The Mathematical Association of Victoria

Trial Examination 2016

FURTHER MATHEMATICS

Written Examination 1

STUDENT NAME: _____

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

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

Materials supplied

- Question and answer book of 30 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 on this page.
- Write your **name** 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

- Place the answer sheet for multiple-choice questions inside the front cover of this book.

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

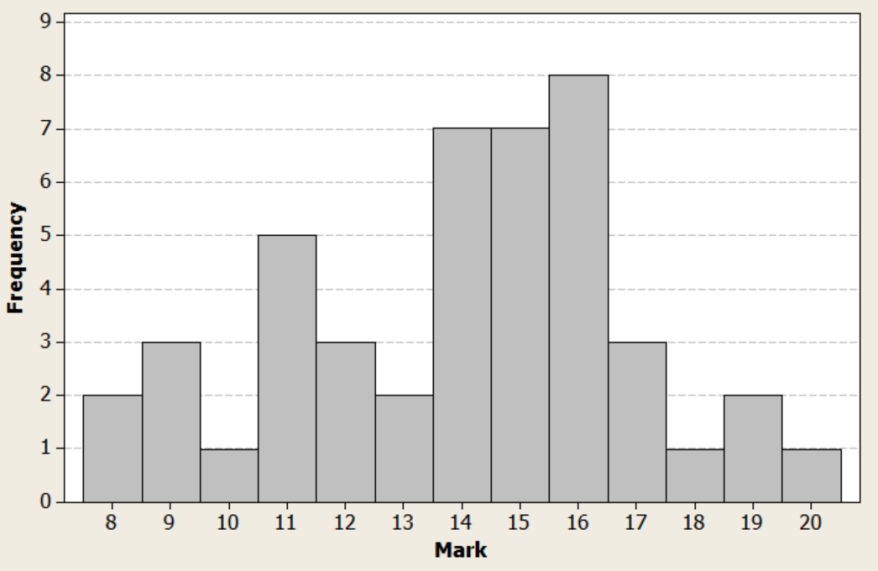
THIS PAGE IS BLANK

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

Question 1
A histogram is shown below for the distribution of marks for 45 students who completed a test in Further Mathematics. The test was scored out of 20 marks.

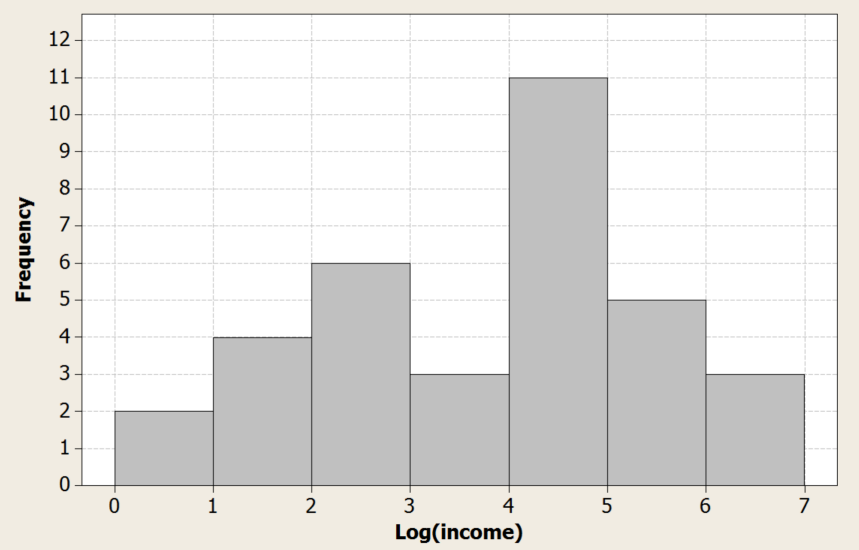


The median mark is:
A. 12
B. 13
C. 14
D. 15
E. 16

Question 2
A survey was completed asking people about their electricity bill. The respondents classified their electricity bill as "low", "average" or "high".
The type of data that will be collected is
A. Discrete numerical
B. Continuous numerical
C. Nominal categorical
D. Ordinal categorical
E. Ordinal numerical

The graph below is used in questions 3 and 4

A graph is shown below of the logarithm of annual income for a number of small companies of various sizes.



Question 3

For this data the modal income is between

A. $100 and $1000
B. $1000 and $10 000
C. $10 000 and $100 000
D. $100 000 and $1 000 000
E. $1 000 000 and $10 000 000

Question 4

The percentage of companies in this sample with an annual income less than $1 000 000 is closest to:

A. 91%
B. 76%
C. 44%
D. 35%
E. 9%

The following information relates to questions 5 and 6

An electrical retailer sells televisions of various sizes. He records the following information:

	Mean $(\bar{x})$	Standard deviation (s)
Television size in cm	120 cm	25 cm
Television price in dollars	\$1080	\$350
r value	0.68	

Question 5

The equation of the least squares regression line that can predict the price of a television from its size is closest to :

A. $size = 67.5 + 0.05 \times price$

B. $price = 67.5 + 0.05 \times size$

C. $price = 9.52 - 62.4 \times size$

D. $price = -62.4 + 9.52 \times size$

E. $size = -62.4 + 9.52 \times price$

Question 6

The value of the correlation coefficient indicates that:

A. 68% of the variation in the price can be explained by the size of the television.

B. As the size of the television for sale increases, the price also tends to increase.

C. Increasing the size of a television causes its sale price to increase.

D. There is a weak positive relationship between the price of a television and its size.

E. For every extra cm of size, on average the television will increase by \$0.68 in price.

Question 7

A pharmacist conducted a survey to determine the characteristics of people on prescription medications. He classified people as school age, working age or retirement age. He then classified their prescription medication use as regular, occasional and seldom. The results of his survey are in the percentaged two way frequency table given below:

Medication Use	Age group		
	School	Working	Retirement
Regular	2.5%	22.4%	45.2%
Occasional	32.5%	32.9%	32.7%
Seldom	65.0%	44.7%	22.1%

The statement that supports the contention that medication use is associated with age group is:

A. Only 2.5% of school age people are regular medication users and 65% seldom use medications.

B. A similar percentage of school age, working age and retirement age people are occasional users of medications.

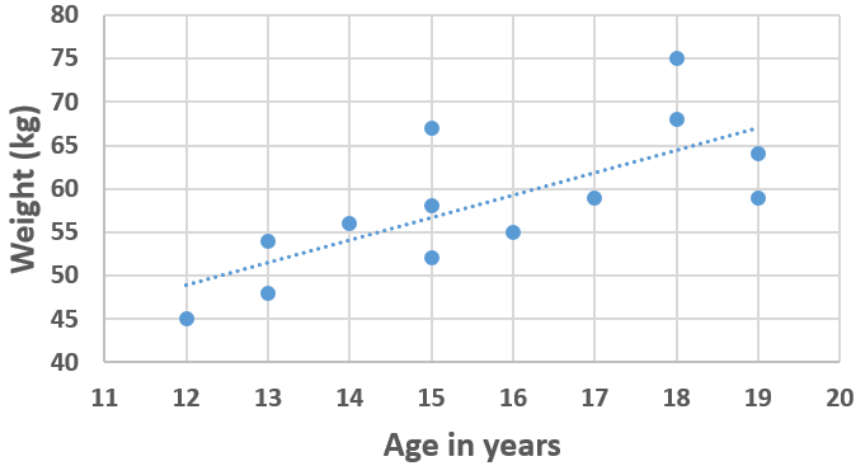
C. The percentage of working age people who seldom use medications is similar to the percentage of retirement age people who are regular users of medications.

D. Only 2.5% of school age people regularly use medications whereas 22.4% of working age people regularly use medications and 45.2% of retirement age people regularly use medications.

E. 23.1% more retirement age people are regular users of medications than seldom use medications.

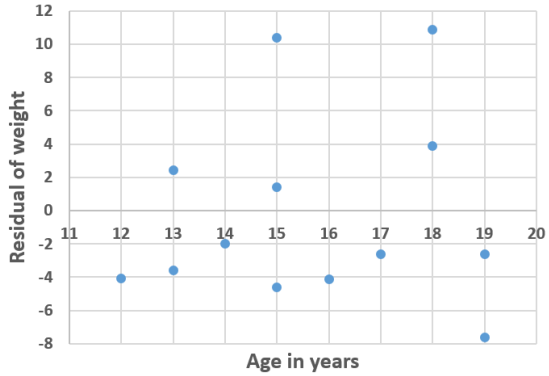
Question 8

A scatterplot is shown below of the relationship between the weight of a number of teenagers and their age. A least squares regression line has been drawn on the plot.

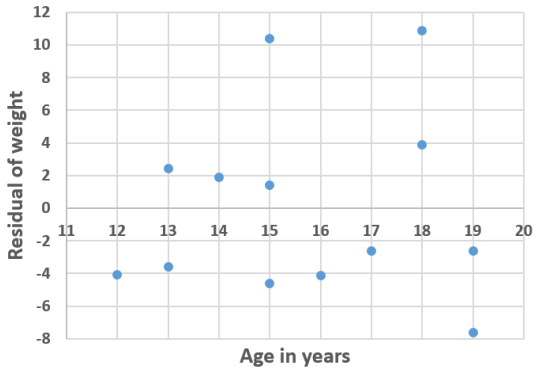


The residual plot for this relationship would be:

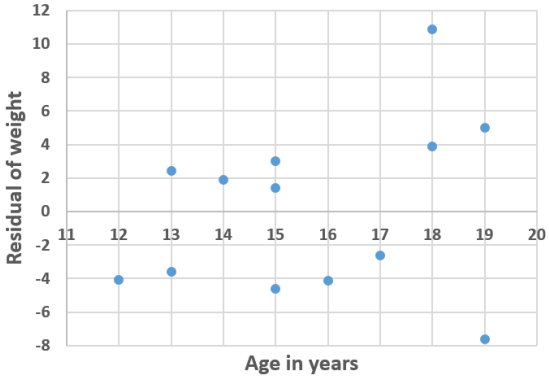
A.



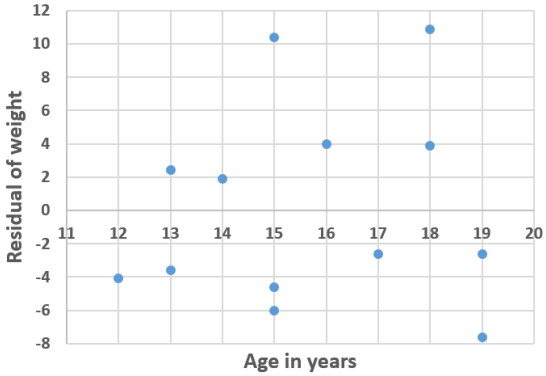
B.



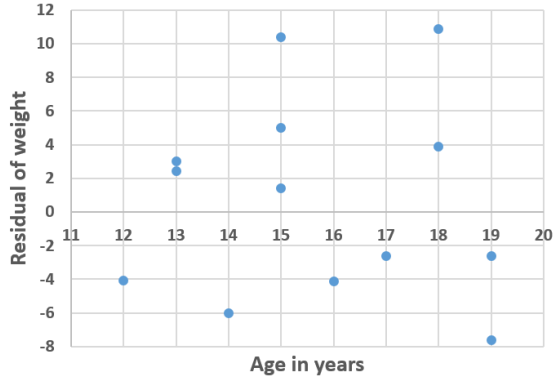
C.



D.



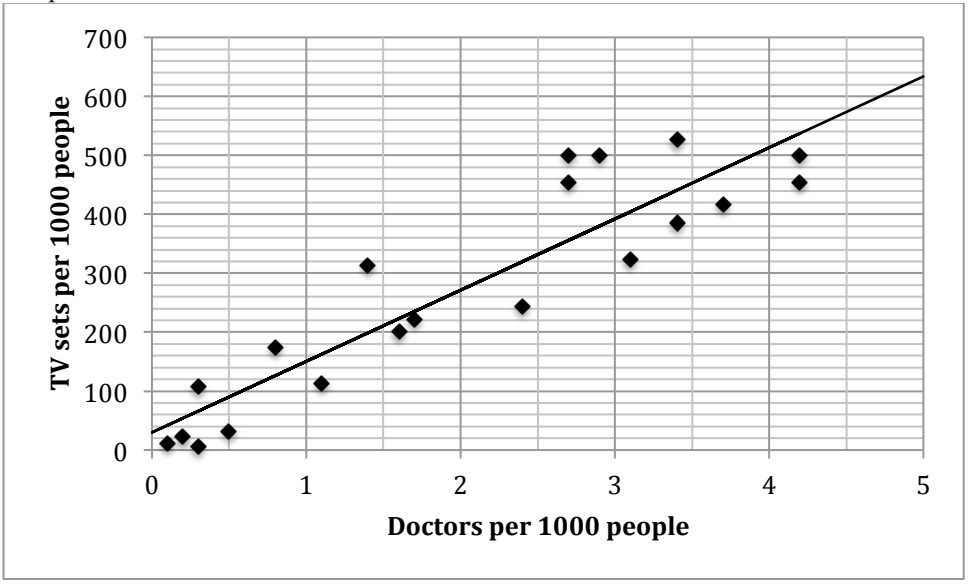
E.



The following information relates to questions 9, 10 and 11

Question 9

The scatterplot below shows the *TV sets* (number per 1000 people) and the *doctors* (number per 1000 people) for a sample of 20 countries.



A least squares regression line has been drawn.

The least squares regression equation for this line is closest to:

A. *TV sets* = 30 + 120 × *doctors*
B. *Doctors* = 30 + 120 × *TV sets*
C. *TV sets* = 30 + 150 × *doctors*
D. *Doctors* = 30 + 150 × *TV sets*
E. *TV sets* = 30 + 200 × *doctors*

Question 10

The interpretation of the vertical axis intercept is :

A. When the number of doctors is zero, there are 30 TV sets per 1000 people
B. When the number of TV sets is zero there are 0 doctors per 1000 people
C. There have to be at least 30 TV sets for there to be any doctors
D. Doctors need at least 30 TV sets to operate
E. If there aren't any doctors, people will get their healthcare from the TV.

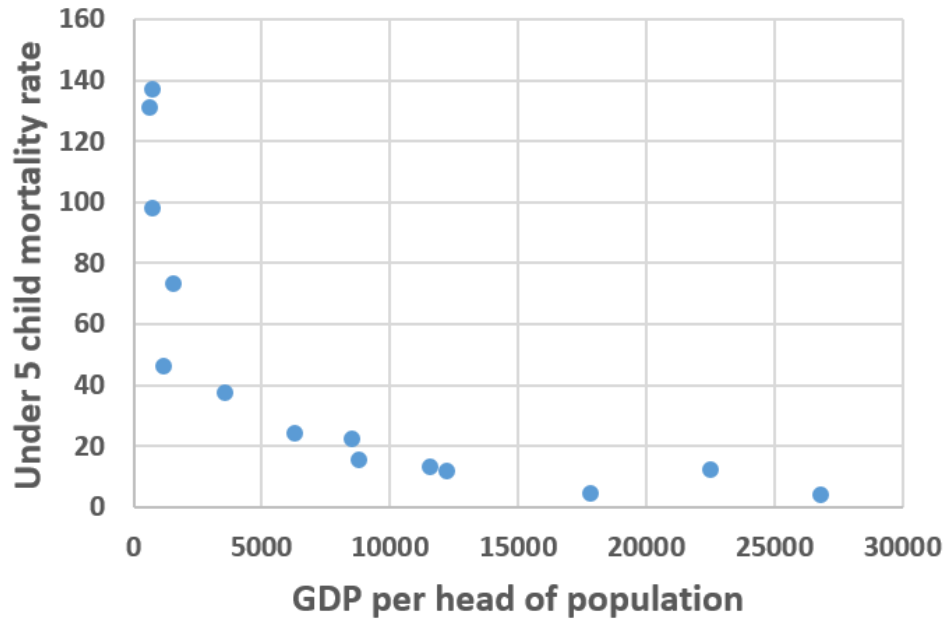
Question 11

In the 1990's, a politician upon seeing a graph similar to this suggested that his country should provide more TV sets to increase the number of doctors in the community. A more correct interpretation of the data is :

A. An increase in the number of doctors causes an increase in the number of TV sets.
B. An increase in the number of TV sets causes an increase in the number of doctors.
C. The wealth of the country is a common cause that affects both the number of doctors and the number of TV sets.
D. It is a coincidence that these two data sets are associated.
E. The graph has a positive correlation so there is a positive causal link between these variables.

The following information applies to Question 12.

The scatterplot and table below show the *under-5 child mortality rate* (in deaths per 1000 births), and the *GDP (*per head of population), for a sample of fourteen countries.



GDP	*Child mortality*
22500	12.5
26800	4.1
3580	37.6
17800	4.4
11590	13.3
6300	24.3
635	131
1570	73.5
753	98.3
1170	46.5
8540	22.4
12200	11.8
750	137
8780	15.7

Question 12

The relationship between *child mortality* and *GDP* is non-linear.
A log transformation is applied to the variable *GDP* to linearise the scatterplot.
The least squares regression line equation determined is closest to :

A. $Child\ mortality = 309 - 72.2 \times log_{10}(GDP)$
B. $Log_{10}(child\ mortality) = 309 - 72.2 \times child\ mortality$
C. $Child\ mortality = 72.2 + 309 \times log_{10}(GDP)$
D. $Child\ mortality = 79.6 - 0.004 \times log_{10}(GDP)$
E. $Child\ mortality = 309 + 72.2 \times log_{10}(GDP)$

Question 13

The relationship between *TV sets* (per 1000 people) and *life expectancy* (in years) is non-linear for a sample of thirty countries.
A squared transformation is applied to the variable *life expectancy* to linearise the scatterplot.
The least squares regression line equation determined is

$$TV\ sets = -338 + 0.0983 \times life\ expectancy^2$$

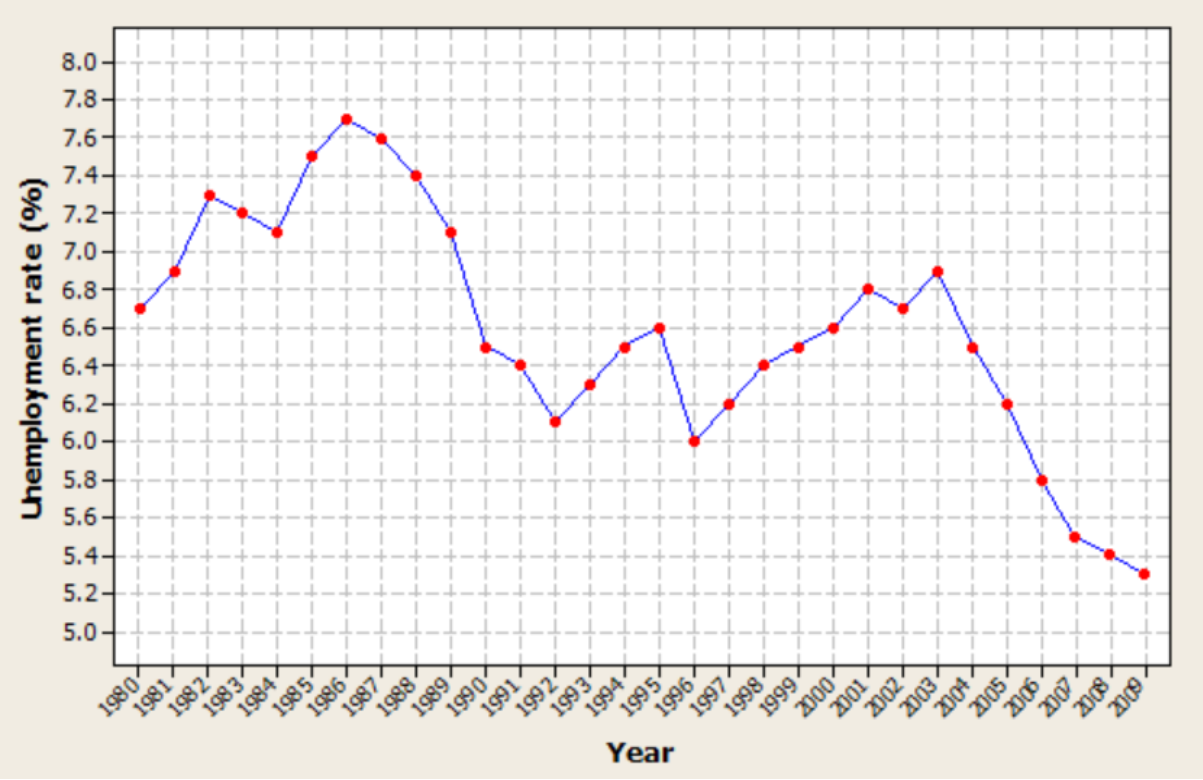
Australia has 502 TV sets per 1000 people.

When the regression equation is used to predict the *life expectancy* value for Australia, the value obtained is closest to :

A. 40.8
B. 84.4
C. 92.4
D. 1668
E. 8545

Question 14

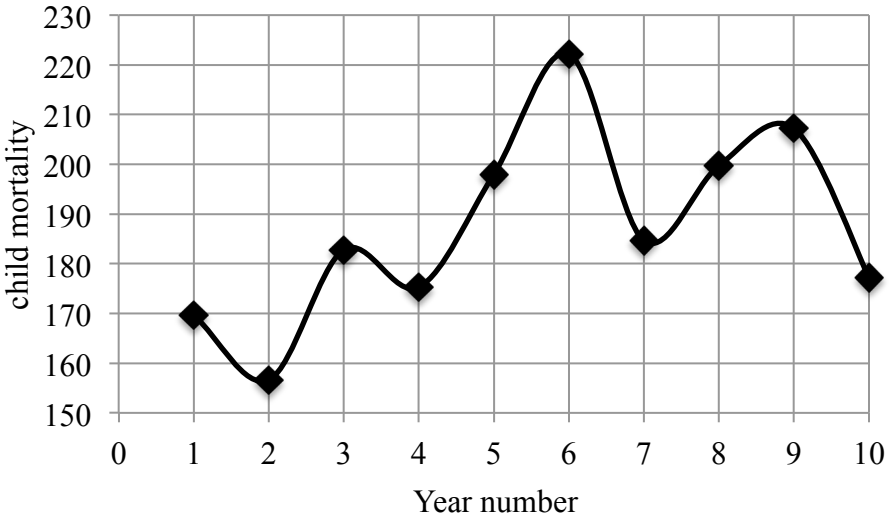
A time series graph is shown below of the unemployment rate as a percentage of the available workforce from the years 1980 through to 2009.



The graph is best described as

A. Cyclic with an increasing trend
B. Seasonal with a decreasing trend
C. Seasonal with an increasing trend
D. Cyclic with a decreasing trend
E. Having only random fluctuations

Question 15
The time series plot below shows the child mortality rate (in deaths per 1000 births) for ten consecutive years during the late nineteenth century in Australia.



A 5-median smoothing technique is applied to this graph.
The smoothed value for year 5 is closest to :
A. 180
B. 182
C. 185
D. 188
E. 192

Question 16
The time series data in the table below shows the child mortality rate (in deaths per 1000 births) for a different ten consecutive years during the late nineteenth century in Australia.

1	2	3	4	5	6	7	8	9	10	11	12
177	160	179	157	151	175	159	202	179	149	157	162

A 4-point moving average smoothing technique with centring is applied to the data.
The centred value for year 6 is closest to:
A. 157
B. 159
C. 161
D. 166
E. 175

Core **Recursion and Financial Mathematics**

Question 17
Which of the following recurrence relations will generate a sequence whose values decay arithmetically?

A. $B_0 = 6000, B_{n+1} = B_n + 300$

B. $B_0 = 6000, B_{n+1} = B_n - 300$

C. $B_0 = 6000, B_{n+1} = 1.05B_n - 300$

D. $B_0 = 6000, B_{n+1} = 1.05B_n$

E. $B_0 = 2000, B_{n+1} = 0.95B_n$

Question 18
Salim is a courier who uses his own van to deliver parcels all over town. The van cost him $27 500 when new and he is allowed to depreciate it by 35¢ for every kilometre travelled.
If he will trade in the van for a new one when its value depreciates to $10 000, how many kilometres, correct to the nearest whole number, will he have travelled ?

A. 28 571
B. 32 000
C. 50 000
D. 57 142
E. 64 000

Question 19
Antonia has $15 000 to invest. She is offered an interest rate of 6.5% per annum compounding quarterly. Antonia asks for the same rate of interest to be compounded weekly. The **increase** in effective interest rate would be closest to

A. 0.05%
B. 0.16%
C. 0.21%
D. 6.66%
E. 6.71%

Question 20
Brenton takes out a loan of $25 000 at an interest rate of 7.2% per annum compounding monthly. Every month he makes a payment of $498 to repay the loan. Let L_n be the balance of the loan after n months. A recurrence relationship that can be used to model the balance of this loan is

A. $L_0 = 25\,000, L_{n+1} = 1.006L_n - 498$

B. $L_0 = 25\,000, L_{n+1} = 1.06L_n - 498$

C. $L_0 = 25\,000, L_{n+1} = 1.072L_n - 498$

D. $L_0 = 25\,000, L_{n+1} = 1.006L_n + 498$

E. $L_0 = 25\,000, L_{n+1} = 1.0006L_n - 498$

The following information is used in questions 21 and 22

Jalal takes out a loan of $30 000 to start up a mowing business. The loan has interest charged at 8.4% per annum interest compounding monthly. An amortisation table for the first 12 months of the loan, with some entries missing, is shown below:

Payment number (n)	Payment made ($)	Interest charged ($)	Reduction in loan balance ($)	Balance of Loan ($)
0	-	-	-	30,000.00
1	650.00	210.00	440.00	29,560.00
2	650.00	206.92	443.08	29,116.92
3	650.00	203.82	446.18	
4	650.00	200.70	449.30	28,221.43
5	650.00	197.55	452.45	27,768.98
6	650.00	194.38	455.62	27,313.37
7	650.00	191.19	458.81	26,854.56
8	650.00	187.98	462.02	26,392.54
9	650.00			
10	650.00	181.49	468.51	25,458.78
11	650.00	178.21	471.79	24,986.99
12	650.00	174.91	475.09	24,511.90

Question 21

The balance of the loan after 3 months is closest to

A. $28 466.92
B. $28 670.74
C. $28 020.74
D. $28 263.10
E. $28 266.22

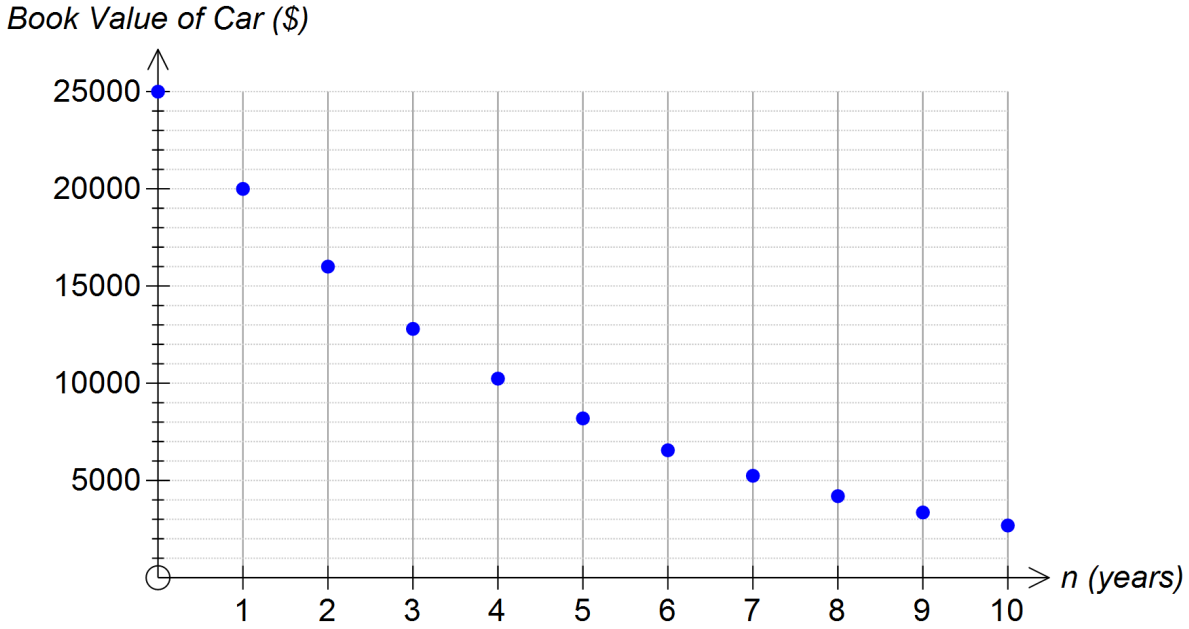
Question 22

The percentage of the ninth payment that reduces the principal is closest to

A. 72.7%
B. 28.4%
C. 99.3%
D. 71.1%
E. 71.6%

Question 23

Julie buys a car for use in her delivery business. She depreciates the car for business purposes. A graph showing the book value of the car after each of the first 10 years is shown below:



Let B_n be the book value in dollars after n years. A rule for determining B_n could be

A. $B_n = 25000 \times 0.8^n$

B. $B_n = 25000 \times 1.8^n$

C. $B_n = 25000 \times 1.2^n$

D. $B_n = 25000 \times (1 - 0.8)^n$

E. $B_n = 25000 \times 0.8 \times n$

Question 24

Liam has a superannuation account with a current balance of $380 000. He wants to retire in four years time, so every month he adds $2500 to the account **after** the account has interest added at 5.4% per annum compounding monthly. There are no fees applied during this period.

After four years Liam retires and the account continues to pay 5.4% per annum compounding monthly, but Liam now takes $4500 per month out of the account as an income. The amount in Liam's account after five years of retirement under these circumstances would be closest to

A. $605 000

B. $1 101 000

C. $483 000

D. $122 000

E. $510 000

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.
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

Contents **Page**

Module 1 MATRICES

Question 1

If A is a 4×3 matrix and B is 2×4 matrix, what will be the order of the product matrix of these two matrices that **is** defined ?

A. 4×4
B. 3×2
C. 2×3
D. 2×4
E. 4×2

Question 2

The transpose of matrix $M = \begin{bmatrix} 7 & 1 & 4 \\ 3 & 6 & 2 \end{bmatrix}$, is :

A. $\begin{bmatrix} 3 & 6 & 2 \\ 7 & 1 & 4 \end{bmatrix}$

B. $\begin{bmatrix} 2 & 6 & 3 \\ 4 & 1 & 7 \end{bmatrix}$

C. $\begin{bmatrix} 7 & 1 \\ 4 & 3 \\ 6 & 2 \end{bmatrix}$

D. $\begin{bmatrix} 7 & 3 \\ 1 & 6 \\ 4 & 2 \end{bmatrix}$

E. $\begin{bmatrix} 3 & 7 \\ 6 & 1 \\ 2 & 4 \end{bmatrix}$

Question 3

If matrix $K = \begin{bmatrix} E \\ D \\ I \\ T \end{bmatrix}$ and matrix $P = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$, then what word is formed by the matrix product $P \times K$?

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

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

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

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

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

The following information relates to Questions 4 and 5.

In a country town there are two weekly newspapers that the residents can purchase – *The Bugle (B)* and *The Clarion (C)*.

In a particular week, the sales matrix was $S_0 = \begin{bmatrix} 700 \\ 900 \end{bmatrix} \begin{matrix} B \\ C \end{matrix}$.

The Bugle has had a revamp and is spending money to promote sales, so they believe that the transition matrix, T, that will describe sales is $T = \begin{bmatrix} 0.96 & 0.05 \\ 0.04 & 0.95 \end{bmatrix} \begin{matrix} B \\ C \end{matrix}$.

Question 4

If the sales values are rounded to nearest whole number, after how many weeks will *The Bugle* have identical sales with *The Clarion*?

A. 7
B. 8
C. 9
D. 10
E. 11

Question 5

The Clarion management was very slow to respond to the promotional activities by *The Bugle*. *The Clarion*'s revamp and promotional activity got underway after 10 weeks, and they believed that the new transition matrix, T_n, would be

$$T_n = \begin{bmatrix} 0.96 & 0.03 \\ 0.04 & 0.97 \end{bmatrix} \begin{matrix} B \\ C \end{matrix}.$$

Given the intervention by *The Clarion*, what would be the sales of each paper after 15 weeks, rounded to the nearest whole number ?

A. $\begin{bmatrix} 783 \\ 817 \end{bmatrix} \begin{matrix} B \\ C \end{matrix}$

B. $\begin{bmatrix} 771 \\ 829 \end{bmatrix} \begin{matrix} B \\ C \end{matrix}$

C. $\begin{bmatrix} 776 \\ 824 \end{bmatrix} \begin{matrix} B \\ C \end{matrix}$

D. $\begin{bmatrix} 765 \\ 835 \end{bmatrix} \begin{matrix} B \\ C \end{matrix}$

E. $\begin{bmatrix} 770 \\ 830 \end{bmatrix} \begin{matrix} B \\ C \end{matrix}$

Question 6
In a particular situation, the following matrix recurrence relation applies

$$S_{n+1} = TS_n + B$$

Where $T = \begin{bmatrix} 0.75 & 0.3 \\ 0.25 & 0.7 \end{bmatrix}$ and $B = \begin{bmatrix} 25 \\ 20 \end{bmatrix}$.

The value of S_0 if $S_1 = \begin{bmatrix} 130 \\ 115 \end{bmatrix}$ is :

A. $\begin{bmatrix} 126 \\ 119 \end{bmatrix}$

B. $\begin{bmatrix} 151 \\ 139 \end{bmatrix}$

C. $\begin{bmatrix} 100 \\ 100 \end{bmatrix}$

D. $\begin{bmatrix} 132 \\ 113 \end{bmatrix}$

E. $\begin{bmatrix} 107 \\ 93 \end{bmatrix}$

Question 7
The total cost of two hamburgers and three drinks is $12.00.
The total cost of three hamburgers and five drinks is $19.00.
Let h be the cost of a hamburger and d be the cost of a drink.

The matrix $\begin{bmatrix} d \\ h \end{bmatrix}$ is equal to :

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

B. $\begin{bmatrix} 3 & 2 \\ 5 & 3 \end{bmatrix}\begin{bmatrix} 12 \\ 19 \end{bmatrix}$

C. $\begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix}\begin{bmatrix} 19 \\ 12 \end{bmatrix}$

D. $\begin{bmatrix} 3 & -2 \\ -5 & 3 \end{bmatrix}\begin{bmatrix} 12 \\ 19 \end{bmatrix}$

E. $\begin{bmatrix} -3 & 2 \\ 5 & -3 \end{bmatrix}\begin{bmatrix} 12 \\ 19 \end{bmatrix}$

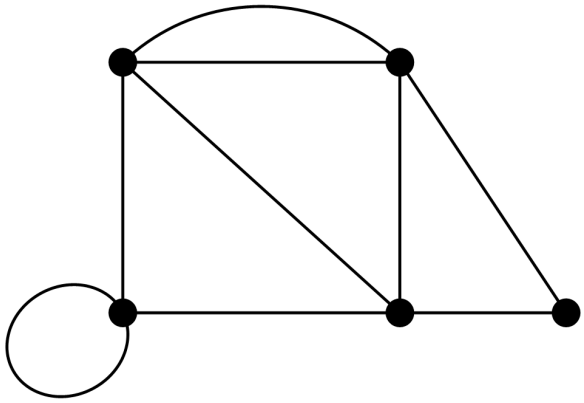
Question 8

P, Q, R and S are matrices such that the calculation $P \times Q \times R + S$ is defined.
Matrix P and matrix R are square, non-zero matrices for which $P + R$ is not defined.
If S is a 5×2 matrix, then the order of Q must be :

A. 2×2
B. 2×5
C. 5×5
D. 5×2
E. 6×5

Module 2 Networks and decision mathematics

Question 1



Which of the following descriptions applies to the network above:

A. Planar and simple
B. Undirected and degenerate
C. Connected and complete
D. Simple and complete
E. Planar and connected

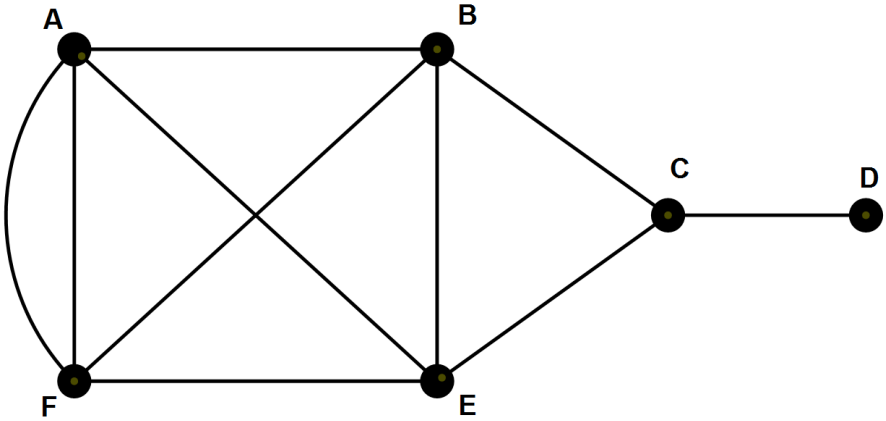
Question 2

A planar graph has the same number of vertices as edges. The number of regions is:

A. 4
B. 2
C. Two less than the number of vertices
D. Two more than the number of vertices
E. Unable to be determined from the information given

Question 3

A network is shown below depicting the connections between towns A, B, C, D, E and F.

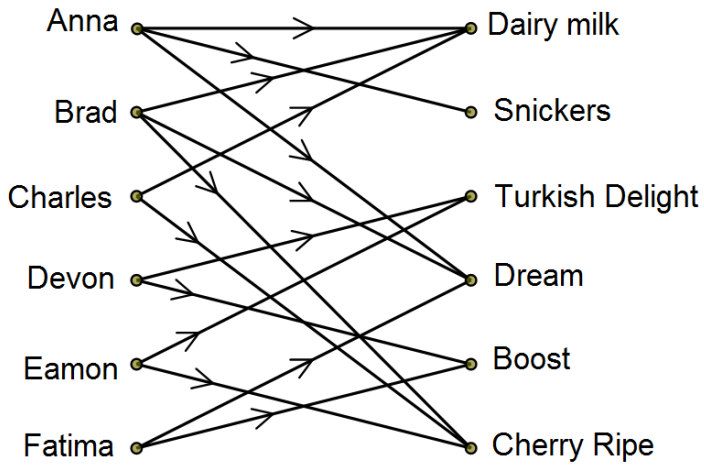


This network has:

A. An eulerian circuit and a hamiltonian path
B. An eulerian trail and a hamiltonian path
C. An eulerian trail and a hamiltonian cycle
D. An eulerian trail, but no hamiltonian paths or cycle
E. A hamiltonian path and a hamiltonian cycle, but no eulerian trails or circuits

Question 4
At a board meeting for a company, each board member shakes hands once with every other board member at the start of the meeting. Given that there are 105 handshakes, how many members attended the board meeting?
A. 53
B. 35
C. 11
D. 15
E. 16

Question 5
A group of friends are given a packet of "Favourites" to share. The bipartite graph shows the chocolates available that each friend likes:

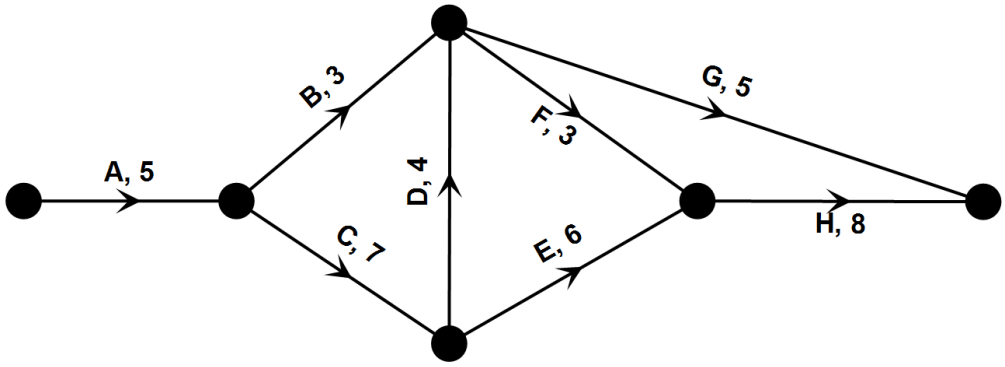


If each friend takes all of the chocolates of one flavour and they only take chocolate that they like, the chocolates that each person has could be:
A. Anna – Snickers, Charles – Dairy milk, Devon – Turkish delight, Eamon – Boost, Fatima – Dream, Brad – Cherry Ripe is a possible answer
B. Anna – Snickers, Charles – Dairy milk, Devon – Turkish delight, Eamon – Cherry Ripe, Fatima – Boost, Brad – Dream is the only possible answer
C. Anna – Snickers, Charles – Cherry Ripe, Devon – Turkish delight, Eamon – Dairy Milk, Fatima – Dream, Brad – Boost is a possible answer
D. Anna – Snickers, Charles – Cherry Ripe, Devon – Boost, Eamon – Turkish Delight, Fatima – Dream, Brad – Dairy Milk is the only possible answer
E. There is more than one possible allocation, but Anna must have Snickers

Question 6
An activity network has 6 activities A, B, C, D, E and F. Activity F has both D and E as immediate predecessors. Activities D and E both have activity C as an immediate predecessor. Activity F has a latest starting time of 8 hours. If the duration of each of activities A, B, C, D, E and F are *a, b, c, d, e* and *f* hours respectively, the latest starting time for activity C would be :

A. $8 - d - e$
B. The smallest value of $8 - d$ or $8 - e$
C. The smallest value of $8 - d - c$ or $8 - e - c$
D. The biggest value of $8 - d$ or $8 - e$
E. The biggest value of $8 - d - c$ or $8 - e - c$

The activity network shown below is used in questions 7 and 8:



Question 7
The number of activities that could individually be delayed by three hours without affecting the overall completion time of the project is:

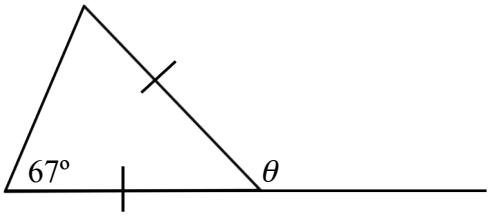
A. None
B. 1
C. 2
D. 3
E. 4

Question 8
Because of a staffing issue, activity *F* cannot be started until activity *E* is completed. The overall completion time for the project is:

A. Delayed by 6 hours
B. Delayed by 4 hours
C. Delayed by 3 hours
D. Delayed by 2 hours
E. Unchanged

MODULE 3 Geometry & Measurement

Question 1



The value of θ is :

A. 46º
B. 67º
C. 92º
D. 113º
E. 134º

Question 2

The city that is closest to the South Pole is :

A.	Pasadena, USA	34.1º N
B.	Kabul, Afghanistan	34.3º N
C.	Mildura, Australia	34.1º S
D.	Sydney, Australia	33.5º S
E.	Capetown, South Africa	33.6º S

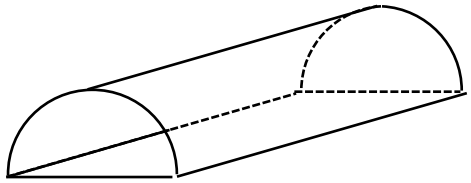
Question 3

Flyover Tours offers tourists the opportunity to fly over the South Pole on a trip that starts from Hobart, Tasmania (43º S, 147º E) and ends up at Puntas Arenas, Chile (53º S, 71º W). The plane will fly along the 147º E meridian from Hobart to the South Pole, and turn to fly along the 71º W meridian from the South Pole to Puntas Arenas. Assuming that the radius of the Earth is 6400 km, the total distance of this trip is closest to :

A. 4800 km
B. 5200 km
C. 9400 km
D. 10 100 km
E. 10 700 km

Question 4

A tent is in the shape of a hemispherical prism as shown right, with a width at the base of 1.6 m and a length of 3.2 m. The door flaps at each end do not require extra material.

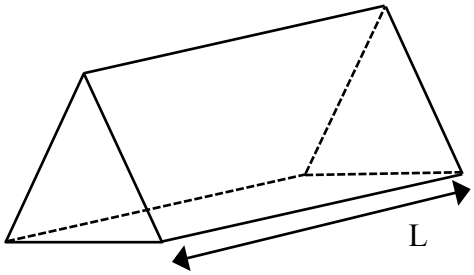


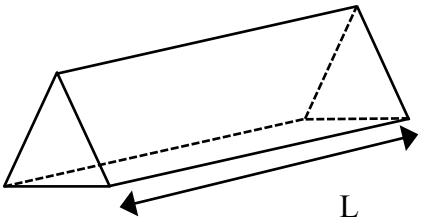
The total area of fabric required to make one tent, including the floor, in square metres, is closest to:

A. 10.05
B. 12.06
C. 15.17
D. 20.30
E. 23.22

Question 5

At a camp site there are two A-frame huts, based on isosceles prisms as shown below.





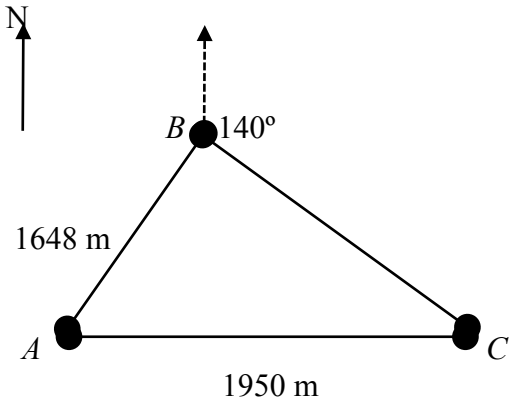
The larger hut is H m high and W m wide.
The smaller hut is half as high and half as wide.
Both huts are the same length (L).

If the smaller hut encloses a volume of V m^3, then the larger hut encloses a volume, in m^3, of :

A. $2V$
B. $3V$
C. $4V$
D. $6V$
E. $8V$

The following information refers to Questions 6 and 7.

A beginner's orienteering course has the participants travelling around a triangular course. The points A, B and C marks the key corners as shown below.



The bearing of *B* from *A* is 025º.
The distance from *A* to *B* is 1648 m.
The bearing from *B* to *C* is 140º.
The distance from *C* back to *A* is 1950 m.
The bearing of *A* from *C* is 270º.

Question 6

The distance from *B* to *C* is, correct to the nearest metre :

A. 1042
B. 1120
C. 1468
D. 1950
E. 2050

Question 7

The area within the triangular course ABC, in square metres, can be calculated by evaluating :

A. $\sqrt{2775 \times 1127 \times 825 \times 825}$

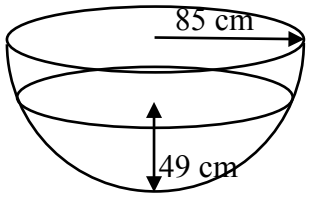
B. $\sqrt{5548 \times 3900 \times 3598 \times 3598}$

C. $\frac{1}{2} \times 1648 \times 1950 \times \sin 25^\circ$

D. $\frac{1}{2} \times 1648 \times 1950 \times \sin 65^\circ$

E. $\frac{1}{2} \times 1648 \times 1950 \times \sin 140^\circ$

Question 8
Water is poured into a hemispherical bowl with a radius of 85 cm.
The maximum depth of water is 49 cm.

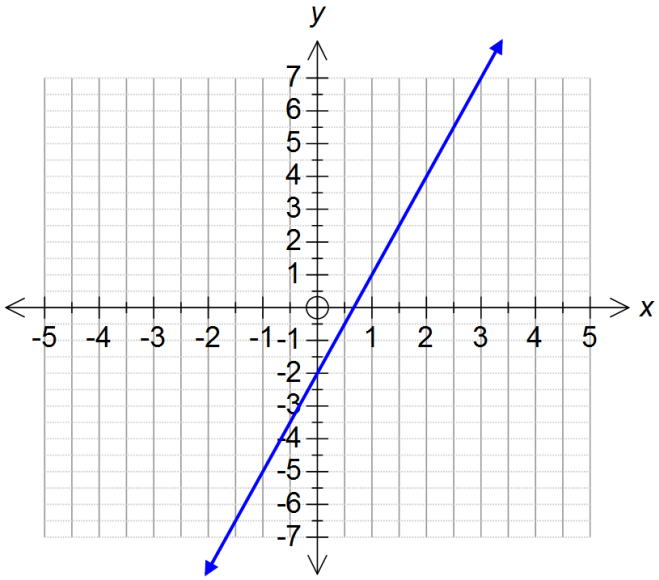


The area of the surface of the water exposed to the air, in square metres, is closest to :
A. 0.75
B. 1.58
C. 1.86
D. 2.06
E. 2.27

End of Module 3 - SECTION B –continued

Module 4 Graphs & Relations

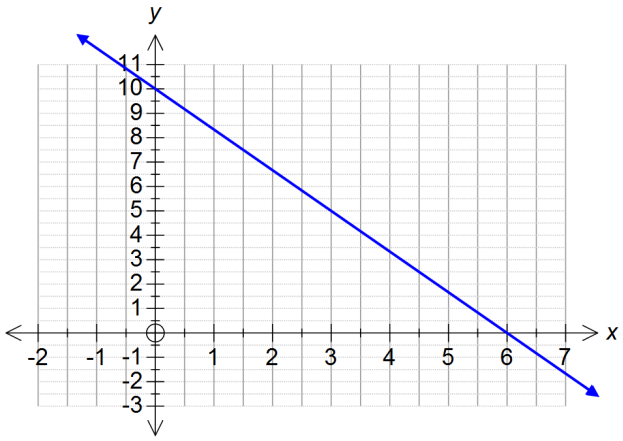
Question 1



The gradient of the graph shown above is equal to:

A. 3
B – 3
C. 2
D. – 2
E. $\frac{1}{3}$

Question 2

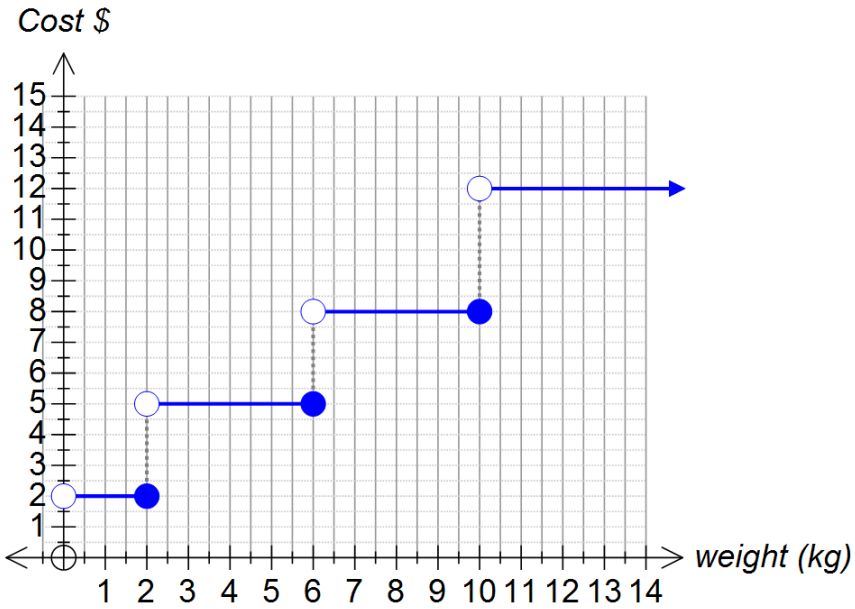


The equation of the graph shown above is:

A. $6x + 10y = 30$
B. $10x + 6y = 30$
C. $3x + 5y = 30$
D. $5x + 3y = 30$
E. $5x - 3y = 30$

Question 3

The graph below represents the charges in dollars for delivering parcels within the Melbourne CBD using "Deliveries R Us". The charges are calculated based on the weight of the parcel in kilograms:



Another company "We deliver" charges for any parcel within the Melbourne CBD to the nearest cent according to the equation:

$$\textit{Charge in \$} = 2 \times \textit{weight in kg}$$

It is cheaper to use "Deliveries R Us" when:

A. The parcel weighs more than 1 kg and less than 2 kg or more than 2.5 kg.
B. The parcel weighs more than 2.5 kg.
C. The parcel weighs between 1 and 2.5 kg inclusive.
D. The parcel weighs less than 1 kg or more than 2.5 kg.
E. The parcel weighs more than 1 kg and up to 2 kg inclusive or more than 2.5 kg.

Question 4

Susie buys her daughter a charm bracelet and 7 charms. Altogether this costs her $435.
Ivan buys his 3 daughters a charm bracelet each and a total of 12 charms for the 3 bracelets. Altogether this costs him $900.
Timothy wants to buy his 2 daughters a charm bracelet each and a total of 8 charms for the 2 bracelets. This will cost Timothy:

A. $165
B. $285
C. $600
D. $720
E. $1050

Question 5
A gym charges $3.50 per day for the first 15 days that a person uses the gym during a calendar year. After 15 days of use members only pay $2.20 per day used for the rest of the year's membership. The relationship between the cost of membership (C) and the number of days (d) used is:

A. $C = \begin{cases} 3.5d, & 0 < d \leq 15 \\ 2.2d + 19.5, & 15 < d \leq 365 \end{cases}$

B. $C = \begin{cases} 3.5d, & 0 < d \leq 15 \\ 2.2d + 52.5, & 15 < d \leq 365 \end{cases}$

C. $C = \begin{cases} 3.5d, & 0 < d \leq 15 \\ 2.2d, & 15 < d \leq 365 \end{cases}$

D. $C = \begin{cases} 3.5d, & 0 < d \leq 15 \\ 2.2d + 15, & 15 < d \leq 365 \end{cases}$

E. $C = \begin{cases} 3.5d, & 0 < d \leq 15 \\ 2.2d, & d \geq 15 \end{cases}$

Question 6
Sasha runs a mobile coffee shop that he takes to events. Every week he has ongoing costs of $235 for his vehicle and insurances and each coffee that he makes costs him $1.20. He sells his coffee for $4.50 each. Which of the following statements is NOT true about Sasha's business:

A. He must sell at least 72 coffees per week to break even.
B. If he sells 150 coffees in a week he will make a profit of $260.
C. If he sells less than 72 coffees in a week he will make a loss.
D. If he needs to make a profit of $600 each week, he must sell at least 254 coffees each week.
E. If he reduces his selling price by 60 cents, he will need to sell 15 more coffees each week to break even.

Question 7
A lounge manufacturer makes 2-seater and 3-seater lounges. He knows that he needs to make at least twice as many 2-seater lounges as 3-seater lounges. If 2-seater lounges are x and 3-seater lounges are y, the constraint inequation that represents this situation is:

A. $y \geq 2x$

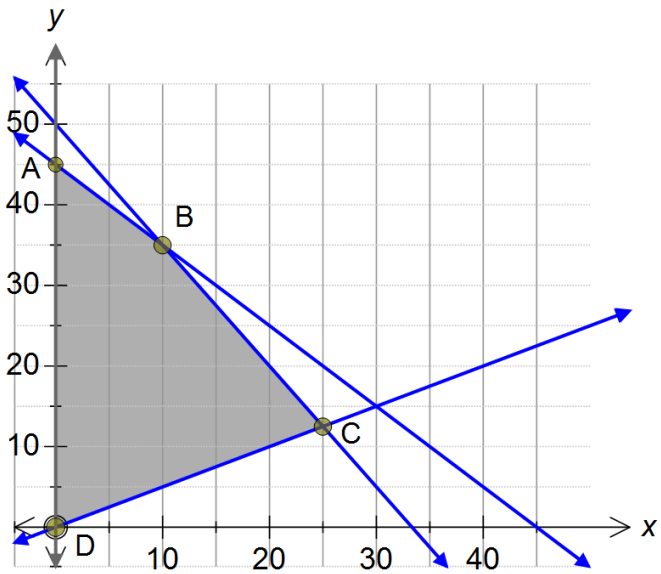
B $y \geq \frac{x}{2}$

C. $y \leq 2x$

D. $y \leq \frac{x}{2}$

E. $x = 2y$

Question 8
A feasible region is shown as the shaded region on the graph below:



The objective function for this problem is $gx + hy = k$. Given that the objective function maximises only at point B, which of the following statements about g and h is true:

A. g and h could be equal
B. g could be less than h, but not less than half h
C. g could be any value less than h
D. g could be 1.5 times h
E. g could be more than h but not as much as 1.5 times h

END OF MULTIPLE - CHOICE QUESTION BOOKLET