The Mathematical Association of Victoria

Trial Exam 2014

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	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 39 pages, with a detachable sheet of miscellaneous formulas in the centrefold.
- Answer sheet for multiple-choice questions.
- Working space is provided throughout the book.

Instructions

- Detach the formula sheet from the centre of this book during reading time.
- Write your **name** in the space provided above on this page and on the answer sheet for multiple choice questions.
- Unless otherwise indicated, the diagrams in this 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.

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SECTION A

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 questions.

Core: Data analysis

Use the following information to answer Questions 1 and 2

The following set of numbers is arranged in **ascending** order. Two data values in the set, m and n, are positive whole numbers.

2, 2, m, 6, 9, 11, 11, 14, n, 21

Question 1

The calculation used to find the interquartile range is

A. $14 - m$

B. $n - m$

C. $11 - 6$

D. $n - 2$

E. $\frac{21 - 2}{4}$

Question 2

If the mean value of the set of data shown above is 10 then a possible value for n is

A. 14

B. 15

C. 16

D. 17

E. 18

Question 3

A Further Maths class did a test on Univariate data. The mean score was calculated to be 65% and the median was found to be 72%.

The distribution of scores for the class must

A. contain at least one outlier at the upper end
B. be symmetric
C. be negatively skewed
D. be positively skewed
E. be bimodal

Question 4

The relationship between the **time spent studying** (hours per week) and **exam performance** (below average, average, above average) is best displayed using

A. a histogram.
B. a time series plot.
C. a scatterplot.
D. parallel box plots.
E. back-to-back stem plots.

Use the following information to answer Questions 5 and 6

In a particular study the speed of a car at the time of braking, s, and the stopping distances, D, were recorded. The stopping distance depends on the speed of the car at the time of braking.

The table below contains the statistics calculated for the data

	Speed of car when brakes were applied s	Distance travelled after braking D
Mean	75 km/h	70 m
Standard deviation	3 km/h	6 m
Pearson's correlation coefficient	0.8	

Question 5

The standardised speed, z, for a car that was travelling at 82.5 km/h is

A. –2.5
B. –1.5
C. 1.5
D. 2.0
E. 2.5

Question 6

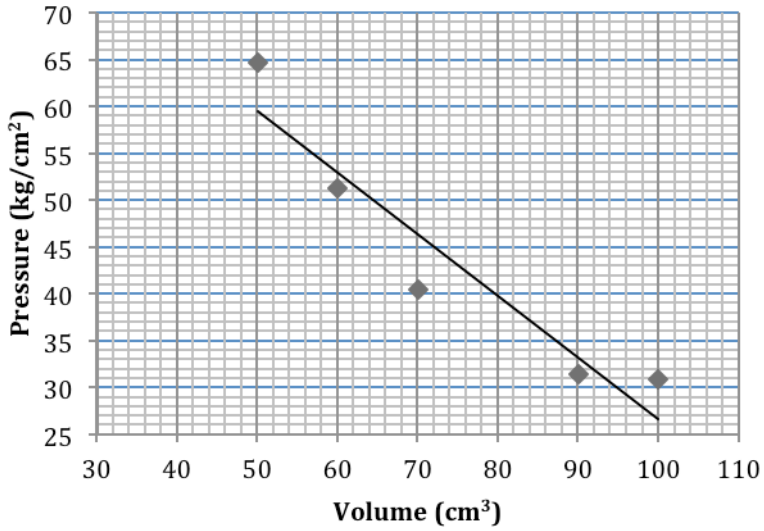
The least squares regression line that can predict the stopping distance from the speed at the time of braking is given by

A. $D = 0.4 \times s - 30$
B. $D = 1.6 \times s - 50$
C. $D = 0.4 \times s - 47$
D. $D = 1.6 \times s - 37$
E. $D = 0.8 \times s - 19$

Use the following information to answer Questions 7 and 8

The pressure P of gas corresponding to various volumes V is recorded as follows

V (cm^3)	50	60	70	90	100
P (kg/cm^2)	64.7	51.3	40.5	31.4	30.8



A least-squares regression line for the two variables V and P is shown on the graph and has the equation

$$P = 92.35 - 0.66 \times V \quad \text{where} \quad r = -0.9475$$

Question 7

Which of the following is **not** true for the line?

A. The residual for the data point (90, 31.4) will be negative
B. For every increase in 1 cm^3 of volume of gas the pressure decreases by 0.66 kg/cm^2
C. The line over-predicts the pressure for a volume of 70 cm^3
D. Using the line to predict the pressure for a volume of 80 cm^3 is a case of interpolation
E. 89.8% of the variation in pressure is caused by the variation in volume

Question 8

The residual plot of the above set of data reveals that a non-linear model is a better fit. In order to linearise the data, which one of the following approaches is most appropriate?

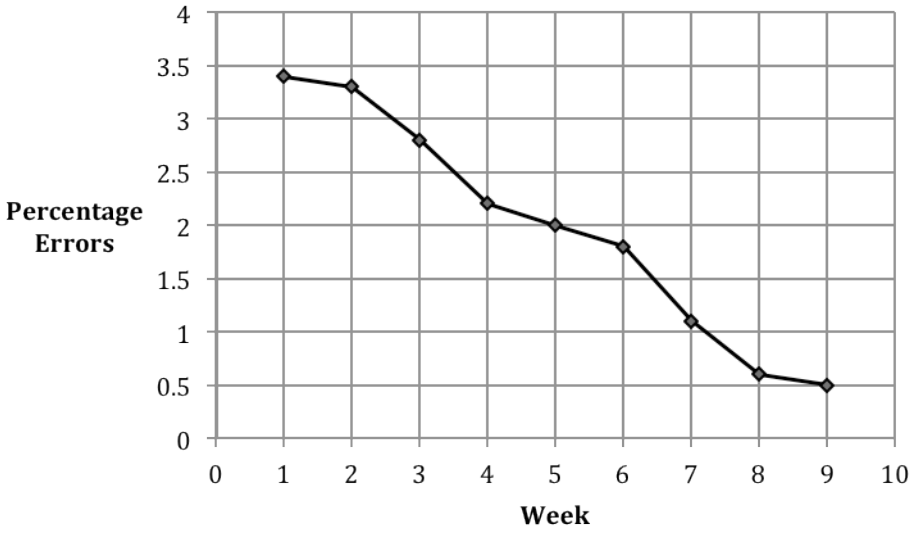
A. only reciprocal transformations
B. both reciprocal and logarithmic transformations
C. only square transformations
D. only logarithmic transformations
E. both square and reciprocal transformations

Question 9

The table below shows the weekly reduction in percentage errors (%) during a Maths tutorial program.

Week	1	2	3	4	5	6	7	8	9
Percentage Errors	3.4	3.3	2.8	2.2	2	1.8	1.1	0.6	0.5

A time series plot of the data is displayed.

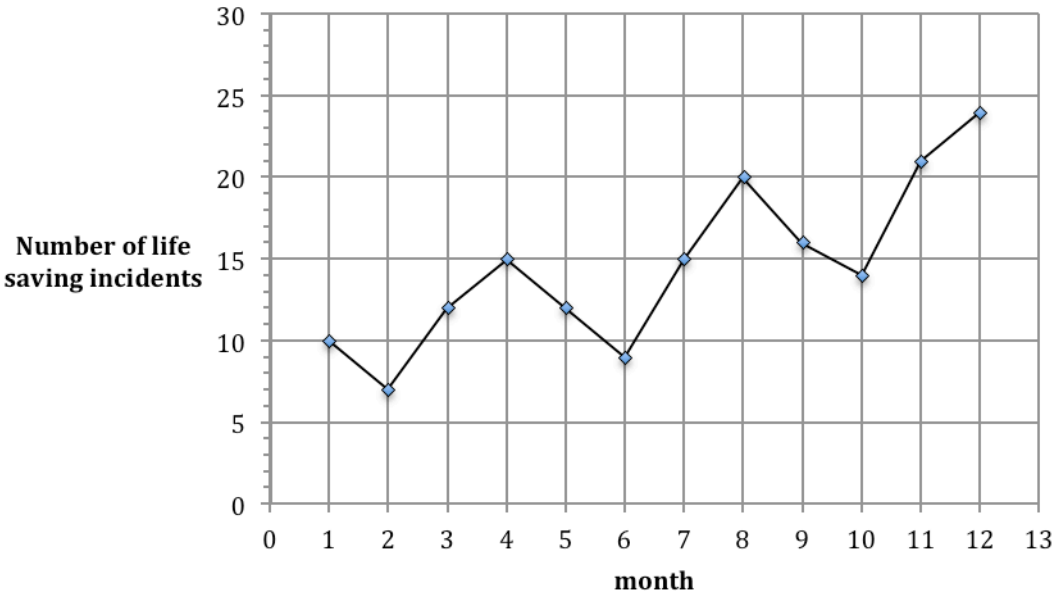


If a three median line is fitted to the data it would show that, on average, the decrease in errors per week was closest to

A. 0.33%
B. 0.39%
C. 0.41%
D. 0.45%
E. 0.49%

Use the following information to answer Questions 10 and 11

The time series plot below shows the number of life saving incidents at a surf beach during a 12 month period.



Question 10

The time series plot has

A. no trend

B. an increasing trend only

C. seasonal variation only

D. seasonal variation with an increasing trend

E. random variation with an increasing trend

Question 11

The data from the time series plot is presented in the table below.

Quarter	1	2	3	4	5	6	7	8	9	10	11	12
Number of life saving incidents	10	7	12	15	12	9	15	20	16	14	21	24

The centred **four** point moving average for Quarter 6 is determined using the calculation

A. $\frac{12+9+15+20}{4}$

B. $\frac{15+12+9+15}{4}$

C. $\frac{13.5+13.5}{2}$

D. $\frac{10.5+12}{2}$

E. $\frac{12.75+14}{2}$

Question 12

The given table displays seasonal indices at Eliza's hat shop for 2013.
The index for Summer is missing.

Summer	Autumn	Winter	Spring
	1	1	1.20

Eliza is hoping for sales to be the same in all four seasons for 2014.
To achieve this, sales in Summer would need to

A. increase by 20%

B. decrease by 20%

C. increase by 25%

D. decrease by 80%

E. increase by 80%

Question 13

A study was done to consider seasonal effects on the sales of ice cream.
An equation that predicts deseasonalised sales from quarter number was found to be

$$\textit{Deseasonalised sales} = 4.24 \times \textit{quarter number} + 1601.29$$

If quarter 27 was in winter which had a seasonal index of 0.72, then the predicted actual sales for the number of ice creams in that particular quarter would be closest to

A. 480

B. 1235

C. 1716

D. 2383

E. 2951

END OF SECTION A

SECTION B

Instructions for Section B

Select **three** modules and answer all questions within the modules selected 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.

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MODULE 1: Number Patterns

Before answering these questions you must **shade** the Number patterns box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

Question 1

In a geometric sequence, the fourth term is 20 and the fifth term is 10.
The first term is:

A. 1.25

B. 80

C. 110

D. 160

E. 320

Question 2

The sum 11 + 13 + 15 + …+ 33 is

A. 200

B. 231

C. 242

D. 264

E. 298

Question 3

In an arithmetic sequence the first four terms are -3, 4, 11, 18, ...

An expression for the nth term of the sequence T_n, is

A. $T_n = 7n - 10$

B. $T_n = 7n - 3$

C. $T_n = 7n + 1$

D. $T_n = 4n + 7$

E. $T_n = 7n - 1$

Question 4

Consider the sequence $2, 4, 6, 10, 16, ...$
A difference equation that generates the terms of this sequence is

A. $t_{n+1} = t_n + 2$, $t_1 = 2$

B. $t_{n+1} = 3t_n - 2$, $t_1 = 2$

C. $t_{n+1} = 2t_n - 4$, $t_1 = 2$

D. $t_{n+2} = t_{n+1} + t_n$, $t_1 = 2, t_2 = 4$

E. $t_{n+2} = t_{n+1} + t_n + 2$, $t_1 = 2, t_2 = 4$

Question 5

A sum of n terms for a geometric sequence is considered.
It is found that $S_1 = 1$, $S_2 = 3$ and $S_3 = 7$.
The fourth term, t_4, for this sequence is

A. 8

B. 11

C. 12

D. 13

E. 15

Question 6

A difference equation is defined by $t_n = 2t_{n-1} - t_{n-2}$.

If $t_4 = 7$ and $t_3 = 6$ then t_2 is

A. 4

B. 5

C. 8

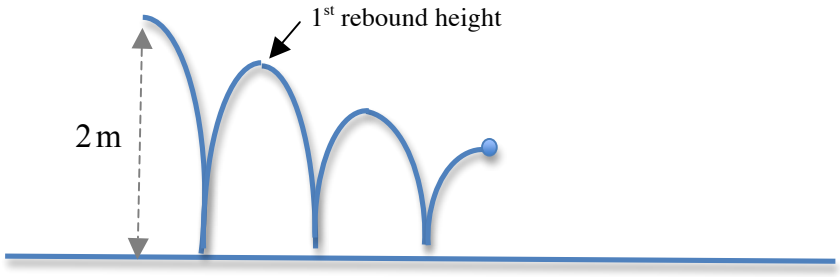
D. 19

E. 20

Use the following information to answer Questions 7, 8 and 9

Michael bounces a super-ball with a rebound height that decreases by 5% after each bounce.

The ball is dropped from a vertical height of 2 metres.



Question 7

The rebound height of the ball, to the nearest centimetre, after the third bounce is

A. 181

B. 171

C. 170

D. 163

E. 50

Question 8

The difference equation that specifies the height, H_n, after the n th bounce is given by

A. $H_n = 0.05H_{n-1}, \quad H_1 = 2$

B. $H_n = 0.05H_{n-1}, \quad H_0 = 2$

C. $H_n = 0.95H_{n-1}, \quad H_1 = 1.9$

D. $H_n = 0.95H_{n-1}, \quad H_1 = 2$

E. $H_n = H_{n-1} - 0.05, \quad H_0 = 2$

Question 9

The total distance, in metres, the ball travels is

A. 38

B. 40

C. 76

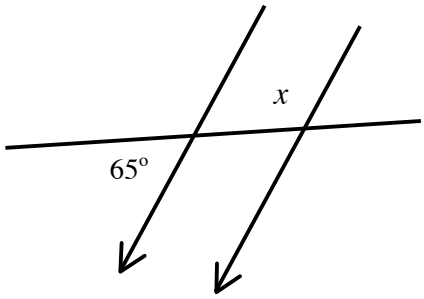
D. 78

E. 80

MODULE 2: Geometry and trigonometry

Before answering these questions you must **shade** the Geometry and trigonometry box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

Question 1

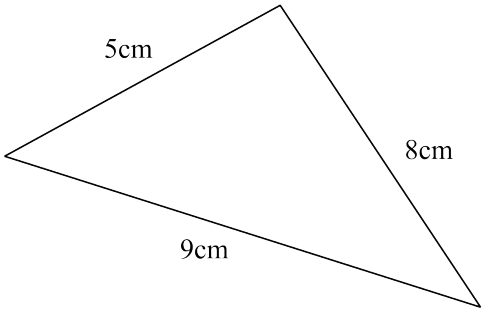


The angle x, in degrees, shown in the diagram above is

A. 25
B. 65
C. 105
D. 115
E. 125

Question 2

A triangle has side lengths of 5 cm 8 cm and 9 cm as shown.

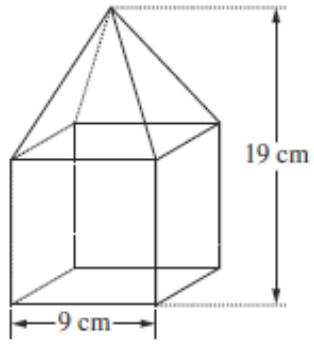


Using Heron's formula, the area of this triangle in cm^2 is

A. $\sqrt{24}$
B. $\sqrt{360}$
C. $\sqrt{396}$
D. $\sqrt{792}$
E. $\sqrt{1080}$

Question 3

A square pyramid fits exactly on top of a cube to form a solid.



The volume of the solid is

A. 513 cm^3

B. 999 $cm^{3`}$

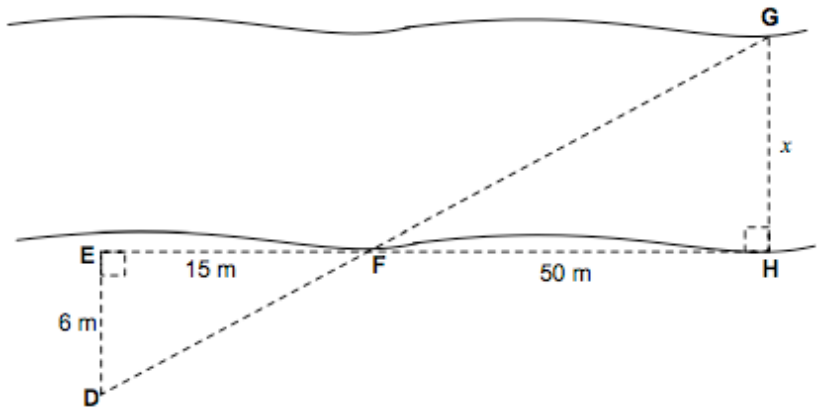
C. 1134 cm^3

D. 1242 cm^3

E. 1539 cm^3

Question 4

Two trees G and H are located on opposite banks of the river. A surveyor takes measurements along the south bank using landmarks at D, E and F as shown in the diagram below.



The width of the river, x metres, is given by

A. $\dfrac{6 \times 50}{15}$

B. $\dfrac{6 \times 15}{50}$

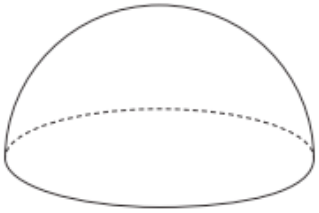
C. $\dfrac{15 \times 50}{6}$

D. $\dfrac{50}{15 \times 6}$

E. $\dfrac{15}{50 \times 6}$

Use the following information to answer Questions 5 and 6

A solid glass paperweight with a diameter of 4 cm is in the shape of a hemisphere as shown below.



Question 5

The total surface area of the paperweight, in square centimetres, is

A. 8π

B. 12π

C. 16π

D. 32π

E. 48π

Question 6

A similar glass paperweight that has four times the total surface area will have a diameter of

A. 8 cm

B. 12 cm

C. 16 cm

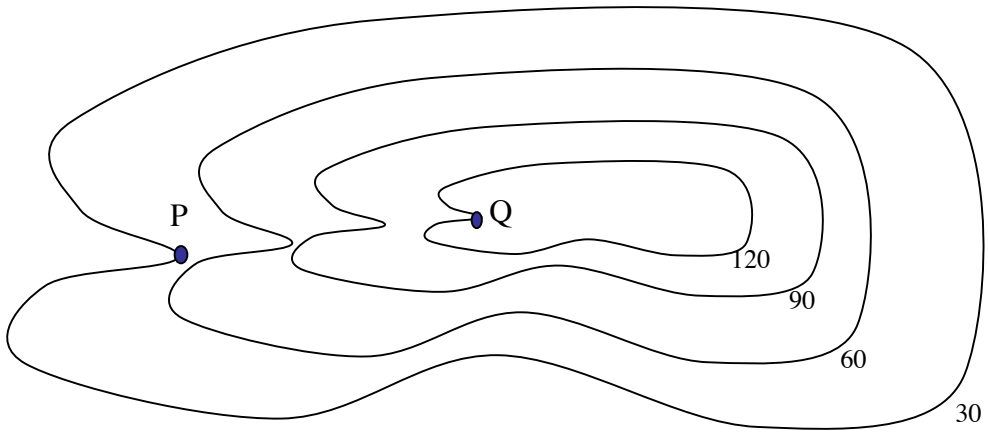
D. 20 cm

E. 24 cm

SECTION B - Module 2: Geometry and trigonometry – continued

Use the following information to answer Questions 7 and 8

The contour map shown below uses 30 metre intervals. The direct distance from P to Q is 150 metres.



Question 7

The slope of P to Q is

A. $\frac{5}{4}$

B. $\frac{4}{3}$

C. $\frac{3}{4}$

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

E. $\frac{4}{5}$

Question 8

The horizontal distance from P to Q, in centimetres, on a map with a scale of 1:1000 is

A. 1.5

B. 4.5

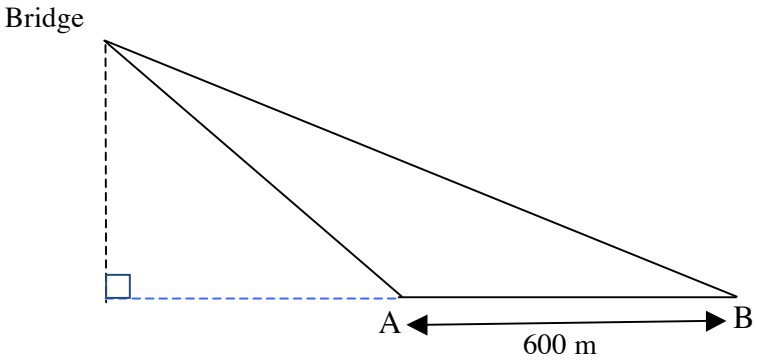
C. 9

D. 12

E. 15

Question 9

A boat is seen out on the river from a bridge at the point A. The angle of depression of the boat from the bridge is 14^{o}. After the boat has moved a further 600 metres directly away from the bridge to the point B, the angle of depression has decreased to 9.5^{o}.



The height of the bridge, above sea level, can be found using the calculation

A. $\dfrac{600 \times \sin(9.5^{o})}{\sin(4.5^{o})}$

B. $\dfrac{600 \times \sin(9.5^{o}) \times \sin(14^{o})}{\sin(4.5^{o})}$

C. $\dfrac{600 \times \sin(66.5^{o})}{\sin(9.5^{o})}$

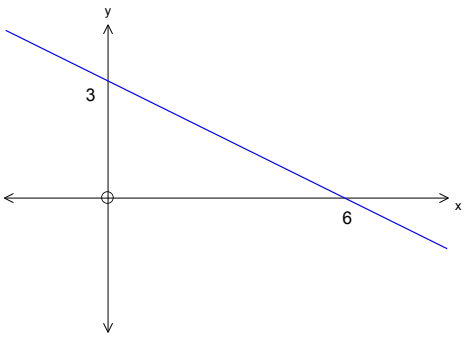
D. $\dfrac{600 \times \sin(66.5^{o}) \times \sin(76^{o})}{\sin(9.5^{o})}$

E. $\dfrac{600 \times \sin(4.5^{o}) \times \sin(14^{o})}{\sin(9.5^{o})}$

MODULE 3: 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 equation of the straight line shown is

A. $x + 2y = 6$

B. $x - 2y = 6$

C. $2x + y = 3$

D. $2x - y = 3$

E. $y = \frac{1}{2}x + 3$

Question 2

The online store *e-sound* allows you to download movies and songs. All movies have one fixed price and songs have another fixed price.

Jamal downloads 3 movies and 4 songs for $19 and Katherine downloads 10 movies and 2 songs for a $35

Mark downloads two movies and two songs for a total cost of

A. $10

B. $11

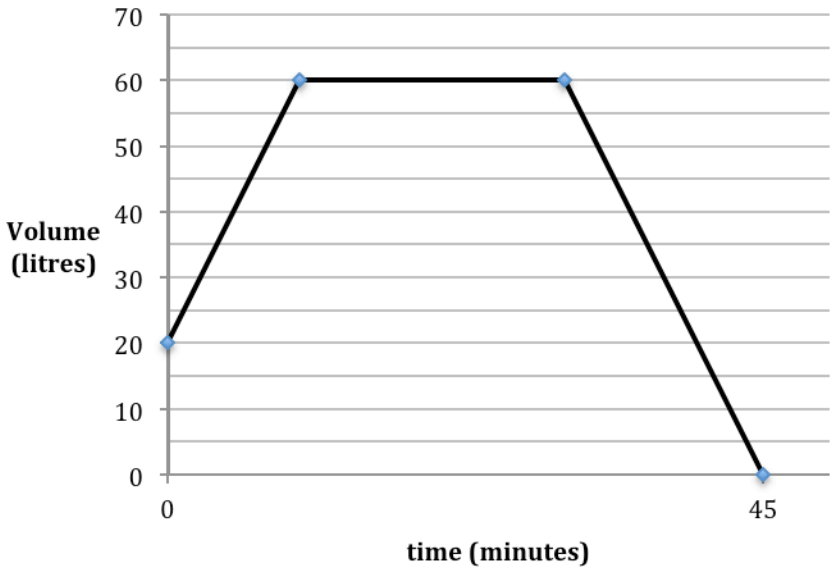
C. $12

D. $13

E. $14

Use the following information to answer Questions 3 and 4

The graph above shows the depth of water, V litres, in Jack's bath at time t minutes over a 45 minute period.



Question 3

Initially the bath contained 20 litres of water and more water was added at a rate of 4 litres per minute. The period of time, in minutes, that the water was added is

A. 5

B. 10

C. 12

D. 15

E. 20

Question 4

The bath was emptied between $t = 30$ and $t = 45$ minutes. The equation that describes the volume of water in the bath during this time period is

A. $V = 60 - 15t$

B. $V = 60 - 4t$

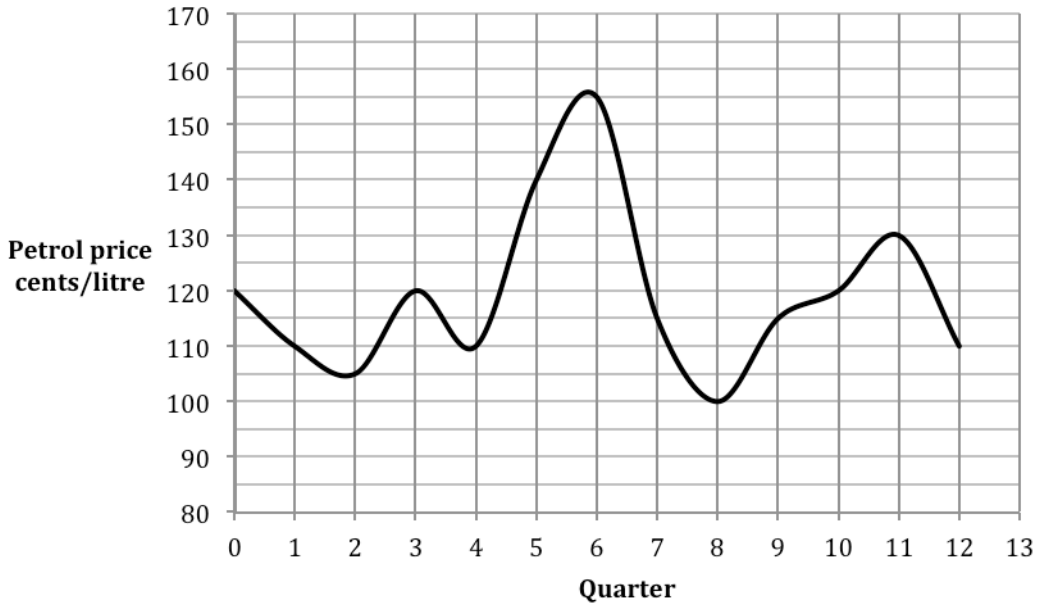
C. $V = 180 - 15t$

D. $V = 180 - 4t$

E. $V = 60 + 4t$

Question 5

The average petrol prices, in cents per litre, over a 12- quarter period is shown on the graph below.



Which one of the following statements is **true**?

A. The highest petrol price over the 12-quarter period is 150 cents per litre

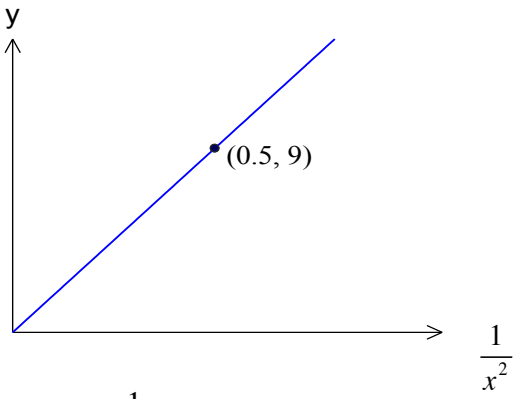
B. The petrol price decreased for exactly 5 of the 12 quarters

C. The petrol price changed most rapidly during the fifth quarter

D. The average rate of change of the petrol price over the first five quarters was 4 cents per litre

E. The difference between the highest and lowest petrol price during this period is 50 cents

Question 6



A graph of y versus $\frac{1}{x^2}$ is shown in the graph.

For the same relationship if $x = 3$ then the value of y is

A. 2

B. 4

C. 6

D. 12

E. 18

Question 7

In a linear programming problem x represents the number of apples sold and y represents the number of bananas sold.

A constraint is described in the following way.

There must be at least twice as many apples as bananas sold.

Written as an inequation, this will be

A. $y \geq 2x$

B. $x \geq 2y$

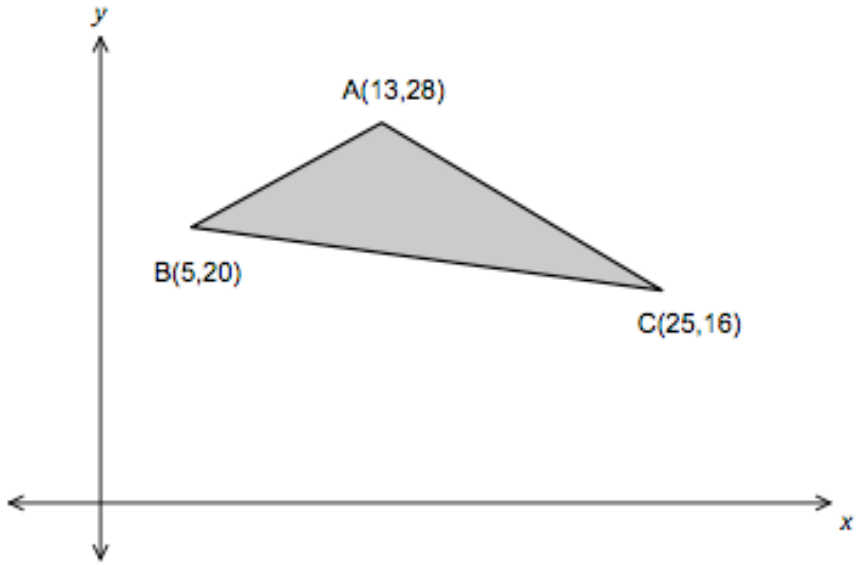
C. $y \leq 2x$

D. $x \leq 2y$

E. $y \geq \frac{1}{2}x$

Use the following information to answer Questions 8 and 9

The three boundary lines used for the feasible region shaded in the graph below have the following equations.
Line AC: $x + y = 41$, Line AB: $x - y = -15$ and Line BC: $0.2x + y = 21$



Question 8

A point that is **not** within the feasible region is

A. (10, 19)
B. (12, 27)
C. (15, 21)
D. (16, 26)
E. (20, 20)

Question 9

The objective function that has a maximum at the point A **only** is

A. $M = 10x + 5y$
B. $M = 10x - 5y$
C. $M = 5x + 10y$
D. $M = 5x + 5y$
E. $M = 5y - 10x$

SECTION B - continued
TURN OVER

Module 4: Business-related mathematics

Before answering these questions you must **shade** the Business-related mathematics box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

Question 1

Ash paid $4500 for a new camera which included a 10% Goods and Services tax (GST).
The price of the camera, in dollars, before the GST was added is equal to

A. $\frac{4500}{1.1}$

B. $\frac{4500}{0.9}$

C. $4500 - (0.1 \times 4500)$

D. $4500 + (0.1 \times 4500)$

E. $4500 - (0.9 \times 4500)$

Question 2

Andi buys a new sports car. She borrows $60 000 and will repay the money the loan in equal monthly instalments of $700. Interest is charged at 6.5% per annum on the reducing balance.
The number of years it will take Andi to repay the loan is closest to

A. 7

B. 8

C. 9

D. 10

E. 11

Question 3

Andrew purchased a $4000 television under a hire purchase agreement.
Andrew paid a deposit of $500 and will pay the remaining balance monthly over two years.
A flat interest rate of 10% per annum is charged.
The effective interest rate paid by Andrew under this agreement is

A. 10%

B. 16.4%

C. 18.5%

D. 19.2%

E. 20.0%

Question 4

Transactions for Fiona's bank account for the month of March are listed in the bank statement below.
Interest is calculated on the minimum monthly balance.

Date	Transaction	Debit	Credit	Balance
March 1	**Opening balance**			**2150.00**
March 6	Deposit		135.00	2285.00
March 7	Withdrawal	600.00		1685.00
March 14	Deposit		725.00	2410.00
March 23	Withdrawal	430.00		1980.00
March 31	**Closing balance**			**1980.00**

The interest payment for the month of March is $3.37
The rate of interest, per annum, for Fiona's account is closest to

A. 0.20%

B. 1.88%

C. 2.04%

D. 2.40%

E. 3.37%

Question 5

Johnny invests $5000 for a period of 4 years.
The interest rate for this investment is 6.4% per annum compounding quarterly.
The interest that Johnny will earn in the third year, in dollars, is equal to

A. $3(\frac{6.4}{100} \times 5000)$

B. $5000 \times 1.016^3 - 5000 \times 1.016^2$

C. $5000 \times 1.016^{12} - 5000 \times 1.016^8$

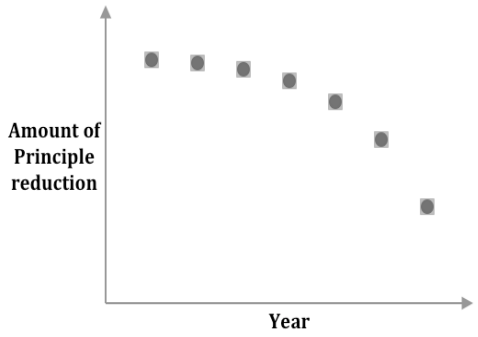
D. $5000 \times 1.064^3 - 5000 \times 1.064^2$

E. $5000 \times 1.064^{12} - 5000 \times 1.064^8$

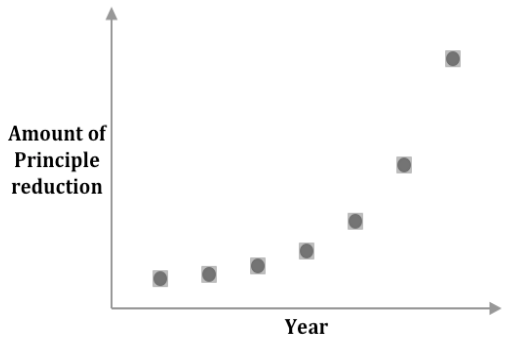
Question 6

Shelby purchased a new unit with money borrowed under a reducing balance loan.
She calculated the amount by which the principal would reduce each year over the term of the loan and drew a graph of the results.
The shape of the graph Shelby prepared is best represented by

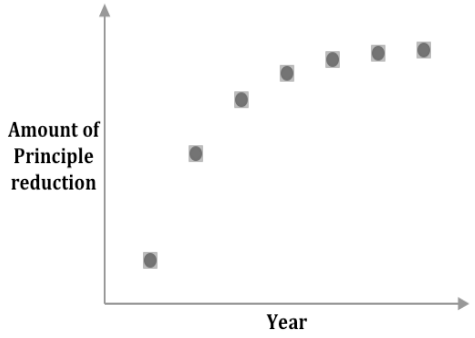
A.



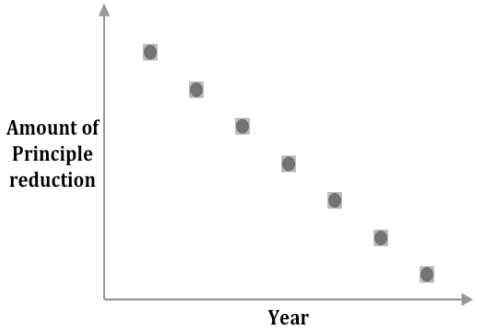
B.



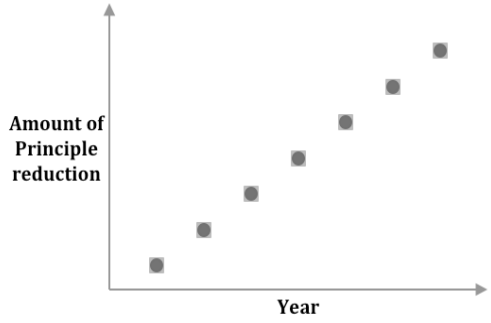
C.



D.



E.



Question 7

Evan is a courier who has purchased a new car for $32 000.
The value of the car is to be depreciated using the unit-cost method.
Evan calculates that the car will be worth $18 500 after it has travelled 100 000 kilometres.
The rate of depreciation used by Evan in cents/kilometre is

A. 10

B. 12

C. 13.5

D. 15

E. 15.5

Question 8

Otto invests $50 000 in an account paying 6% interest compounding yearly.
The number of years it will take for Otto's investment to double in value is closest to

A. 6

B. 9

C. 10

D. 12

E. 15

Question 9

Oscar needs to borrow $5 000 and can repay the loan in monthly instalments of $250. A credit company offers him a personal loan at 12% per annum interest compounded monthly. Oscar's brother offers him a flat rate, simple interest loan at a rate of 10% per annum over 2 years.

Which of the following statements is **incorrect**?

A. The loan will be repaid in less than two years with the credit company.

B. It will take Oscar exactly two years to repay his brother.

C. The credit company will charge less than $1000 interest.

D. Oscar's brother will charge more than $1000 interest.

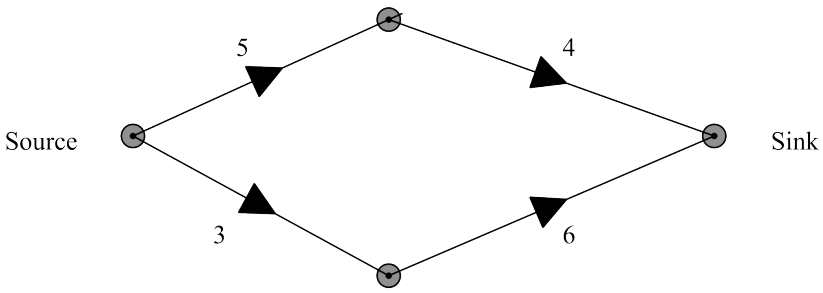
E. Oscar's total payments to the credit company would be less than the total payments to his brother.

Module 5: 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 directed graph shown below



The maximum flow from source to sink is

A. 6

B. 7

C. 8

D. 9

E. 11

Question 2

A planar graph has 4 vertices and 3 regions. The number of edges this graph has is

A. 5

B. 6

C. 7

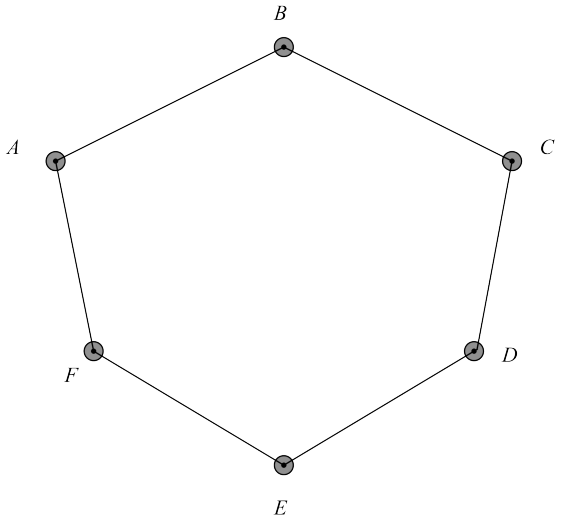
D. 9

E. 12

Question 3

On the network diagram below the nodes, A to F, represent six futsal teams.
Each edge represents a match played between the two teams.

The graph is to be made complete to represent each team playing every other team once.

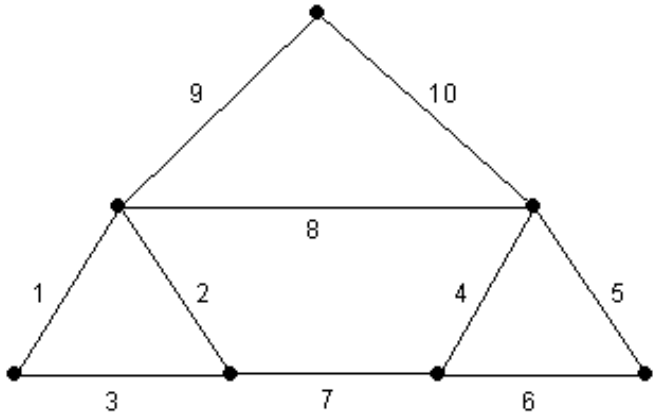


The number of additional edges that must be included is

A. 5
B. 6
C. 9
D. 10
E. 15

Question 4

A minimal spanning tree is to be drawn for the network below

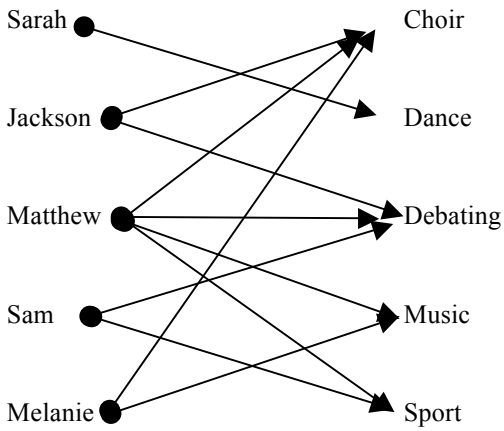


The length of this minimal spanning tree is

A. 22
B. 23
C. 25
D. 28
E. 55

Question 5

A group of five school friends are involved in at least one of five different co-curricular activities. The information is displayed in the following bipartite graph.



Each student must speak about one activity they are involved with at the school assembly and each activity is to be represented by a student who is involved in it.

An allocation that is **not** possible is

A.

Student	Activity
Sarah	Dance
Jackson	Debating
Matthew	Music
Sam	Sport
Melanie	Choir

B.

Student	Activity
Sarah	Dance
Jackson	Choir
Matthew	Debating
Sam	Sport
Melanie	Music

C.

Student	Activity
Sarah	Dance
Jackson	Choir
Matthew	Sport
Sam	Debating
Melanie	Music

D.

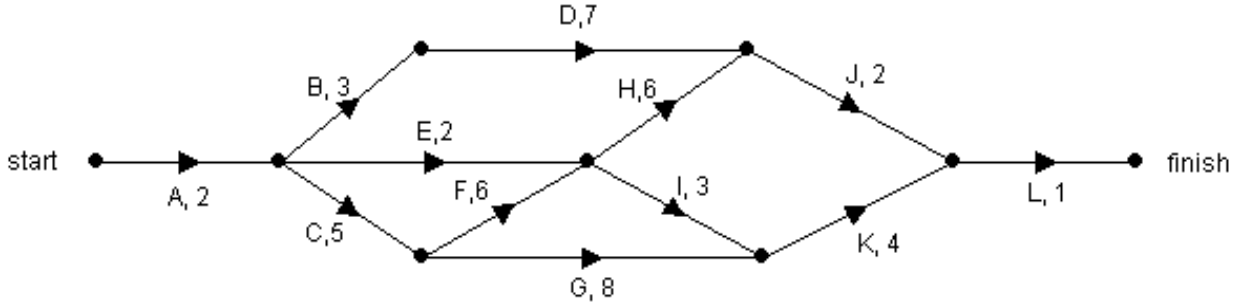
Student	Activity
Sarah	Dance
Jackson	Choir
Matthew	Music
Sam	Debating
Melanie	Sport

E.

Student	Activity
Sarah	Dance
Jackson	Debating
Matthew	Choir
Sam	Sport
Melanie	Music

Questions 6, 7 and 8 refer to the following information

The network, shown below, gives the 12 activities that are needed to complete a project.
All completion times given are in hours.



Question 6

The earliest start time, in hours, for activity K is

A. 2
B. 4
C. 7
D. 15
E. 16

Question 7

The minimum time for completion of this project, in hours, is

A. 12
B. 17
C. 20
D. 21
E. 22

Question 8

The activity that has the greatest float time is

A. B
B. E
C. G
D. I
E. K

Question 9

Four friends Andi, Bob, Cedric and Dimitar each take a certain time, in minutes, to complete four tasks A, B, C and D as shown on the table. One of the times is missing.

	Task A	Task B	Task C	Task D
Andi	14	9	20	12
Bob	15		23	13
Cedric	9	11	27	9
Dimitar	15	16	21	12

It is known that the minimum time for the four tasks to be completed with each friend completing one task is 51 minutes. It is also known that Bob completed task B.
The unknown time in the table, in minutes, is

A. 8

B. 9

C. 10

D. 11

E. 12

MODULE 6: 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

Consider the two matrices $A = \begin{bmatrix} 1 & 1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$.

Performing the matrix product AB will produce a matrix that

A. is equal to B
B. adds 1 to every element of B
C. adds the rows of matrix B
D. adds the columns of matrix B
E. is the inverse of matrix B

Question 2

Consider the following matrix product

$$\begin{bmatrix} x & 2 \\ 3 & y \end{bmatrix}\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix} = \begin{bmatrix} 8 & 10 \\ 7 & 8 \end{bmatrix}$$

It can be concluded that

A. $y = 2x$
B. $x = 2y$
C. $y = x$
D. $y = 4x$
E. $x = 4y$

Question 3

Matrix A is of order 3×4, matrix B is of order 2×3, matrix C is of order 3×2 and matrix D is of order 4×3. If matrix E can be added to matrix C then matrix E could be

A. $A \times D \times B$

B. $C \times B \times A$

C. $B \times A \times C$

D. $B \times A \times D$

E. $A \times D \times C$

Question 4

Consider the matrix product $A \times \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$.

Matrix A will be

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

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

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

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

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

Question 5

Consider the following four matrices

$$A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}, \quad B = \begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix}, \quad C = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}, \quad D = \begin{bmatrix} 2 & 1 \end{bmatrix}$$

The number of product matrices that are defined by selecting any two different matrices at a time to form the product is

A. 4
B. 5
C. 6
D. 7
E. 8

Question 6

Consider three matrices, **A, B** and **I**, where **I** is the identity matrix.
If **AB = 5I** then an expression for $\mathbf{B}^{-1}$ is

A. $\frac{1}{5}\mathbf{A}$

B. $5\mathbf{A}$

C. $\frac{1}{5}\mathbf{I}$

D. $\frac{1}{5}\mathbf{AB}$

E. $5\mathbf{B}$

Question 7

Bob travels to work by either train or bus and his decision is based entirely on which mode of transport he took the day before.

If he travels by train on one day the chance of him travelling by train the next day is 40%.
If he travels by bus one day the chance of him travelling by train the next day is 20%.

In the long run the chance of him travelling by bus on a particular day is

A. 25%
B. 40%
C. 60%
D. 75%
E. 100%

Question 8

Below is a transition matrix that shows the percentage changes for transportation to school each day.

	This Day		
	Bus	Car	Walk
Bus	0.9	0.01	0.2
Car	0.03	0.8	0.04
Walk	0.07	0.19	0.76

Next Day

100 people were using each type of transportation to get to school on Monday

Which of the following statements is **incorrect**?

A. 1% of those who travel by car today will catch the bus tomorrow
B. 10% of those who travel by bus today will not travel by bus tomorrow
C. Most people will use the same type of transportation they used previously
D. There will be 99 students walking to school on Friday
E. There will be 90 travelling by bus on Tuesday

Question 9

A series of rehearsals for the School Musical "Singing in the Rain" commenced in March. Each week participants could choose extra dance rehearsals or extra singing rehearsals.

A matrix equation used to determine the number of students expected to attend extra rehearsals is given by

$$R_{n+1} = \begin{bmatrix} 0.8 & 0.4 \\ 0.2 & 0.6 \end{bmatrix} \times R_n - \begin{bmatrix} 4 \\ 8 \end{bmatrix}$$

Where R_n is the column matrix that lists the number of students attending in week n.

The attendance matrix for the first week of extra rehearsals is given by

$$R_1 = \begin{bmatrix} 65 \\ 10 \end{bmatrix} \begin{matrix} \text{dancing} \\ \text{singing} \end{matrix}$$

The number of students expected to attend extra dance rehearsals during week 3 is

A. 9
B. 11
C. 19
D. 42
E. 52

END OF MULTIPLE - CHOICE QUESTION BOOKLET