earning a rate of 3.8% per annum, compounded monthly. At the end of each month, Jessica adds an additional $250.

A recurrence relation that can be used to model Jessica's investment could be

A. $V_0 = 10\ 000, \qquad V_{n+1} = 0.962 \times V_n + 250$

B. $V_0 = 10\ 000, \qquad V_{n+1} = 1.038 \times V_n + 250$

C. $V_0 = 10\ 000, \qquad V_{n+1} = 0.962 \times V_n - 250$

D. $V_0 = 10\ 000, \qquad V_{n+1} = 1.00317 \times V_n + 250$

E. $V_0 = 10\ 000, \qquad V_{n+1} = 1.317 \times V_n - 250$

Question 20

The value of a reducing balance loan, V_n, after n monthly payments of \$785 have been made, can be determined using the recurrence relation

$V_0 = 32\,000, \qquad V_{n+1} = 1.018 \times V_n - 785$

The value of the loan after four payments have been made is closest to

A. \$32 000

B. \$31 791

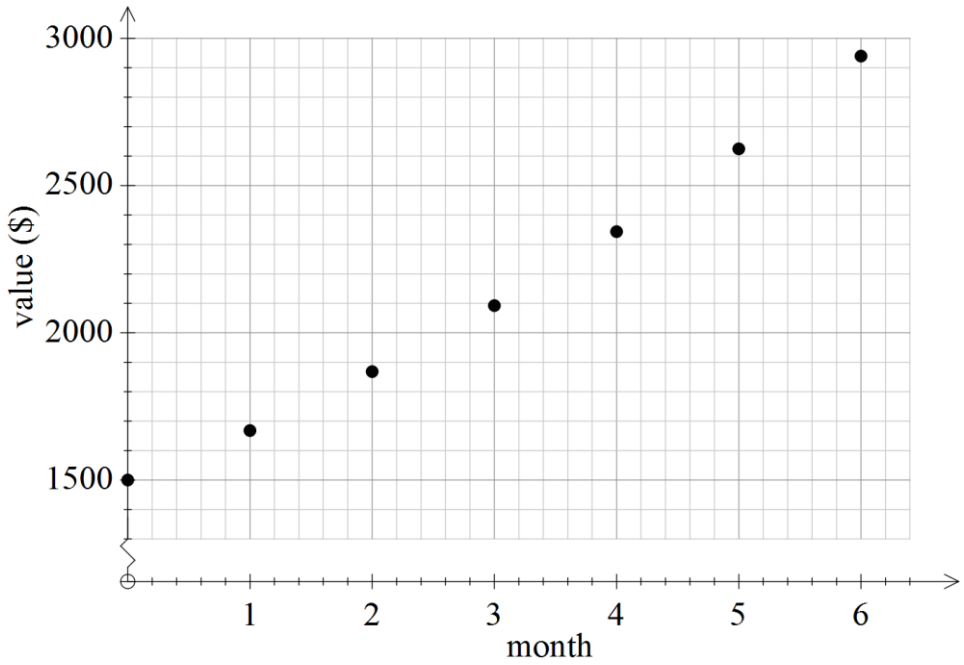
C. \$31 578

D. \$31 361

E. \$31 141

Question 21

Consider the following graph.



Which of the following could be modelled by the graph?

A. a reducing balance loan with regular payments

B. a flat rate loan with regular payments

C. a compound interest account

D. an interest only loan

E. a simple interest investment with regular payments

Question 22

The amortisation table for a reducing balance loan is shown below.

The interest rate for this loan is 5.4% per annum compounding monthly.

The loan is to be repaid with monthly payments of $1375.

Payment number	Payment	Interest	Principal reduction	Balance of loan
0	0.00	0.00	0.00	275 000.00
1	1375.00	1237.50	137.50	274 862.50
2	1375.00	1236.88	138.12	274 724.38

The value of the principal reduction after the third payment is closest to

A. $1235.63

B. $1375.00

C. $138.74

D. $139.37

E. $13 452.59

Question 23

Christine invests $4500 in a savings account that pays interest at the rate of 3.25% per annum compounding quarterly. At the end of each quarter, immediately after the interest has been paid, she adds an additional $500 to her investment.

After 2 years, the amount of interest that Christine's investment has earned is closest to

A. $136.55

B. $300.95

C. $416.57

D. $685.34

E. $4416.57

Question 24

Peter borrows $35 000 to buy a motorbike. He takes out a loan for 5 years at an interest rate of 4.25% compounding monthly. He makes monthly payments of $648.53.

After 2 years Peter receives a pay increase and is able to increase his payments to $750 per month.

Peter can now repay his loan in a shorter time. The amount of time, to the nearest month, he will save is

A. 0 months.

B. 4 months.

C. 5 months.

D. 6 months.

E. 9 months.

END OF SECTION A
TURN OVER

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

The transpose of $\begin{bmatrix} 2 & 5 & 9 & 11 \\ 3 & 8 & 12 & 15 \end{bmatrix}$ is

A. $\begin{bmatrix} 3 & 2 \\ 8 & 5 \\ 12 & 9 \\ 15 & 11 \end{bmatrix}$

B. $\begin{bmatrix} 3 & 8 & 12 & 15 \\ 2 & 5 & 9 & 11 \end{bmatrix}$

C. $\begin{bmatrix} 2 & 3 \\ 5 & 8 \\ 9 & 12 \\ 11 & 15 \end{bmatrix}$

D. $\begin{bmatrix} 2 & 5 & 9 & 11 \\ 3 & 8 & 12 & 15 \end{bmatrix}$

E. $\begin{bmatrix} 11 & 15 \\ 9 & 12 \\ 5 & 8 \\ 2 & 3 \end{bmatrix}$

Question 2

The matrix equation below represents a pair of simultaneous linear equations.

$$\begin{bmatrix} 8 & 4 \\ s & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 6 \end{bmatrix}$$

Which of the following statements is correct?

A. These simultaneous linear equations have a unique solution only when $s = 4$

B. These simultaneous equations have a unique solution only when $s \neq 4$

C. The solution to these simultaneous equations when $s = 2$ is $x = 2$ and $y = 5$

D. These simultaneous linear equations do not have a unique solution when $s = 3$

E. These simultaneous linear equations cannot be solved.

Question 3

The table below shows the cost of different drink options sold at the school canteen.

Drink choice	iced tea	flavoured milk (small)	flavoured milk (large)	bottled water
Cost ($)	$3.50	$2.50	$4.00	$1.75

The canteen manager recorded the number of each drink choice sold on a particular day.

These are shown in the table below.

Drink choice	iced tea	flavoured milk (small)	flavoured milk (large)	bottled water
Number sold	65	156	105	256

The matrix calculation that will find the total amount of money spent on drinks for this particular day is

A. $\begin{bmatrix}3.50 & 2.50 & 4.00 & 1.75\end{bmatrix}\begin{bmatrix}65 & 156 & 105 & 256\end{bmatrix}$

B. $\begin{bmatrix}3.50 & 2.50 & 4.00 & 1.75\end{bmatrix}\begin{bmatrix}1\\1\\1\\1\end{bmatrix}$

C. $\begin{bmatrix}65 & 156 & 105 & 256\end{bmatrix}\begin{bmatrix}1\\1\\1\\1\end{bmatrix}$

D. $\begin{bmatrix}65\\156\\105\\256\end{bmatrix}\begin{bmatrix}3.50 & 2.50 & 4.00 & 1.75\end{bmatrix}$

E. $\begin{bmatrix}3.50 & 2.50 & 4.00 & 1.75\end{bmatrix}\begin{bmatrix}65\\156\\105\\256\end{bmatrix}$

Question 4

Let $N = \begin{bmatrix} a & d \\ b & e \\ c & f \end{bmatrix}$

The element in row i and column j of N is $n_{i,j}$

The elements in matrix N are determined by the rule $n_{i,j} = 2j + i$

Matrix N is

A.

$$\begin{bmatrix} 3 & 4 & 5 \\ 5 & 6 & 7 \end{bmatrix}$$

B.

$$\begin{bmatrix} 3 & 4 \\ 5 & 6 \\ 7 & 8 \end{bmatrix}$$

C.

$$\begin{bmatrix} 3 & 5 \\ 6 & 4 \\ 8 & 7 \end{bmatrix}$$

D.

$$\begin{bmatrix} 3 & 5 \\ 4 & 6 \\ 5 & 7 \end{bmatrix}$$

E.

$$\begin{bmatrix} 11 & 12 \\ 21 & 22 \\ 31 & 32 \end{bmatrix}$$

Question 5

Families in a small town were asked about their weekly supermarket choices.

Every week, these families choose between The General Store *(G)*, Ultramarket *(U)* or Tradingzone *(T)*.

No families will miss a weekly shop, and none expressed an interest in leaving the small town.

Which of the following matrices could represent the transition matrix for this information?

A.

$$\begin{array}{c} \\ G \\ T \\ U \end{array} \begin{array}{c} \begin{array}{ccc} G & T & U \end{array} \\ \begin{bmatrix} 0.65 & 0.15 & 0.20 \\ 0.40 & 0.30 & 0.30 \\ 0.22 & 0.64 & 0.10 \end{bmatrix} \end{array} \begin{array}{l} \text{this week} \\ \\ \text{next week} \\ \\ \end{array}$$

B.

$$\begin{array}{c} \\ G \\ T \\ U \end{array} \begin{array}{c} \begin{array}{ccc} G & T & U \end{array} \\ \begin{bmatrix} 0.65 & 0.15 & 0.20 \\ 0.40 & 0.30 & 0.30 \\ 0.22 & 0.64 & 0.10 \end{bmatrix} \end{array} \begin{array}{l} \text{this week} \\ \\ \text{next week} \\ \\ \end{array}$$

C.

$$\begin{array}{c} \\ G \\ T \\ U \end{array} \begin{array}{c} \begin{array}{ccc} G & T & U \end{array} \\ \begin{bmatrix} 0.45 & 0.15 & 0.40 \\ 0.40 & 0.20 & 0.20 \\ 0.15 & 0.65 & 0.25 \end{bmatrix} \end{array} \begin{array}{l} \text{this week} \\ \\ \text{next week} \\ \\ \end{array}$$

D.

$$\begin{array}{c} \\ G \\ T \\ U \end{array} \begin{array}{c} \begin{array}{ccc} G & T & U \end{array} \\ \begin{bmatrix} 0.65 & 0.13 & 0 \\ 0.10 & 0.23 & 0 \\ 0.25 & 0.64 & 1 \end{bmatrix} \end{array} \begin{array}{l} \text{this week} \\ \\ \text{next week} \\ \\ \end{array}$$

E.

$$\begin{array}{c} \\ G \\ T \\ U \end{array} \begin{array}{c} \begin{array}{ccc} G & T & U \end{array} \\ \begin{bmatrix} 0.65 & 0.15 & 0.20 \\ 0.20 & 0.30 & 0.30 \\ 0.25 & 0.65 & 0.50 \end{bmatrix} \end{array} \begin{array}{l} \text{this week} \\ \\ \text{next week} \\ \\ \end{array}$$

Use the following information to answer Questions 6 and 7.

In Term 1, 2016, on Friday of the first week, 450 students were asked which drink choice, from iced tea *(I)*, juice *(J)* or flavoured milk *(M)*, they would order to accompany their lunch. The school only serves these choices on a Friday, with students allowed only water for the remaining days of the week.

175 students said that they would choose juice, 215 would choose iced tea and the remaining students selected flavoured milk.

This information is represented in the state matrix, S_1, below.

$$S_1 = \begin{bmatrix} 215 \\ 175 \\ 60 \end{bmatrix} \begin{matrix} I \\ J \\ M \end{matrix}$$

Assuming the same number of students order a drink from the canteen the following week, the transition matrix for students' drink choice each week is represented by the transition matrix, *T*, below.

$$T = \begin{array}{c} \textit{this week} \\ \begin{matrix} I & J & M \end{matrix} \\ \begin{bmatrix} 0.65 & 0.24 & 0.39 \\ 0.15 & 0.54 & 0.33 \\ 0.20 & 0.22 & 0.28 \end{bmatrix} \begin{matrix} I \\ J \\ M \end{matrix} \end{array} \quad \textit{next week}$$

Question 6

The number of students who will select juice in the third week is closest to

A. 140

B. 141

C. 142

D. 146

E. 147

Question 7

In the long term, the number of students who will select iced tea as their drink choice is closest to

A. 209

B. 208

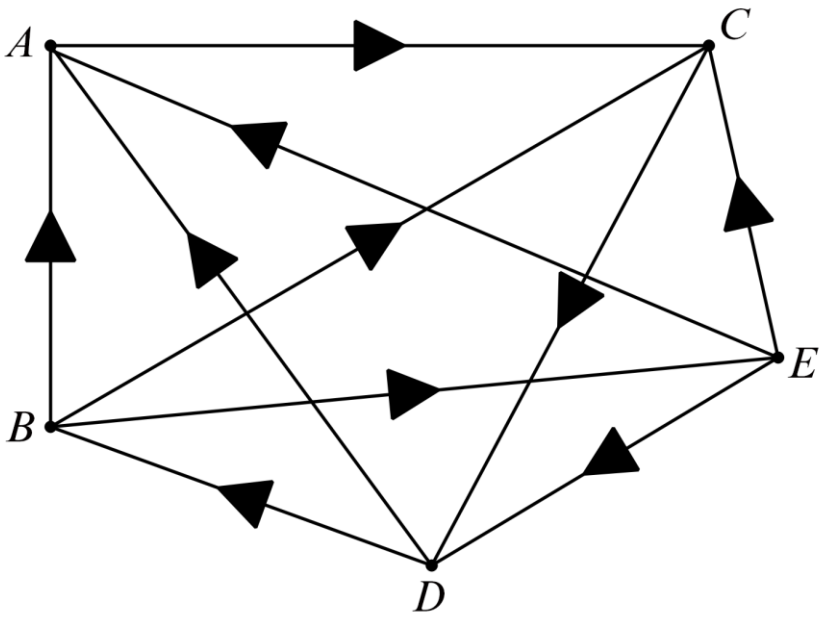
C. 141

D. 140

E. 101

Question 8

The graph below represents the results of a round-robin sporting contest, between Adam (A), Benjamin (B), Cameron (C), Dave (D) and Ethan (E).



The winner of this round-robin competition, based on one- and two-step dominance is

A. Adam.

B. Benjamin.

C. Cameron.

D. Dave.

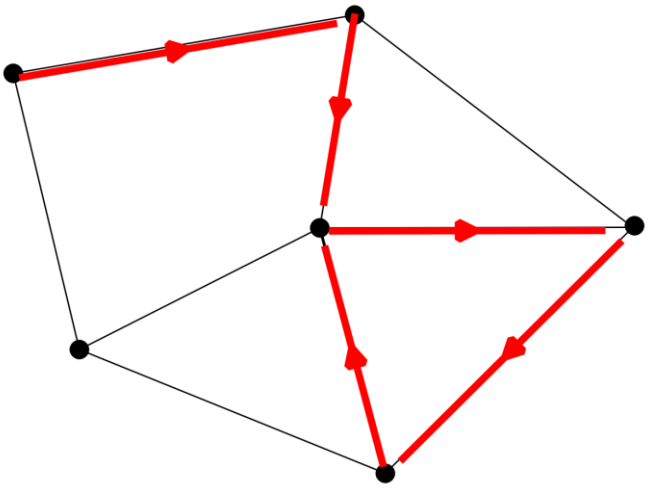
E. Ethan.

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

Consider the following network.



The navigation through this network is best described as

A. a trail.

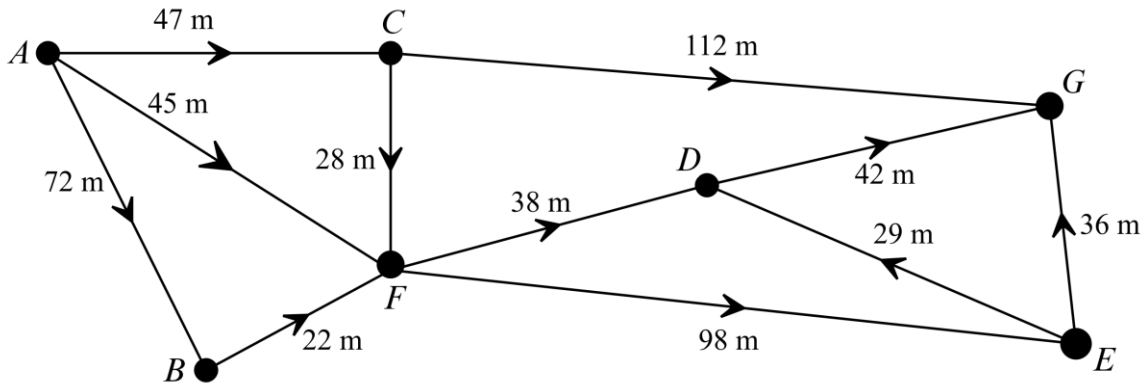
B. a path.

C. a cycle.

D. a circuit.

E. none of the above.

Question 2



Using the graph above, the length of the shortest path from vertex *A* to vertex *D* is

A. 113

B. 94

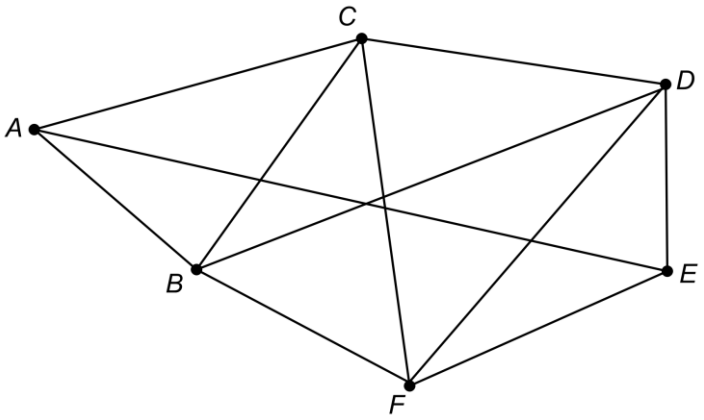
C. 83

D. 66

E. 45

Question 3

The following graph does not contain a Eulerian circuit.



An edge can be added in order to allow a Eulerian circuit to exist.

This edge should be added between which two vertices?

A. *A* and *C*

B. *A* and *B*

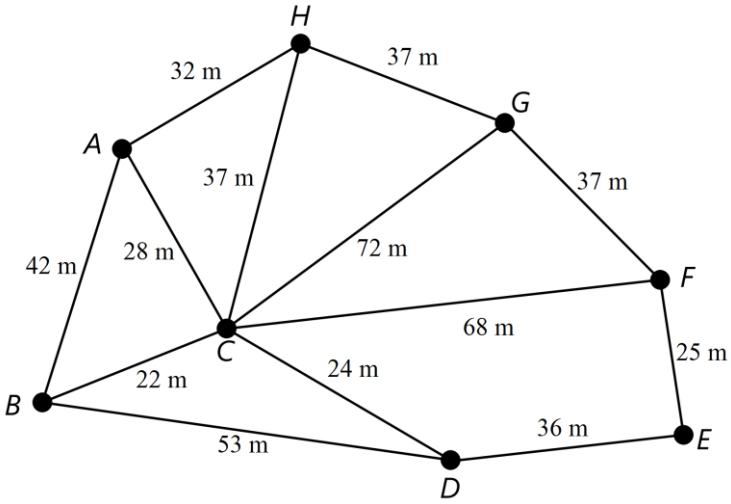
C. *C* and *E*

D. *C* and *E*

E. *E* and *A*

Question 4

Consider the network below.



When using Prim's algorithm to find the minimum spanning tree, which of the following edges is **not** included in the minimum spanning tree?

A. *E–F*

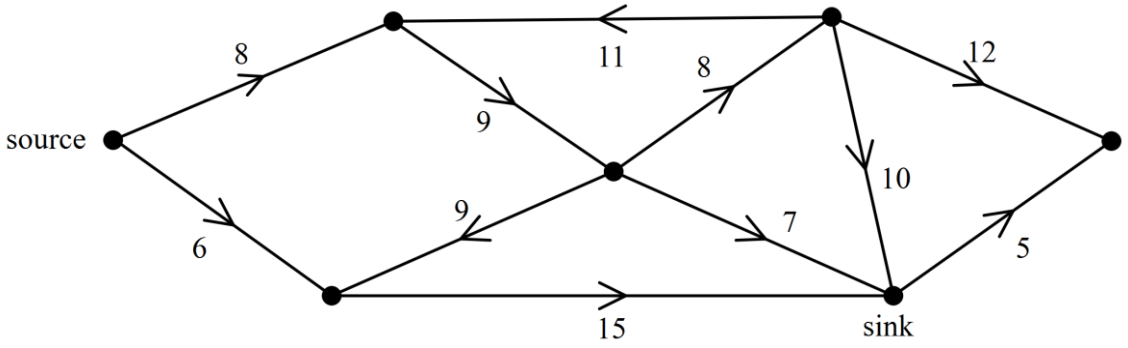
B. *A–H*

C. *A–C*

D. *C–G*

E. *B–C*

Question 5



The maximum flow for the network above is

A. 13

B. 14

C. 15

D. 16

E. 17

Question 6

Four students, Adam, Bryce, Carey and Donald, are each to be assigned a different job by their teacher in order to complete a project in the minimum time possible.

The table below shows the time, in minutes, that each student would take to complete each of the jobs.

	Adam	**Bryce**	**Carey**	**Donald**
Job 1	38	45	41	42
Job 2	26	22	28	25
Job 3	42	43	38	40
Job 4	31	29	30	32

The minimum time allocation can be achieved only when

A. Adam does Job 1.

B. Bryce does Job 2.

C. Carey does Job 3.

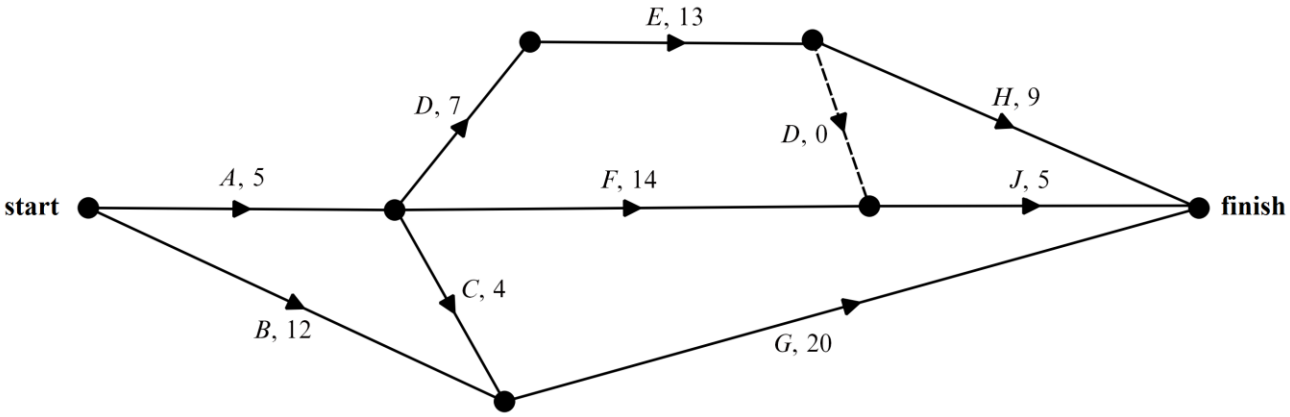
D. Donald does Job 1.

E. Bryce does Job 3.

Use the following information to answer Questions 7 and 8.

The directed graph below shows the sequence of activities to complete a project.

All times are in days.



Question 7

Which of the following statements correctly explains the purpose of the dummy activity in the context of this project?

A. Activity *J* cannot start until activity *H* is completed.

B. Activity *J* cannot start until both activities *F* and *E* have been completed; however, only activity *E* is required for activity *H*.

C. Activity *E* is a predecessor for both activities *F* and *J*.

D. Activity *H* cannot start until both activities *F* and *E* are completed; however, only activity *E* is required for activity *H*.

E. Activity *F* is the only predecessor for activity *J*.

Question 8

The completion time for activity *F* is reduced to 12 days.

The length of the critical path for this project, in days, is now

A. 24

B. 30

C. 32

D. 34

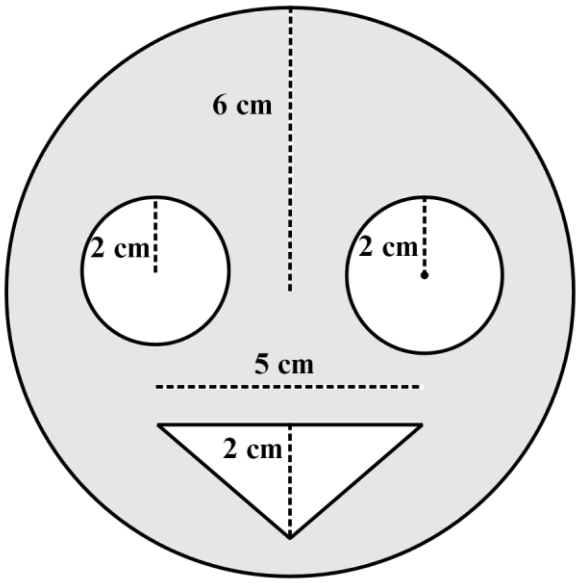
E. 38

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 diagram below.



The shaded area, rounded to the nearest square centimetre, is

A. 82

B. 83

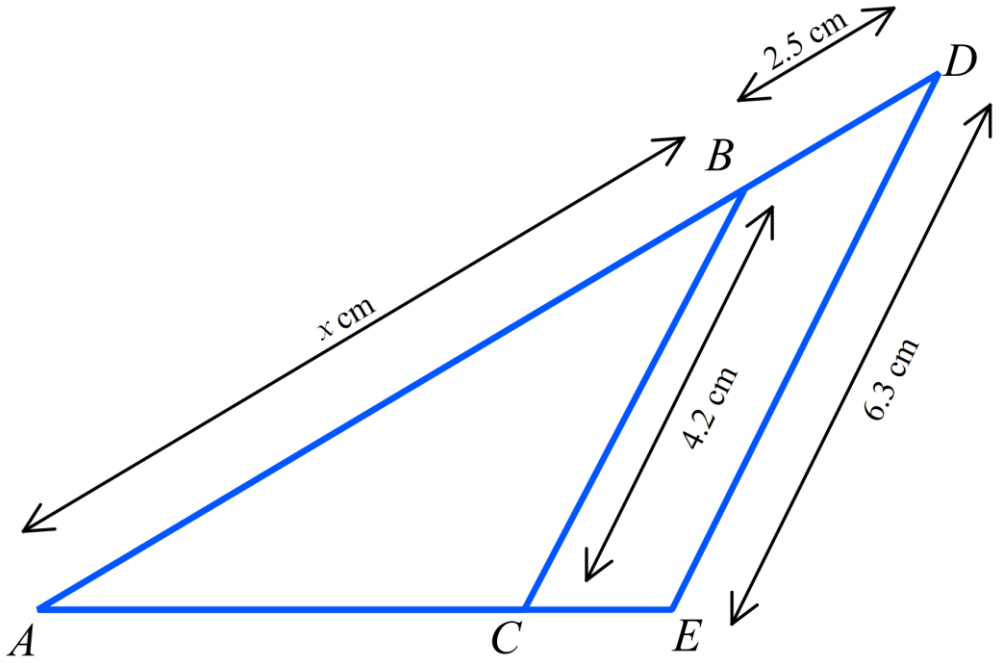
C. 87

D. 88

E. 113

Question 2

Triangle *ABC* is similar to triangle *ADE*.



The length of *x*, in centimetres, is closest to

A. 2

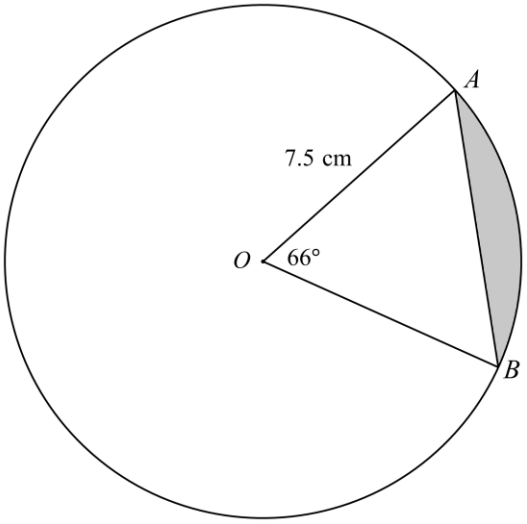
B. 3

C. 5

D. 12

E. 36

Question 3



The area of the segment that is shaded grey in the diagram above, rounded to one decimal place, is

A. 1 cm^2

B. 1.8 cm^2

C. 6.7 cm^2

D. 26.8 cm^2

E. 33.1 cm^2

Question 4

Two cities with the same longitude have latitude 28° N and 56° S.

The distance between the two cities, in kilometres, is closest to

A. 905

B. 3128

C. 4691

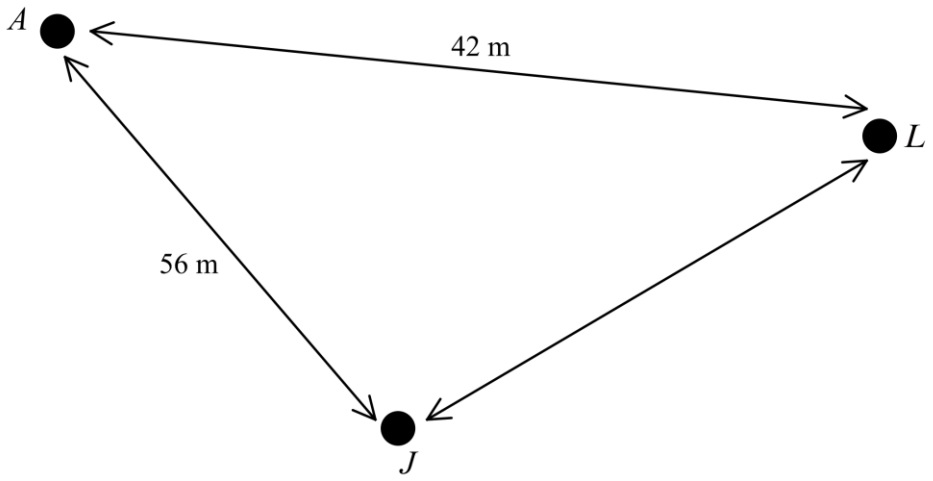
D. 6255

E. 9383

Question 5

Three friends, Annalise (A), Lacy (L) and Jennifer (J), position themselves in a triangle, as shown below, in order to practise kicking a soccer ball to each other.

The angle JAL is equal to $54°$.



The distance, in metres, that Lacy must kick the ball to Jennifer, rounded to two decimal places, is

A. 37.04

B. 46.21

C. 77.08

D. 2135.06

E. 2666.54

Question 6

A mathematics teacher, located at a school in Torquay $(38° \text{ S}, 144° \text{ E})$, releases the results of her exam to all students at the same time.

Georgia, one of her students, is on holiday in Terang $(38° \text{ S}, 142° \text{ E})$.

If the teacher releases her results at 9.30 a.m. in Torquay, what time will Georgia receive her results?

Assume that 15° of longitude equates to 1 hour of time difference.

A. 9.22 a.m.

B. 9.30 a.m.

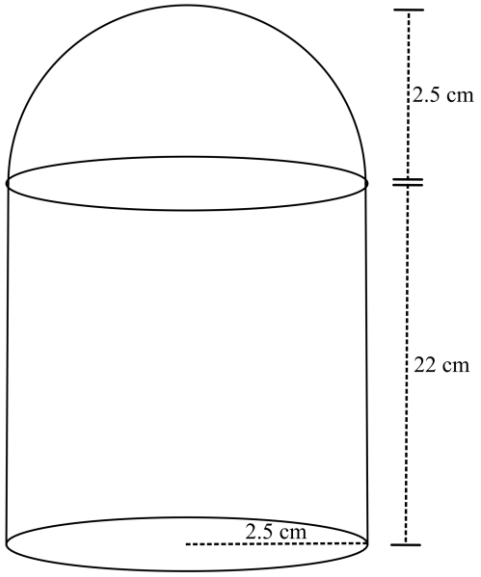
C. 9.38 a.m.

D. 10.00 a.m.

E. 10.38 a.m

Question 7

A frozen drink is served in a cup shaped as a cylinder, with a hemispherical lid, as shown below.



If the frozen drink is filled to the top of the lid, the volume, in cubic centimetres, of liquid that the drink cup can hold is closest to

A. 445

B. 463

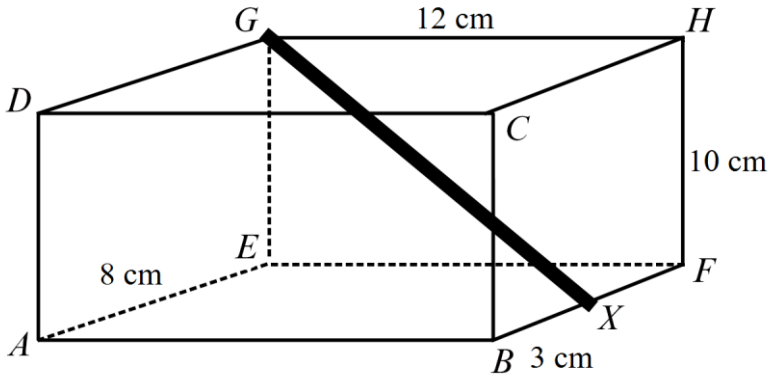
C. 465

D. 484

E. 497

Question 8

A rectangular gift box, *ABCDEFGH*, is 12 cm long, 8 cm wide and 10 cm high, as shown below.



A small metal rod is placed within the box to maintain its shape and protect the present.

One end of the rod is at *G* and the other end sits at *X*.

The point *X* lies on the line *BF*, 3 cm from *B*.

The length of the rod, in centimetres, is closest to

A. 13

B. 16

C. 17

D. 22

E. 20

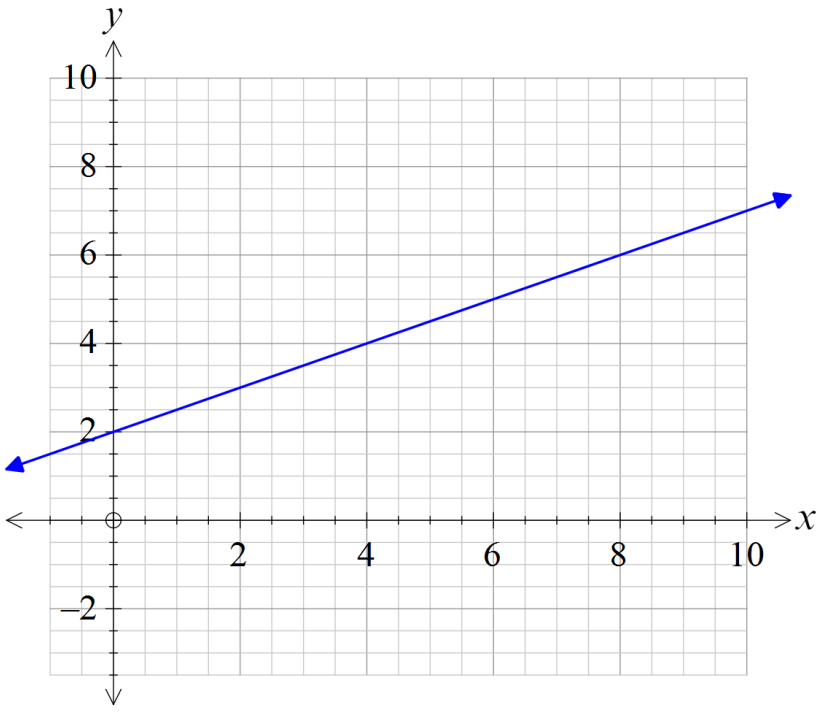
End of Module 3 – SECTION B – continued

TURN OVER

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 coordinate for the *x*-intercept for the straight line graph above is

A. (–2, 0)

B. (2, 0)

C. (0, 2)

D. (0, 4)

E. (–4, 0)

Question 2

An internet company charges a monthly line rental fee of $29 plus an additional $0.35 for each megabyte of internet used.

Let m be the number of megabytes used in a month.

Let C be the cost of the monthly internet bill, in dollars.

The equation for the relationship between the cost of the monthly internet bill, in dollars, and the number of megabytes used is

A. $C = 29m + 0.35$

B. $m = 29 + 0.35C$

C. $m = 29C + 0.35$

D. $C = 0.35m + 29$

E. $C = 29 \times 0.35m$

Use the following information to answer Questions 3 and 4.

Consider the inequality

$y \geq \frac{2}{5}x$

Question 3

Which of the following pairs of points satisfy the inequality?

A. $\left(1, \frac{2}{5}\right)$ and $\left(2, \frac{3}{5}\right)$

B. $\left(2, \frac{4}{5}\right)$ and $\left(2, \frac{2}{5}\right)$

C. $(2, 1)$ and $\left(3, \frac{4}{5}\right)$

D. $\left(1, \frac{2}{5}\right)$ and $\left(2, \frac{4}{5}\right)$

E. $\left(3, 1\frac{2}{5}\right)$ and $\left(2, \frac{2}{5}\right)$

Question 4

Which of the following statements correctly describes the conditions of this inequality?

A. The *y*-value must be larger than two-fifths of the *x*-value.

B. The *y*-value is no more than two-fifths of the *x*-value.

C. The *y*-value is less than or equal to two-fifths of the *x*-value.

D. The *y*-value is greater than or equal to two-fifths of the *x*-value.

E. The *y*-value can be found by dividing the *x*-value by two-fifths.

Question 5

Consider the table of values below.

x	1	2	5	10
y	$\frac{1}{2}$	4	$\frac{125}{2}$	500

A possible model for the relationship between *x* and *y* could be

A. $y = \frac{1}{2}x^2$

B. $y = \frac{1}{2}x$

C. $y = 2x^3$

D. $y = \frac{1}{2}x^3$

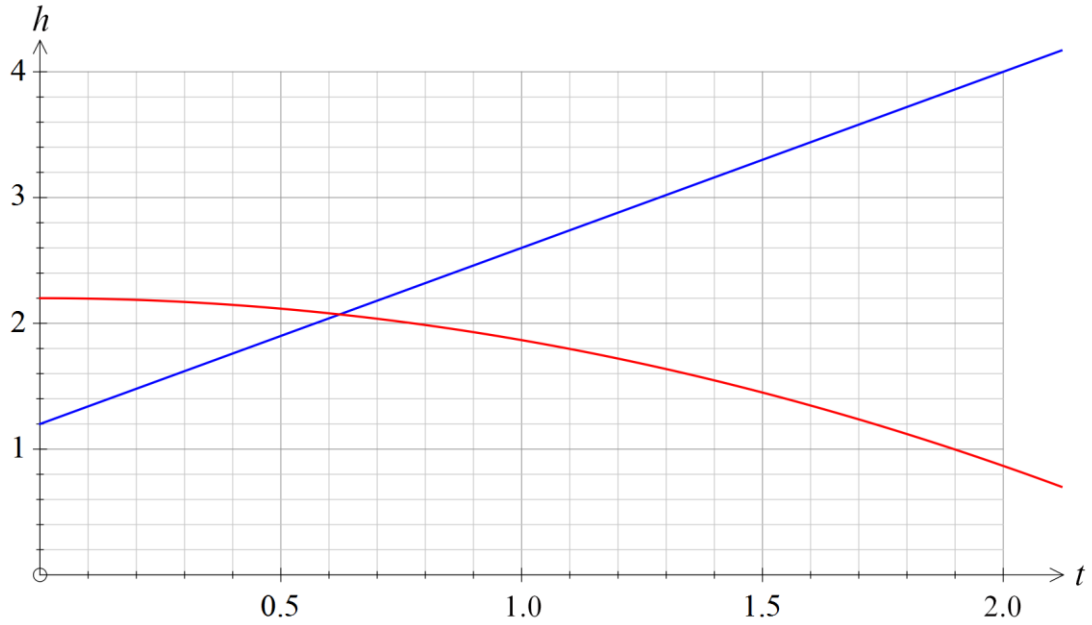
E. $y = 2x^2$

Question 6

Jonathan uses a rocket launcher to propel a tennis ball into the air, according to the linear relation $h = 1.2 + 1.4t$, where t is the time, in minutes, after the ball is launched.

At the same time, Brodrick kicks a soccer ball into the air, according to the rule $h = -\frac{1}{3}t^2 + 2.2$.

The graph for both balls is shown below.



The total length of time, in seconds, that Brodrick's soccer ball is higher than Jonathan's tennis ball is closest to

A. 0.5

B. 0.6

C. 0.8

D. 37

E. 38

Question 7

Priya walks from her house to her work, which is 600 m away.

The equation for distance from home, in metres, t minutes after departure is

$$\text{distance} = \begin{cases} 75t & 0 \leq t \leq 8 \\ 600 & 8 < t \leq 10 \\ kt & 10 < t \leq 11 \end{cases}$$

The value of the coefficient, k, is

A. 0.6

B. 1

C. 6

D. 50

E. 60

Question 8

The constraints of a linear programming problem are given by the following set of inequalities.

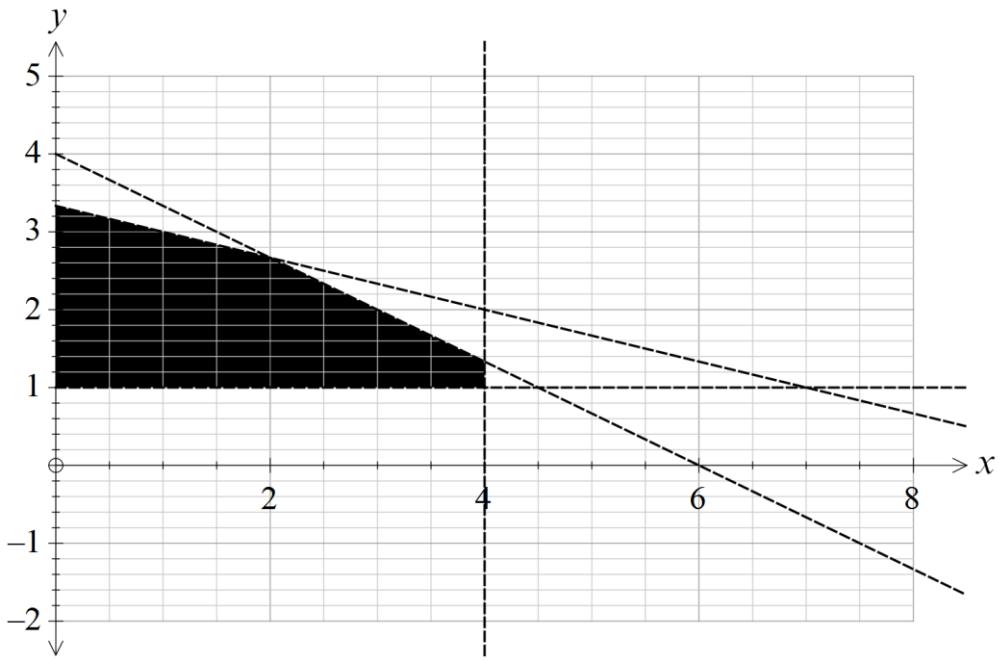
constraint 1: $x + 3y < 10$

constraint 2: $ax + 3y < 12$

constraint 3: $x < 4$

constraint 4: $y > 1$

The graph showing the feasible region is shown below.



The value of a in constraint 2 is

A. 6

B. 4

C. 3.4

D. 2

E. 1

END OF MULTIPLE-CHOICE QUESTION BOOK