The Mathematical Association of Victoria

FURTHER MATHEMATICS

Trial Written Examination 1

2011

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

Student's 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	13	13			13
B	54	27	6	3	27
					Total 40

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, one bound reference, one approved graphics calculator or approved CAS calculator or CAS 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 white out liquid/tape.

Materials supplied

- Question and answer book of 36 pages, with a detachable sheet of miscellaneous formulas at the back
- Answer sheet for multiple-choice questions at the back.
- Working space is provided throughout the book.

Instructions

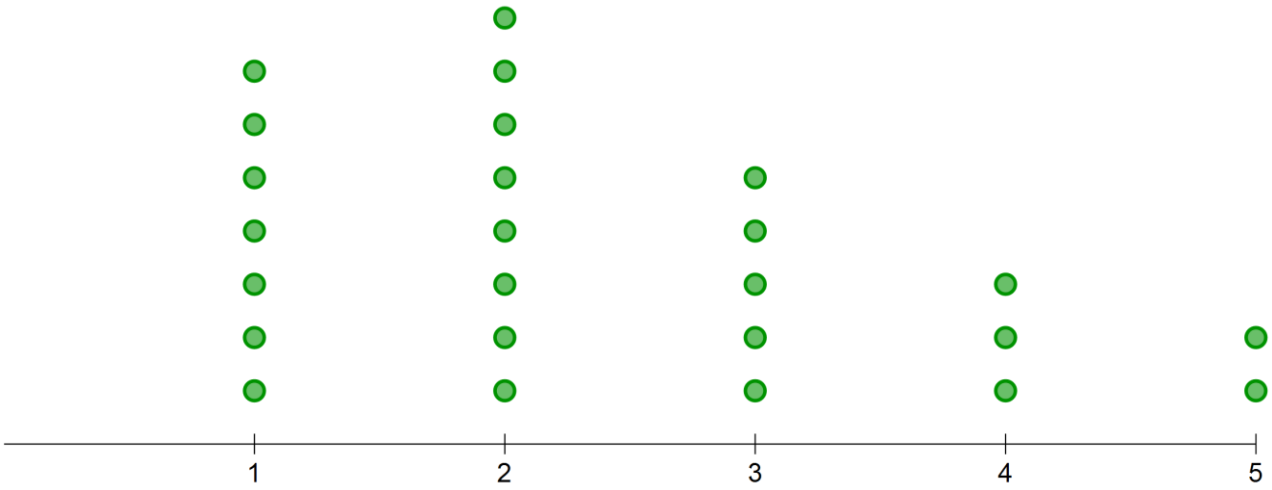
- Detach the formula sheet from the back of this book during reading time.
- Unless otherwise indicated, the diagrams in this book are NOT drawn to scale.

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

Core: Data analysis

The following information relates to Question 1, 2 and 3.

The dot plot below shows the distribution of the number of occupants recorded in cars driving through a round-about in a 10 minute time period.



Question 1

The mode of this distribution is

A. 1

B. 2

C. 3

D. 4

E. 8

Question 2

The median of this distribution is

A. 1

B. 2

C. 3

D. 4

E. 5

Question 3

The distribution of this data is best described as

A. bi-modal

B. symmetrical

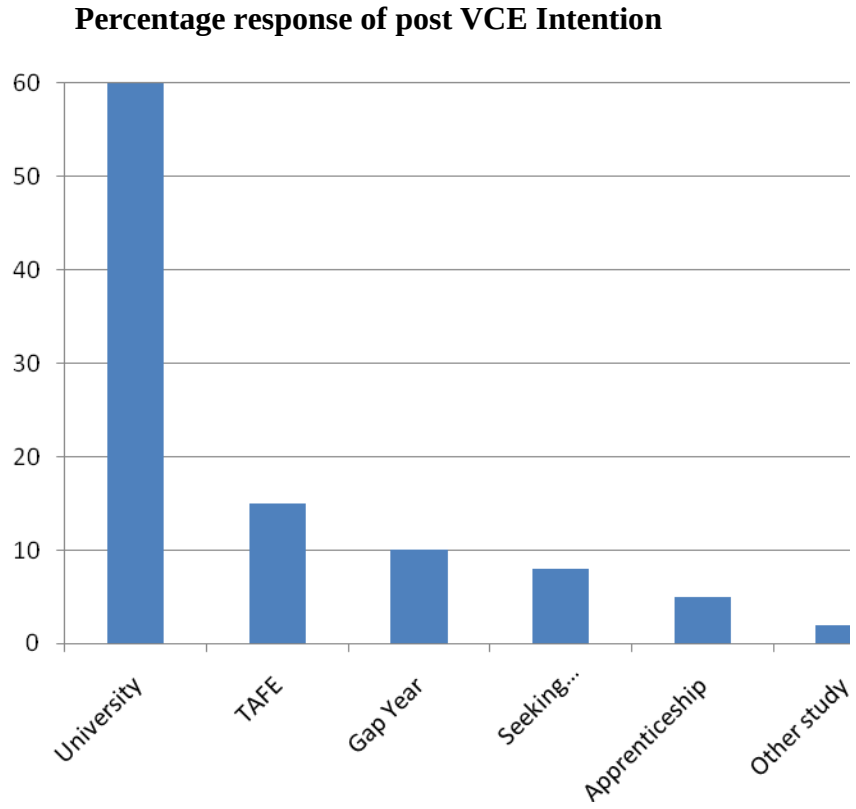
C. random

D. positively skewed

E. negatively skewed

Question 4

One hundred and fifty Year Twelve students were surveyed as to their career aspirations after they completed their VCE studies. The percentage responses are displayed in the graph below.



The number of students who are intending to pursue either University or TAFE study in the year after completing their VCE is closest to

A. 75

B. 83

C. 90

D. 105

E. 112

The following information relates to Questions 5 and 6.

The useful life of a computer is known to be approximately normally distributed with a mean of 3.25 years and a standard deviation of 0.5 years.

Question 5

A computer that has a useful life of 2.5 years will have a z-score of

A. -5

B. -1.5

C. -0.5

D. 0.75

E. 1.5

Question 6

The percentage of computers that have a useful life of between 2.75 and 4.25 years is closest to

A. 64

B. 68

C. 82

D. 92

E. 98

Question 7

Collected sample data was summarised as provided in the following table. The frequency of a score of 4 was unknown.

x	f
1	4
2	6
3	8
4	a

The mean score of this data is 3. The value of 'a' is closest to

A. 3

B. 9

C. 10

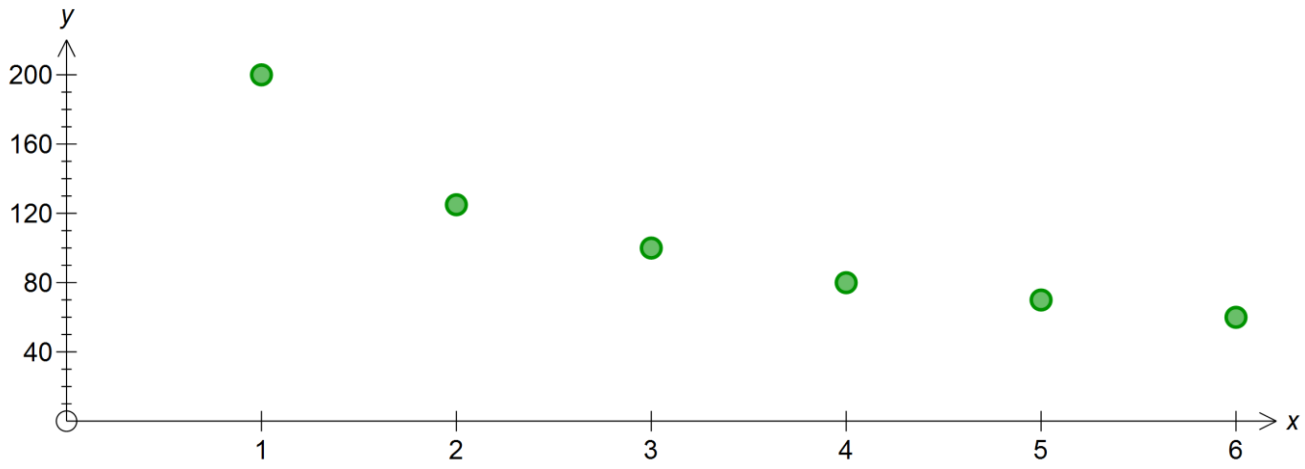
D. 12

E. 14

Question 8

The following raw data was used to construct the scatterplot shown below.

x	1	2	3	4	5	6
y	200	125	100	80	70	60



To transform the data to produce a linear graph, it would **not** be appropriate to plot

A. y against x^2

B. y against $\frac{1}{x}$

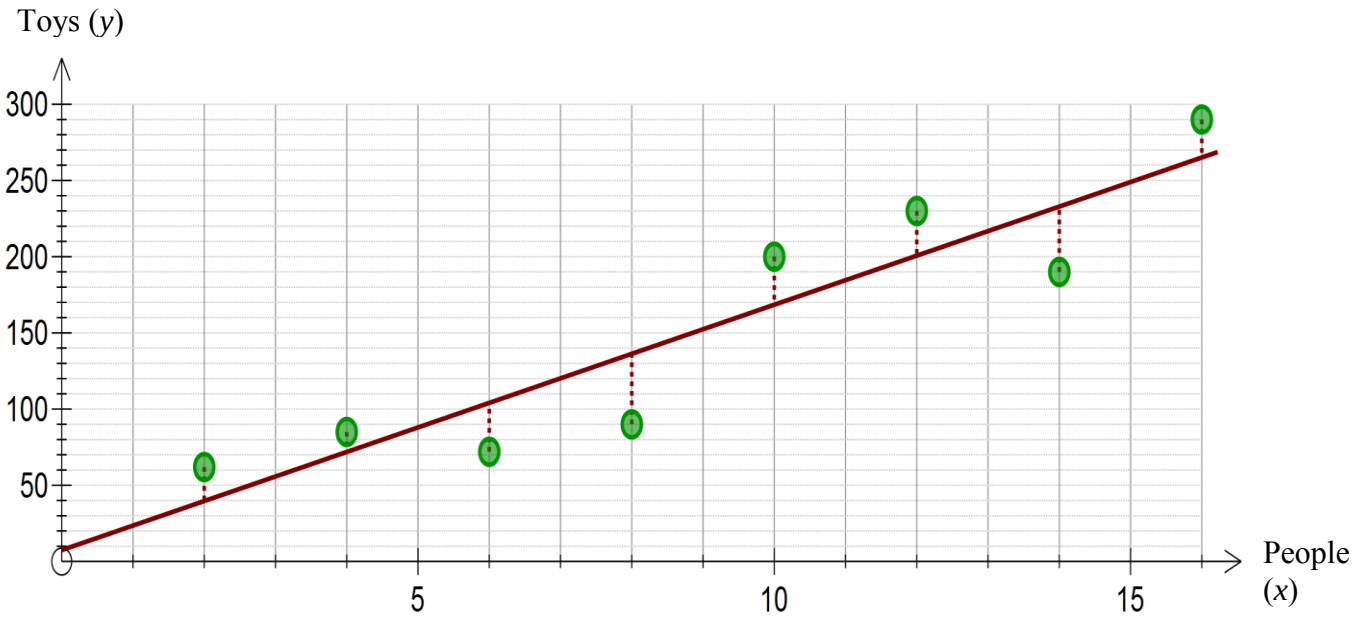
C. y against $\log x$

D. $\log y$ against x

E. $\frac{1}{y}$ against x

The following information relates to Questions 9 and 10.

In the data below, x represents the number of people working in a factory assembling toys and y is the number of toys that can be assembled in a work-shift.



Question 9

For this data it has been calculated that $\bar{x} = 9$, $\bar{y} = 152.38$, $s_x = 4.90$, $s_y = 87.19$, and $r = 0.909$
The equation of the least squares regression line will be closest to

A. $y = 7 + 16x$

B. $y = 10 + 16x$

C. $y = 5 + 17x$

D. $y = 10 + 17x$

E. $y = 10 + 18x$

Question 10

The points of a residual plot for this data will show

A. a random spread of points

B. an equal number of points above and below the *x*-axis

C. a symmetrical pattern

D. a linear pattern with a positive gradient

E. a linear pattern with a negative gradient

Question 11

The data below represents the quarterly sales figures for a Year Twelve Study Guide over a two year period.

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total sales
Year 1	3215	407	212	3400	7234
Year 2	3170	425	290	3310	7195

The seasonal index for the second quarter is closest to

A. 0.0563

B. 0.0577

C. 0.0591

D. 0.2307

E. 0.4613

Question 12

The seasonal indices for the number of packets of potato chips sold at a school canteen are given below.
The seasonal index for Friday is missing.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Seasonal index	0.62	0.84	1.26	1.30	

If the number of packets of potato chips sold on a Friday was 62, then the deseasonalised figure for Friday is closest to

A. 60

B. 61

C. 62

D. 63

E. 77

Question 13

The table below gives the number of litres of petrol sold by a service station over a twelve week period.

Week	1	2	3	4	5	6	7	8	9	10	11	12
Sales (1000L)	17	21	19	23	18	16	20	18	22	20	15	22

The four point moving mean centred on week 5, in thousands of litres, will be

A. 18.75

B. 19

C. 19.125

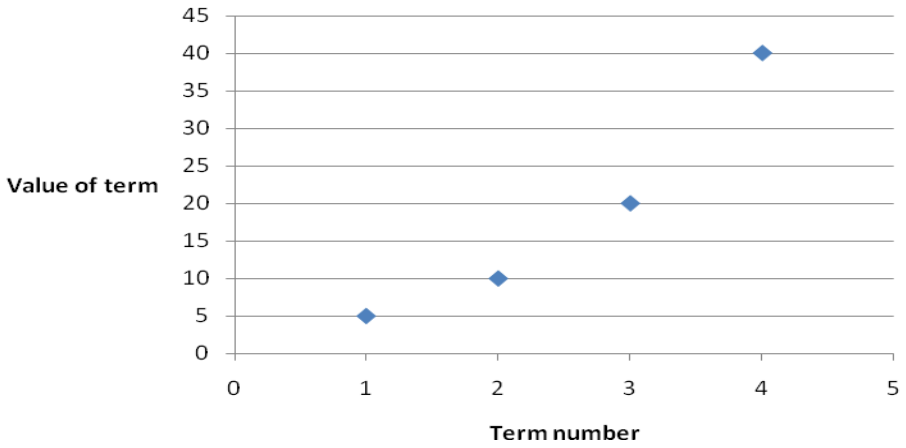
D. 19.5

E. 19.625

END OF CORE

Module 1: Number patterns

Question 1



The first four terms of a geometric sequence are plotted above. The common ratio of the geometric sequence is

A. $\frac{1}{2}$

B. 1

C. 2

D. 5

E. 10

Question 2

In a geometric sequence the first term is 412 and the third term is 3708. The fourth term could be

A. −11 124

B. −1 236

C. 1 648

D. 4 120

E. 7 713

Question 3

The difference equation $f_n - f_{n-1} = 7,\ f_0 = -2$ describes the sequence f_0, f_1, f_2 given by

A. $-2, -9, -16$

B. $-2,\ 5,\ 12$

C. $5,\ 12,\ 19$

D. $7,\ 9,\ 11$

E. $9,\ 16,\ 23$

Question 4

A sequence is generated by the difference equation $a_{n+2} = a_{n+1} + a_n$

If $a_1 = 3$ and $a_3 = -5$, then a_2 is equal to

A. -8

B. -4

C. -2

D. -1

E. 8

Question 5

$1000 is invested at 5% per annum, compounding annually for 6 years. To calculate the value of the return after 6 years you could set up the a sequence with the characteristics

A. arithmetic $a = 1000$, $d = 0.05$ Find t_7

B. arithmetic $a = 1000$, $d = 1.05$ Find t_7

C. geometric $a = 1000$, $r = 0.05$ Find t_6

D. geometric $a = 1000$, $r = 1.05$ Find t_7

E. geometric $a = 1000$, $r = 1.05$ Find t_6

Question 6

The local supermarket is giving away prizes to shoppers each day to attract more customers to the store. On Monday 4 prizes were given away and on Thursday 13 prizes were given away If the number of prizes given away each day form the terms of an arithmetic sequence, then the total number of prizes given away in the first seven days of the promotion is equal to

A. 3

B. 22

C. 77

D. 91

E. 182

Question 7

The number of terms in the arithmetic sequence $6, -1, -8, -15, \ldots\ldots\ldots -281$ is

A. 10

B. 40

C. 41

D. 42

E. 43

Question 8

A ball is dropped from a height of 3 metres. After the first bounce it rises to a height of 2 metres. In subsequent bounces the ball rises to $\frac{2}{3}$ of the previous bounce. The total distance travelled, in metres, before the ball comes to rest is

A. $4\frac{1}{2}$

B. 6

C. $7\frac{1}{2}$

D. 9

E. 15

Question 9

The number of bacteria in a culture is increasing by 10% every hour. Initially there were 12 000 bacteria present. After seven hours the bacteria population would be closest to

A. 12 866

B. 21 259

C. 23 385

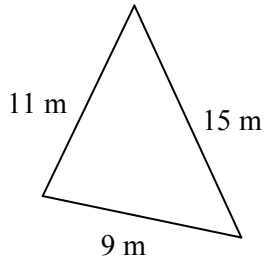
D. 25 723

E. 92 400

END OF MODULE 1

Module 2: Geometry and trigonometry

Question 1



The area of the triangle shown above, in m^2, correct to one decimal place is

A. 38.5

B. 49.2

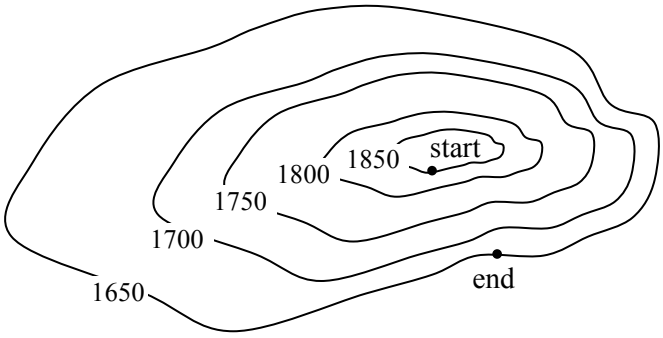
C. 49.5

D. 58.3

E. 58.5

Question 2

The contour map below has contour lines drawn at intervals of 50 metres.
The start and end of a ski run are marked on this map.
It is known that angle of elevation of the start of the ski run from the end is 25˚.



The shortest distance, in metres, from the start to the end of the ski run is closest to

A. 180

B. 200

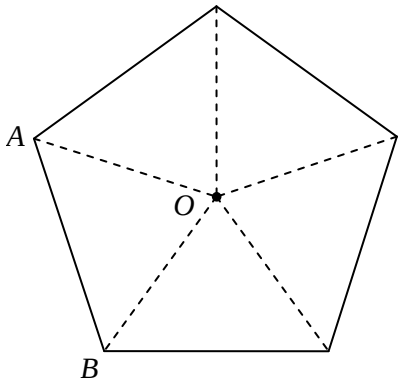
C. 220

D. 430

E. 470

Question 3

A regular pentagon with side length *AB* and centre *O* is shown below.



The angle *AOB* is equal to

A. 45˚

B. 54˚

C. 60˚

D. 72˚

E. 108˚

Question 4

A waterfall is located 8.5 km from a campsite on a bearing of 232˚.
How many kilometres south of the campsite is the waterfall?

A. 5.2

B. 6.6

C. 6.7

D. 10.8

E. 10.9

Question 5

Two sets of traffic lights are 4 km apart on a main road.
These traffic lights are shown on a map that is drawn to the scale 1 : 500,000.

On the map, the distance between the traffic lights will be

A. 0.8 cm

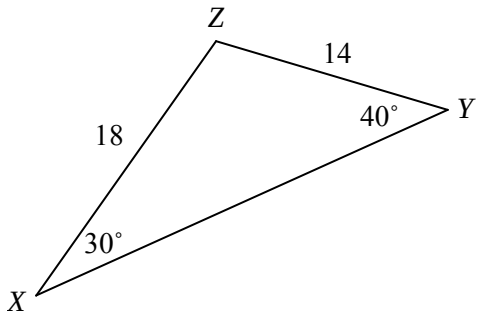
B. 1.25 cm

C. 2 cm

D. 2.5 cm

E. 5 cm

Question 6



The length *XY* in the triangle shown above is given by

A. $\sqrt{18^2 + 14^2}$

B. $\sqrt{18^2 + 14^2 - 2 \times 18 \times 14 \times \cos 70°}$

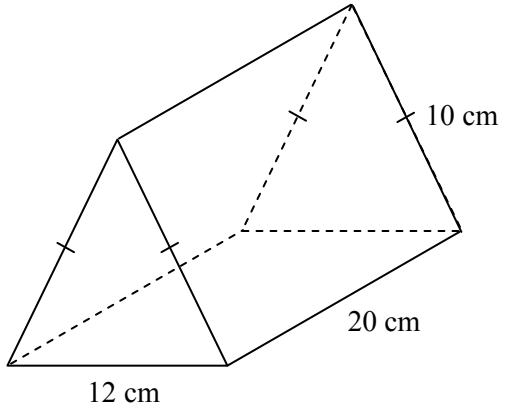
C. $\dfrac{18 \times \sin 30°}{\sin 40°}$

D. $\dfrac{18°}{\sin 40°}$

E. $\dfrac{14 \sin 110°}{\sin 30°}$

Question 7

A block of wood in the shape of an isosceles triangular prism is shown below.



All surfaces of the block of wood are to be painted. The total surface area, in cm^2, is

A. 720

B. 736

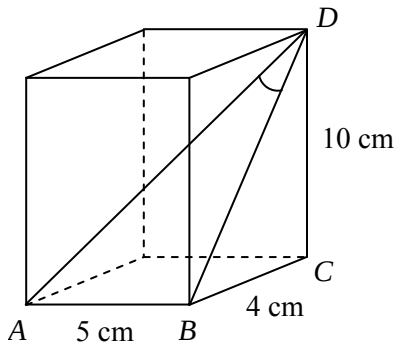
C. 760

D. 832

E. 960

Question 8

The rectangular prism shown below has length $AB = 5$ cm, width $BC = 4$ cm and height $CD = 10$ cm.



The angle ADB is closest to

A. 21.8°

B. 24.1°

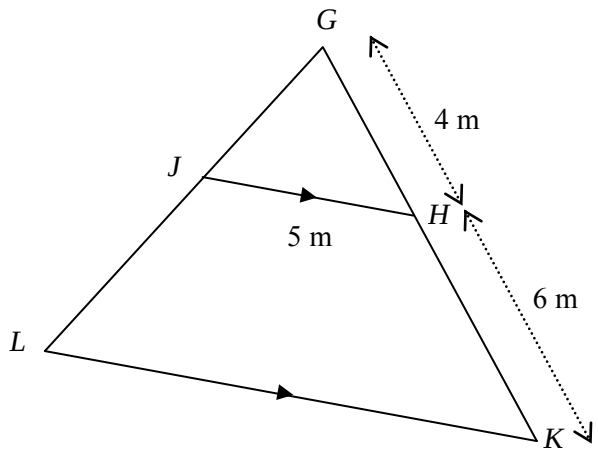
C. 24.9°

D. 26.6°

E. 27.7°

Question 9

Some girls are playing a ball game.
At one instant in the game, Hillary, *H*, was 4 metres from the goal, *G*.
Kate, *K*, and Jacqui, *J*, were 6 metres and 5 metres from Hillary respectively.
The line joining Lyn, *L*, and Kate was parallel to the line joining Jacqui and Hillary.



How many metres was Lyn from Kate at this instant in the game?

A. 7

B. 7.5

C. 11

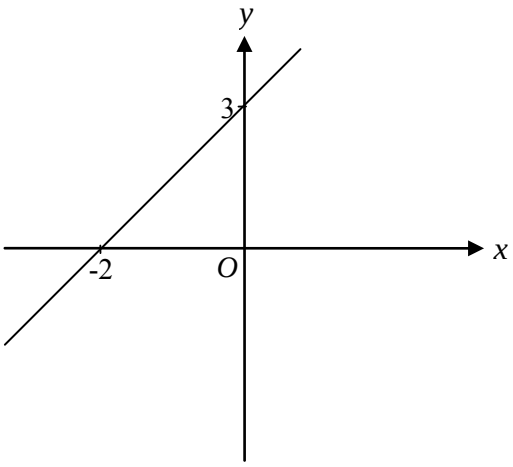
D. 12.5

E. 13

END OF MODULE 2

Module 3: Graphs and relations

Question 1



The equation of the straight line graph shown above is

A. $3x + 2y = 6$

B. $3y - 2x = 6$

C. $3y = 2x$

D. $3x - 2y = -6$

E. $3x + 2y = -6$

Question 2

The equation of the straight line with a y-intercept of -2, and passing through the point (3, 4) is

A. $4x - 5y = 10$

B. $4x - 3y = 2$

C. $3x - 4y = 2$

D. $2x - 3y = 2$

E. $2x - y = 2$

Question 3

The cost, C dollars, of hiring a minibus for a day is given by the equation $C = 0.1d + 120$, where d is the number of kilometres travelled in the day. Nigel was charged \$151 for the hire of a minibus for a day. The number of kilometres travelled in the minibus was closest to

A. 135

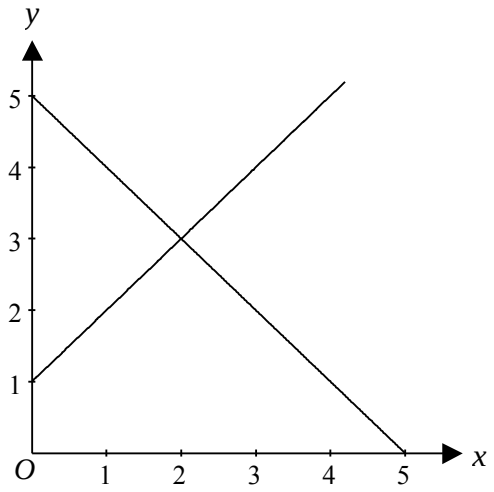
B. 271

C. 310

D. 320

E. 2710

Question 4



The lines $y = x + 1$ and $x + y = 5$ are drawn in the graph above.

A point that satisfies both $x + y < 5$ and $y \geq x + 1$ is

A. (4, 2)

B. (2, 2)

C. (2, 3)

D. (2, 4)

E. (1, 3)

Question 5

Lisa purchases 2 adult and 3 child tickets for her family to attend the *Kiss* Revival Concert. It costs her $425 for the tickets. It costs Tim $380 to purchase 1 adult and 4 child tickets. How much will Vivienne pay to purchase 2 adult and 2 child tickets?

A. $67

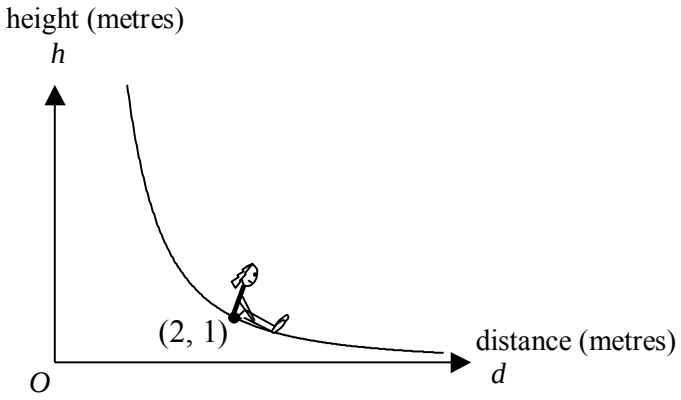
B. $112

C. $313.75

D. $358

E. $392

Question 6



The graph above represents part of a water slide at an entertainment park. An equation which models the relationship between the height of the slide, h metres, at distance, d metres, from O, is

A. $h = \frac{1}{2d^2}$

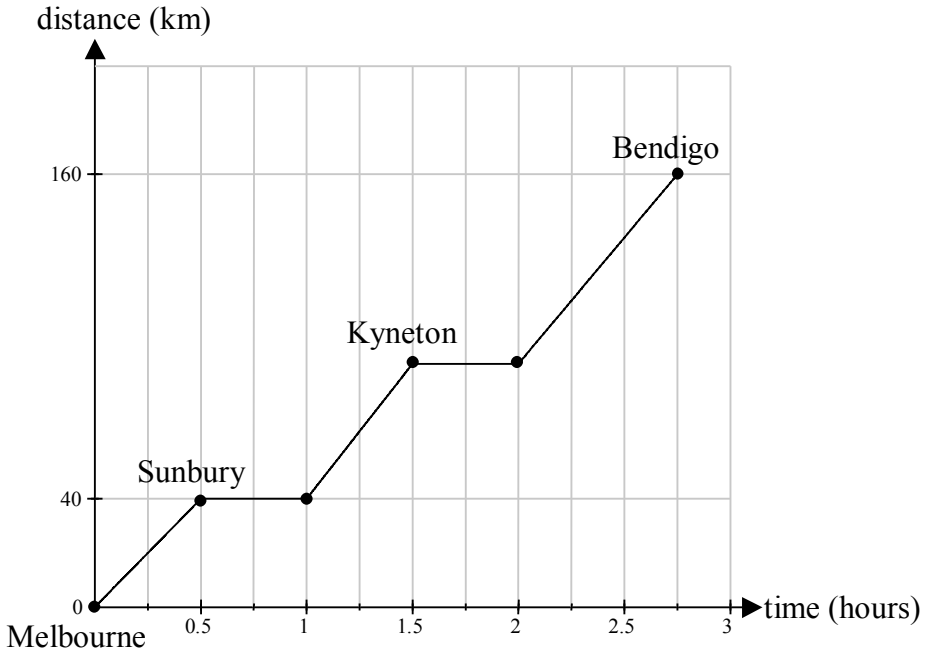
B. $h = \frac{2}{d^2}$

C. $h = \frac{4}{d^2}$

D. $h = \frac{1}{d}$

E. $h = \frac{1}{2d}$

Question 7



The graph above shows Felicity's trip driving 160 kilometres from Melbourne to Bendigo.
She travelled 40 km to Sunbury, where she stopped to visit a shop.
Between Sunbury and Kyneton she travelled at an average speed of 100 km/h.
After a coffee break at Kyneton, she travelled a further 45 minutes to reach Bendigo.

Felicity's average speed, in km/h, driving between Kyneton and Bendigo was closest to

A. 58

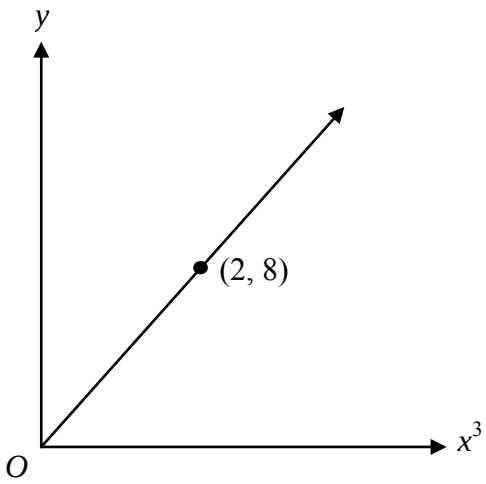
B. 93

C. 100

D. 110

E. 156

Question 8



In the graph above, the rule connecting y and x is

A. $y = x$

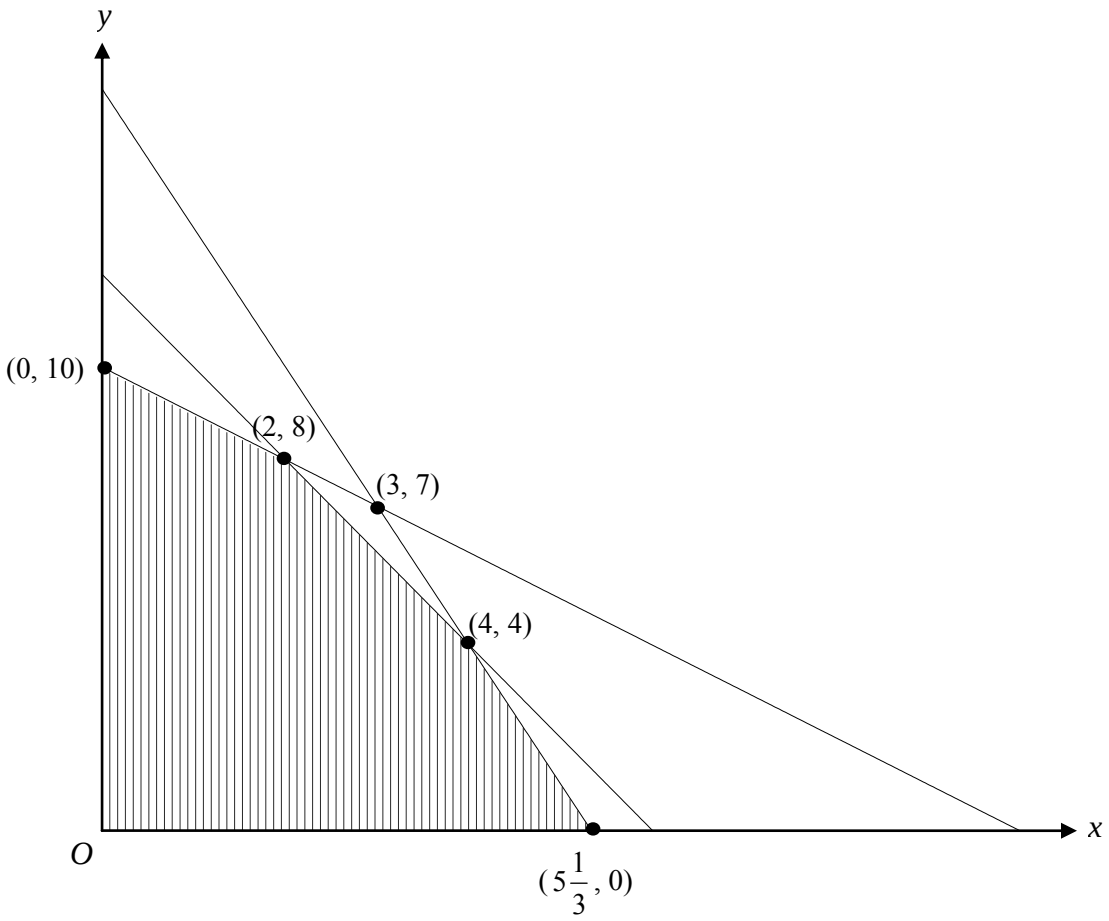
B. $y = 4x$

C. $y = x^3$

D. $y = 4x^3$

E. $y = \frac{1}{4}x^3$

Question 9



In the above graph, the shaded region, with boundary included, represents the feasible region for a linear programming problem. The objective function for this problem is $P = 3x + 2y$.

The co-ordinates of the point which maximises P within the feasible region is

A. (0, 10)

B. (2, 8)

C. (3, 7)

D. (4, 4)

E. $(5\frac{1}{3}, 0)$

END OF MODULE 3

Module 4: Business-related mathematics

Question 1

A discount of 40% is offered on a $300 camera at a sale.
The price of the camera after the discount has been applied is

A. $120

B. $180

C. $214

D. $220

E. $260

Question 2

The compound interest on $50,000 invested at 12% per annum for four years, compounding quarterly would be given by

A. $50{,}000 \times 1.03^{16} - 50{,}000$

B. $50{,}000 \times 1.04^{16} - 50{,}000$

C. $50{,}000 \times 1.12^{4}$

D. $50{,}000 \times 1.03^{4}$

E. $50{,}000 \times 1.04^{4}$

Question 3

A $500,000 investment in perpetuity pays $1000 per fortnight.
The annual interest rate that applies to this perpetuity is

A. 0.2%

B. 2.4%

C. 4.8%

D. 5.2%

E. 10.4%

Question 4

The cost of staying one night in a motel is $171.60. This included 10% GST (Goods and Services Tax). This cost before the GST is added would be

A. $154.44

B. $156.00

C. $161.60

D. $171.60

E. $188.76

Question 5

A sum of money is invested for five years in a simple interest account paying interest at the rate of 4% per annum. $1000 interest is earned over the five year period. The amount of money invested would be

A. $200

B. $1000

C. $5000

D. $20,000

E. $25,000

Question 6

The value of a car depreciates by 20 cents for each kilometre it travels.
Initially the car's value is $30,000. It will be replaced when its value reaches $7000.
The number of kilometres the car will travel before it is replaced is

A. 115,000

B. 140,000

C. 150,000

D. 185,000

E. 460,000

Question 7

$150,000 is invested in an account paying interest of 6% per annum compounding monthly. Each month, after interest has been paid, an additional $700 is deposited into the account.
At the end of 10 years, the balance of this account will be closest to

A. $158,300

B. $234,000

C. $243,000

D. $387,700

E. $425,700

Question 8

A new oven in a bakery cost $8000 to purchase. Each year it will depreciate by 15% of its value at the start of that year. The total amount by which the oven will depreciate over five years is closest to

A. $1200

B. $2000

C. $3550

D. $4450

E. $6000

Question 9

Under a hire purchase agreement a $500 washing machine is purchased for $100 deposit and $15 per month for three years. The effective rate of interest per annum that is applied to this hire purchase agreement is closest to

A. 9.3%

B. 11.7%

C. 14.5%

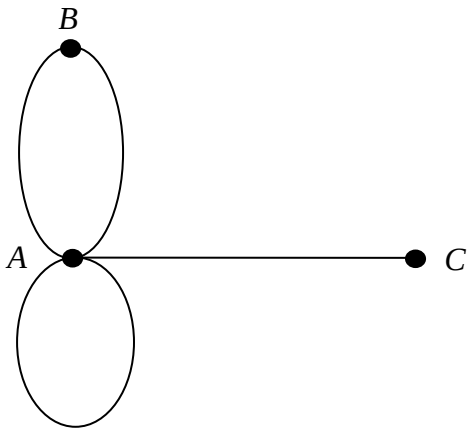
D. 18.2%

E. 22.7%

END OF MODULE 4

Module 5: Networks and decision mathematics

Question 1



The sum of the degrees of the vertices in the above graph is equal to

A. 3

B. 4

C. 5

D. 7

E. 8

Question 2

A connected planar graph has 5 faces. This graph could have

A. 6 vertices and 9 edges

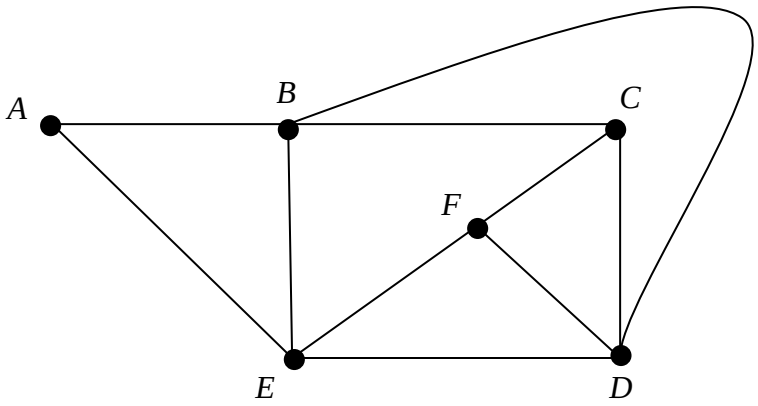
B. 9 vertices and 6 edges

C. 8 vertices and 12 edges

D. 12 vertices and 8 edges

E. 10 vertices and 7 edges

Question 3



For the graph shown above, an Euler path is given by

A. *ABEFDBC*

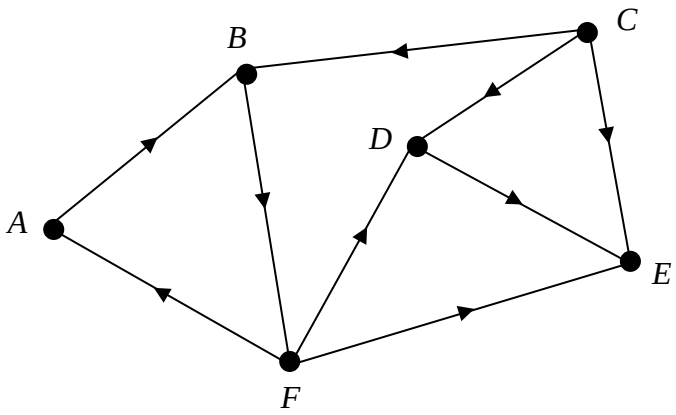
B. *FEABEDBCDFC*

C. *FCBDEAB*

D. *CBAEFDC*

E. *EABEDCBDFE*

Question 4



If M is the adjacency matrix for the above network, vertex E is reachable from vertex A is shown by

A. M

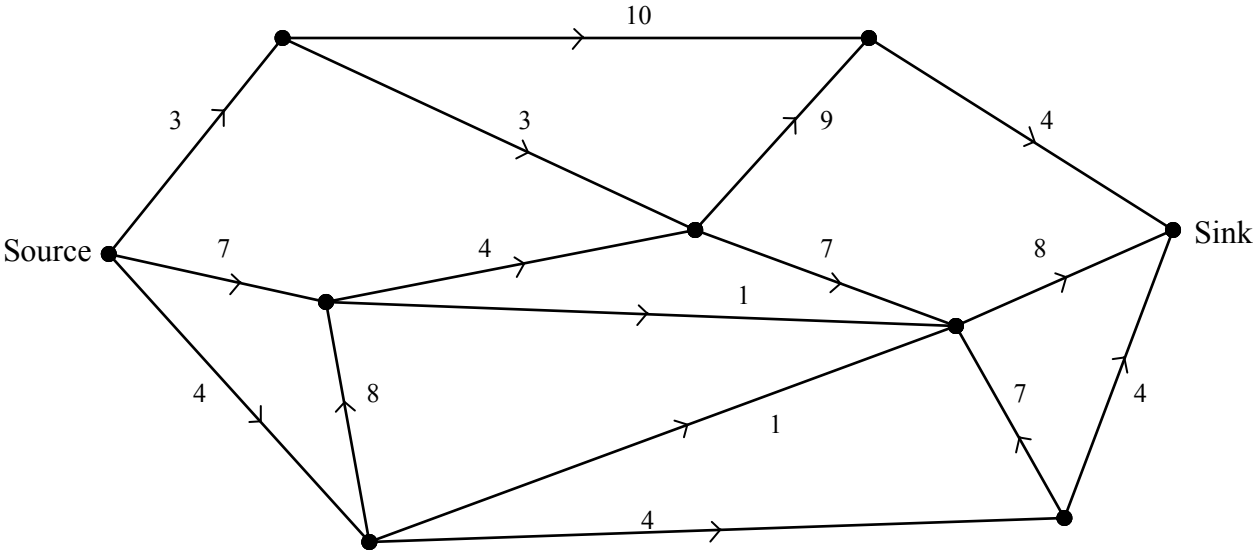
B. M^2

C. M^3 and M^4

D. M and M^3

E. M and M^4

Question 5



In the network above, the values on the edges give the maximum flow possible between vertices. The arrows indicate the direction of the flow. The maximum flow from source to sink is

A. 12

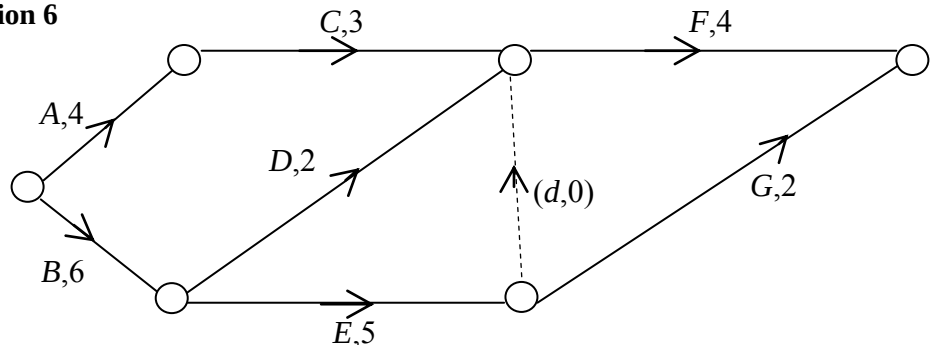
B. 13

C. 14

D. 16

E. 25

Question 6



In the above network the immediate predecessors for activity *F* are

A. *C* and *D*

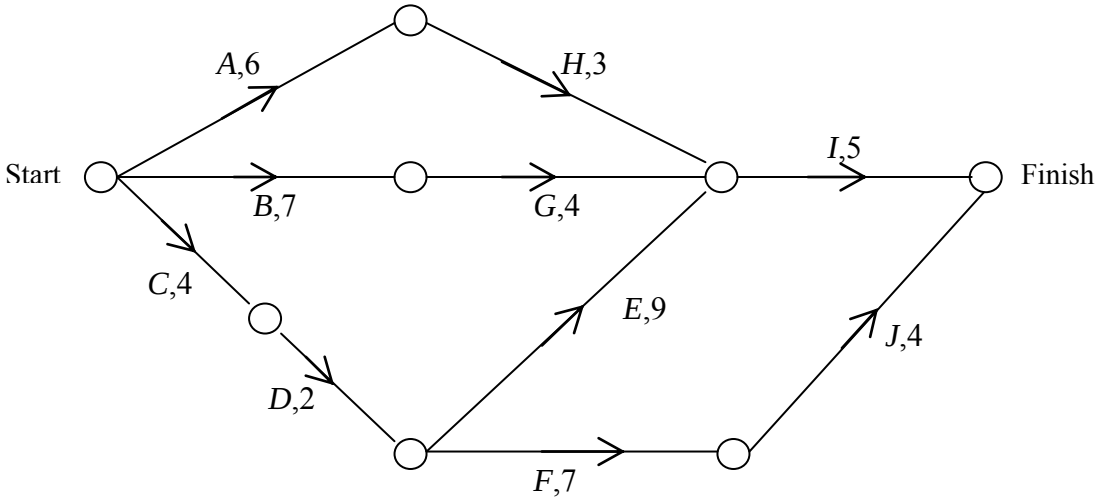
B. *A* and *C*

C. *C*, *D* and *E*

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

E. *A*, *C*, *D*

Question 7



The earliest completion time of this project is

A. 14

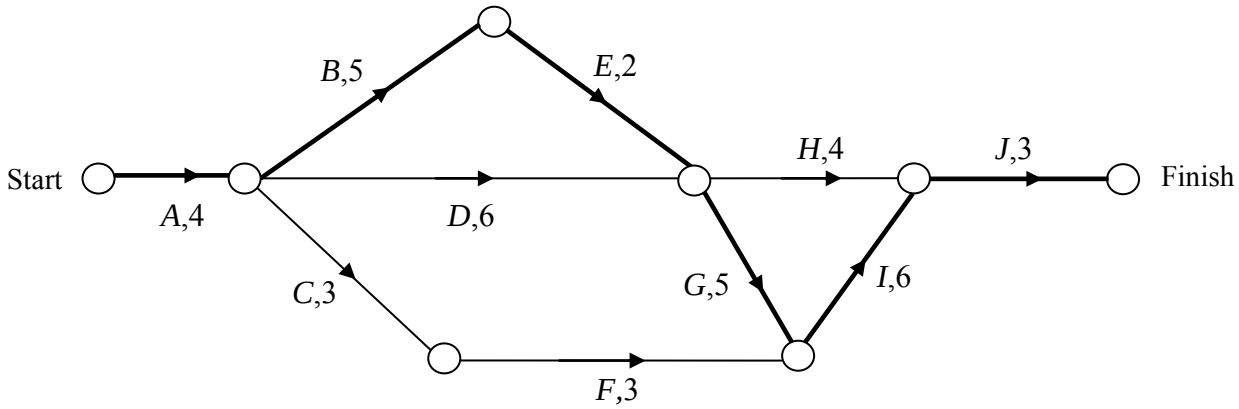
B. 16

C. 17

D. 19

E. 20

Question 8



The project network above, with the critical path as indicated, *ABEGIJ*, gives the time in days that it takes to complete the tasks in a building project.

Some of the activities can be reduced in time by employing more workers. The table below shows the activities that can have additional workers employed and the maximum possible reduction time in days.

Activity	Maximum reduction (days)
B	3
D	1
G	2

If additional workers are employed, the shortest time, in days, in which the project can be completed is

A. 20

B. 21

C. 22

D. 23

E. 24

Question 9

The table below shows the time in hours it takes Abigail, *A*, Belinda, *B*, and Clare, *C*, to complete tasks *D*, *E* and *F* in a model they are constructing.

	D	*E*	*F*
A	4	6	6
B	3	5	7
C	5	2	3

If they each only want to complete one task in the project, the shortest time in which the project can be completed is

A. 9

B. 11

C. 12

D. 13

E. 18

END OF MODULE 5

Module 6: Matrices

The following information relates to Questions 1 and 2.

Let $M = \begin{bmatrix} 3 & 7 \end{bmatrix}$, $N = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$ and $P = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$.

Question 1

Which one of the following matrix products does not exist?

A. PM

B. NM

C. MP

D. NP

E. MN

Question 2

The determinant of matrix N is

A. -2

B. $-\frac{1}{2}$

C. 0

D. $\frac{1}{2}$

E. 2

Question 3

When written in matrix form, the simultaneous equations $y = 2x - 1$ and $6y + 3x = 3$ would be

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

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

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

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

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

Question 4

A bushwalker walked to location *W* on the first day of a five day hike.
She then followed the transition matrix shown below from day to day.

$$\begin{array}{c} \text{this location (today)} \\ \begin{array}{ccccc} V & W & X & Y & Z \end{array} \\ \left[\begin{array}{ccccc} 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \end{array}\right] \begin{array}{l} V \\ W \\ X \\ Y \\ Z \end{array} \end{array} \quad \text{next location (tomorrow)}$$

The location where the bushwalker ends her five day hike ends is

A. *V*

B. *W*

C. *X*

D. *Y*

E. *Z*

Question 5

The number of litres of fuel required to fill the petrol and oil tanks of a car and a van are shown in the matrix below.

$$Litres\ of\ Fuel = \begin{matrix} \\ petrol \\ oil \end{matrix} \begin{matrix} \begin{matrix} car & van \end{matrix} \\ \begin{bmatrix} 40 & 70 \\ 5 & 8 \end{bmatrix} \end{matrix}$$

The cost of one litre of each fuel purchased from service station *A* and service station *B* is shown in the following cost matrix.

$$Cost\ per\ litre\ (\$) = \begin{matrix} \\ station\ A \\ station\ B \end{matrix} \begin{matrix} \begin{matrix} petrol & oil \end{matrix} \\ \begin{bmatrix} 1.60 & 5.00 \\ 1.50 & 6.00 \end{bmatrix} \end{matrix}$$

A matrix that contains the cost, in dollars, of filling the tanks of a car and a van with petrol and oil from service station *A* and service station *B* would be

A. $\begin{bmatrix} 64 & 105 \\ 25 & 48 \end{bmatrix}$

B. $\begin{bmatrix} 41.60 & 75 \\ 6.50 & 14 \end{bmatrix}$

C. $\begin{bmatrix} 64 & 350 \\ 7.50 & 48 \end{bmatrix}$

D. $\begin{bmatrix} 169 & 620 \\ 20 & 73 \end{bmatrix}$

E. $\begin{bmatrix} 89 & 152 \\ 90 & 153 \end{bmatrix}$

Question 6

The matrix product below provides information on how the number of staff working in different sections of a company has changed over a 10 year period.

$$\begin{bmatrix} 0 & 0 & 1.2 \\ 0 & 0.7 & 0 \\ 1.1 & 0 & 0 \end{bmatrix} \begin{bmatrix} \text{publicity} \\ \text{sales} \\ \text{technology} \end{bmatrix}$$

It can be concluded that the number of staff working in

A. technology has increased by 10%

B. publicity has increased by 20%

C. sales has increased by 70%

D. technology has increased by 20%

E. the company has not changed

Question 7

$T = \begin{bmatrix} 0.8 & 0.3 \\ 0.2 & 0.7 \end{bmatrix}$ is a transition matrix and $S_5 = \begin{bmatrix} 1150 \\ 850 \end{bmatrix}$ is a state matrix.

If $S_5 = T S_4$ then S_3 is closest to

A. $\begin{bmatrix} 800 \\ 1200 \end{bmatrix}$

B. $\begin{bmatrix} 1000 \\ 1000 \end{bmatrix}$

C. $\begin{bmatrix} 1175 \\ 825 \end{bmatrix}$

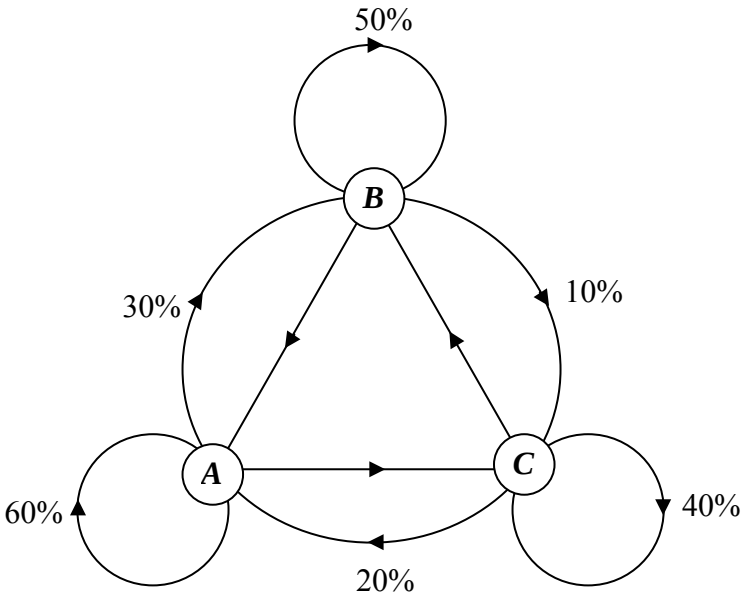
D. $\begin{bmatrix} 1188 \\ 813 \end{bmatrix}$

E. $\begin{bmatrix} 1194 \\ 806 \end{bmatrix}$

Question 8

Members of a gymnasium can choose to train at one of three locations: *A*, *B*, or *C*.
The transition diagram below shows the percentage of members who will train at the same location or will go to one of the other two locations to train from day to day.

Some information is missing from this diagram.



The percentage of members who will train at location *C* today, but will train at location *B* tomorrow is

A. 10%

B. 20%

C. 30%

D. 40%

E. 60%

Question 9

Each weekend Jerry buys one of four pizzas: Gourmet, *G*, Hawaiian, *H*, Italian, *I*, or Seafood, *S*.
The transition matrix below shows the way Jerry changes his preference for pizza from one week to the next.

	This weekend			
	G	*H*	*I*	*S*
	0.7	0.1	0.1	0.1	*G*
	0.05	0.6	0.2	0.15	*H*
	0.15	0.2	0.6	0.05	*I*
	0.1	0.1	0.1	0.7	*S*

Next weekend

Which one of the following statements is true?

A. If Jerry buys a Hawaiian pizza this week then he will not buy an Italian pizza next week.

B. Jerry prefers to buy Gourmet pizzas over Hawaiian pizzas.

C. Seafood pizzas are Jerry's favourite pizza.

D. Jerry will not buy the same type of pizza two weeks in a row.

E. In the long run Jerry will buy the same proportion of each type of pizza.

END OF MODULE 6

Further Mathematics Formulae Sheet

Core: Data Analysis

Standardised score: $z = \dfrac{x - \bar{x}}{s_x}$

Least squares line: $y = a + bx$ where $b = r\dfrac{s_y}{s_x}$ and $a = \bar{y} - b\bar{x}$

Residual value: residual value = actual value – predicted value

Seasonal index: seasonal index = $\dfrac{\text{actual figure}}{\text{deseasonalised figure}}$

Module 1: Number Patterns

arithmetic series: $a + (a+d) + ...+ (a+(n-1)d) = \dfrac{n}{2}\left[2a + (n-1)d\right] = \dfrac{n}{2}\left(a + l\right)$

geometric series: $a + ar + ar^2 + ... + ar^{n-1} = \dfrac{a(1-r^n)}{1-r}$, $r \neq 1$

infinite geometric series: $a + ar + ar^2 + ar^3 + ... = \dfrac{a}{1-r}$, $|r| < 1$

Module 2: Geometry and trigonometry

area of a triangle: $\dfrac{1}{2}bc\sin A$

Heron's formula: $A = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \dfrac{1}{2}(a+b+c)$

circumference of a circle: $2\pi r$

area of a circle: πr^2

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 cylinder: $\pi r^2 h$

volume of a prism: area of base × height

volume of a pyramid: $\dfrac{1}{3}$ area of base × height

Pythagoras' theorem: $c^2 = a^2 + b^2$

sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

cosine rule: $c^2 = a^2 + b^2 - 2ab\cos C$

Module 3: Graphs and relations

Straight line graphs

gradient (slope): $m = \frac{y_2 - y_1}{x_2 - x_1}$

equation: $y = mx + c$

Module 4: Business-related mathematics

simple interest: $I = \frac{Prt}{100}$

compound interest: $A = PR^n$ where $R = 1 + \frac{r}{100}$

hire purchase: effective rate of interest $\approx \frac{2n}{n+1} \times$ flat rate

Module 5: Networks and decision mathematics

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

Module 6: Matrices

determinant of a 2 × 2 matrix: $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$; $\det A = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$

inverse of a 2 × 2 matrix: $A^{-1} = \frac{1}{\det A}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ where $\det A \neq 0$

MULTIPLE CHOICE ANSWER SHEET

STUDENT NAME: …….

Circle the letter that corresponds to each correct answer.

SECTION A		**SECTION B**									
Compulsory		Answer THREE different modules.									
		Show EACH MODULE answered by shading the appropriate box and WRITING in the box below									
			☐ Number patterns			☐ Number patterns				☐ Number patterns	
			☐ Geometry and trigonometry			☐ Geometry and trigonometry				☐ Geometry and trigonometry	
			☐ Graphs and relatons			☐ Graphs and relatons				☐ Graphs and relatons	
			☐ Business-related maths			☐ Business-related maths				☐ Business-related maths	
	Core: **Data Analysis**		☐ Networks and decision maths			☐ Networks and decision maths				☐ Networks and decision maths	
1	A B C D E		☐ Matrices			☐ Matrices				☐ Matrices	
2	A B C D E										
3	A B C D E		**MODULE**			**MODULE**				**MODULE**	
4	A B C D E										
5	A B C D E	**1**	A B C D E		**1**	A B C D E		**1**	A B C D E		
6	A B C D E	**2**	A B C D E		**2**	A B C D E		**2**	A B C D E		
7	A B C D E	**3**	A B C D E		**3**	A B C D E		**3**	A B C D E		
8	A B C D E	**4**	A B C D E		**4**	A B C D E		**4**	A B C D E		
9	A B C D E	**5**	A B C D E		**5**	A B C D E		**5**	A B C D E		
10	A B C D E	**6**	A B C D E		**6**	A B C D E		**6**	A B C D E		
11	A B C D E	**7**	A B C D E		**7**	A B C D E		**7**	A B C D E		
12	A B C D E	**8**	A B C D E		**8**	A B C D E		**8**	A B C D E		
13	A B C D E	**9**	A B C D E		**9**	A B C D E		**9**	A B C D E		