**The Mathematical Association of Victoria**

# Trial Exam 2013

# 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 35 pages, with a detachable sheet of miscellaneous formulas at the back
- Answer sheet for multiple-choice questions.
- 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.**

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## CORE: Data Analysis

### Question 1

A multiple-choice test consists of 10 questions. A class of thirty students complete the test. The results are shown in the table below.

| Number of correct answers | Frequency |
|---|---|
| 2 | 1 |
| 3 | 0 |
| 4 | 4 |
| 5 | 6 |
| 6 | 5 |
| 7 | 3 |
| 8 | 4 |
| 9 | 5 |
| 10 | 2 |
| **Total** | **30** |

### Question 1

The percentage of students who scored more than 7 is closest to

**A.** 47%
**B.** 37%
**C.** 33%
**D.** 14%
**E.** 11%

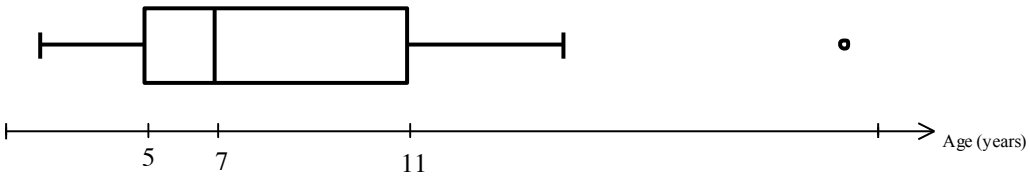
### Question 2

The mean number of correct answers for this test is closest to

**A.** 5
**B.** 5.5
**C.** 6
**D.** 6.5
**E.** 7

**Question 3**

The boxplot shows the distribution of the ages of a mob of kangaroos with one outlier.




The oldest kangaroo, shown as an outlier, must be greater than

**A.** 17 years old
**B.** 18 years old
**C.** 19 years old
**D.** 20 years old
**E.** 23 years old

**Question 4**

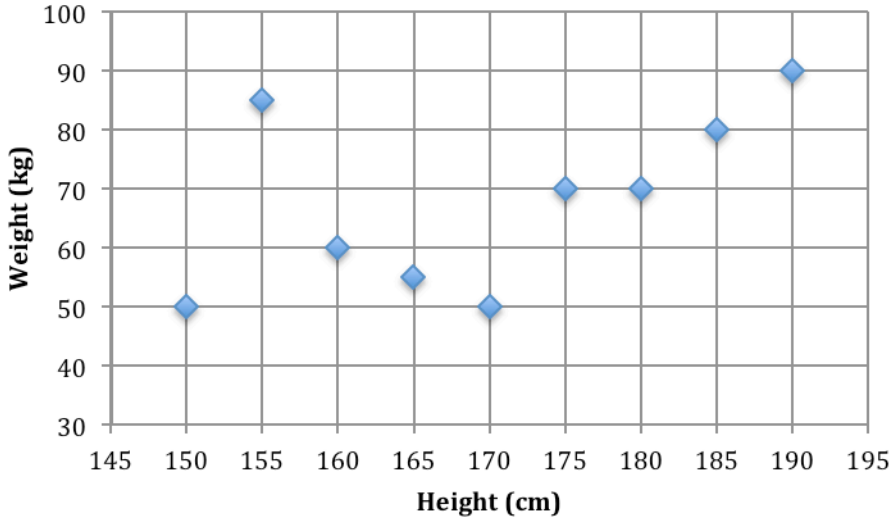
A survey was conducted to determine if there was an association between gender (male/female) and attitude to compulsory voting (for/against).

The most appropriate graph to display the information would be a

**A.** dot plot
**B.** two way frequency table
**C.** time series plot
**D.** histogram
**E.** stem and leaf plot

*The following information relates to Questions 5 and 6*

A student is in the process of drawing the 3 median regression line for the data shown below.




**Question 5**

Once the data is separated into three groups, the median points are found for each group.

The median point in the middle group is

**A.** (170, 70)
**B.** (170, 65)
**C.** (170, 60)
**D.** (170, 55)
**E.** (170, 50)

**Question 6**

The three median regression line for the data may be approximated by the equation

$$Weight = \frac{2}{3} \times height - 48$$

We can conclude that

**A.** a height increase of 9 cm is associated with a weight increase of 6 kg
**B.** a height increase of 2 cm is associated with a weight increase of 3 kg
**C.** predicting the weight for a person with height 200 cm is a case of interpolation
**D.** the equation over-predicts the weight of the person in the sample who is 185 cm tall
**E.** if the person whose height was 155 cm lost 5 kg the equation would change

**Question 7**

The following summary statistics was collected from a group of Year 12 students.

| | Average | Standard deviation |
|---|---|---|
| hours of sleep on previous night | 6.5 | 0.5 |
| number of errors in exam | 13 | 3 |

A scatterplot representing the number of errors made against the hours of sleep shows a strong negative linear association between the two variables.

For the same sample of data it was found that 81% of the variation in the number of errors made is explained by the variation in the hours of sleep.

From this information we can conclude that for every extra hour of sleep, the number of errors made will

**A.** decrease by 5.4
**B.** decrease by 0.15
**C.** increase by 5.4
**D.** increase by 0.15
**E.** decrease by 81%

**Question 8**

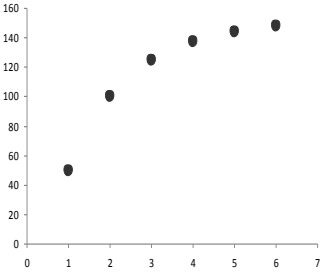
For a group of Year 12 students, it was found that the value of the product moment correlation coefficient between the number of hours studied in a week and their expenditure on energy drinks was $r = 0.7$

If the expenditure on energy drinks can be predicted from the number of hours studied then it could be concluded that

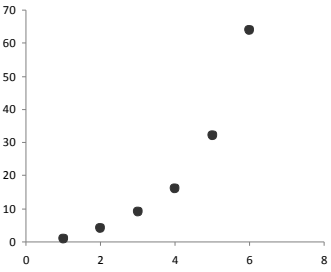
**A.** 70% of the students who study for long hours buy energy drinks
**B.** students who study more hours tend to buy more energy drinks
**C.** students who buy more energy drinks tend to study less hours
**D.** 49% of the variation of hours studied is explained by the variation of expenditure on energy drinks
**E.** 30% of students who study for long hours don't buy energy drinks

**Question 9**

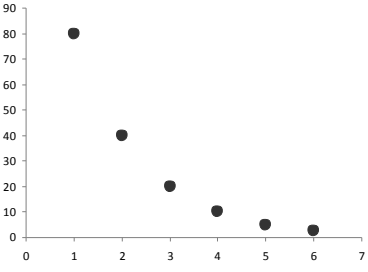
Consider the scatterplots of three sets of bivariate numerical data shown below.




GRAPH A




GRAPH B




GRAPH C

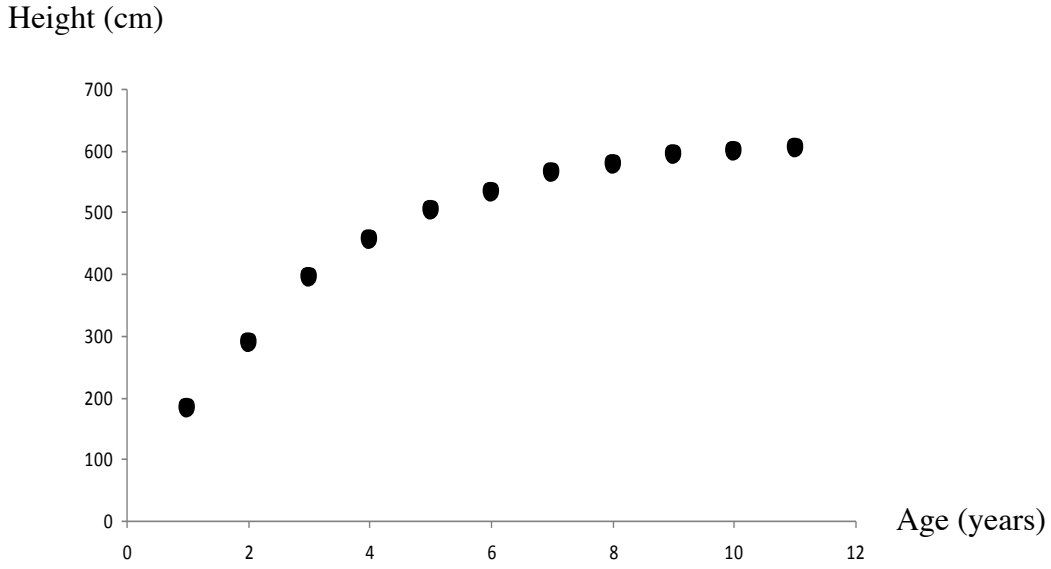
A reciprocal transformation applied to the dependent variable could potentially linearise

**A.** all three graphs
**B.** graphs A and B
**C.** graph B only
**D.** graph C only
**E.** graphs B and C

**Question 10**

A scatterplot of the height of a tree, in centimetres, against its age, in years, is constructed from the data shown in the table.

| **Age (years)** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Height (cm)** | 183 | 290 | 396 | 457 | 503 | 533 | 564 | 579 | 594 | 600 | 604 |




To linearise the scatterplot, a log transformation is applied to the age of the tree.

The equation of the least squares regression line of the linearised data is

**A.** $Height = 250.6 + 38.58 \times Age$

**B.** $Height = 250.6 + 38.58 \times \log(Age)$

**C.** $Height = 428.4 + 186.1 \times \log(Age)$

**D.** $Height = 186.1 + 428.4 \times \log(Age)$

**E.** $Height = 186.1 + 428.4 \times Age$

**Question 11**

The relationship between the average number of ice-creams sold and the maximum daily temperature was found to be non-linear. An $x^2$ transformation revealed a linear relationship and produced a least squares regression line with an equation given by

$$\text{Number of ice-creams sold} = 0.2 \times \text{Max Daily Temperature}^2 + 10.2$$

On a particular day 240 ice-creams were sold.
The predicted number of ice-creams for this day had a residual of -25.

The maximum daily temperature that led to this outcome was closest to

**A.** 9º C
**B.** 25º C
**C.** 32º C
**D.** 34º C
**E.** 36º C

**Question 12**

The time, in minutes, that it took Douglas to complete his household chores each day was recorded over a one week period.

| Day | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|---|
| Time | 34 | 39 | 37 | 33 | 28 | 38 | 36 |

Both three-point mean smoothing and three-point median smoothing are to be used to smooth this data.
The day for which the smoothed value is the same using both methods is

**A.** Monday
**B.** Tuesday
**C.** Wednesday
**D.** Thursday
**E.** Friday

**Question 13**

The following (incomplete) table shows seasonal indices at Crockett's dress shop for 2012

| Summer | Autumn | Winter | Spring |
|---|---|---|---|
| 1.20 | | | 1.05 |

Which one of the following statements regarding sales in 2012 is true?

**A.** The highest sales season could not be Autumn or Winter
**B.** Both Autumn and Winter must have sales below the season average
**C.** Sales figures for Autumn and Winter could be identical
**D.** Sales in Spring were generally greater than sales in Summer
**E.** The seasonal indices for Autumn and winter will both be greater than 1

**END OF CORE**

## MODULE 1 Number Patterns

### Question 1

Consider the arithmetic sequence $-7, -4, -1, \ldots$
The common difference for this sequence can be determined by evaluating

**A.** -4 + 7
**B.** -4 – 7
**C.** -7 + 4
**D.** -7 - 4
**E.** -1 - 4

### Question 2

Consider the following 4 sequences

$7, 0.7, 0.07, \ldots$
$-15.2, -13.8, -12.4, \ldots$
$\frac{1}{4}, \frac{1}{6}, \frac{1}{8}, \ldots$
$4, 9, 16, \ldots$

The number of sequences which are neither arithmetic nor geometric is

**A.** 0
**B.** 1
**C.** 2
**D.** 3
**E.** 4

### Question 3

Which one of the following difference equations generates a geometric sequence?

**A.** $t_{n+1} = 2 + \frac{1}{2}t_n \; ; \; t_1 = 2$
**B.** $t_{n+1} = 2 - t_n \; ; \; t_1 = 2$
**C.** $t_{n+1} = t_n + 3 \; ; \; t_1 = 2$
**D.** $t_{n+1} = 2t_n + 1 \; ; \; t_1 = 2$
**E.** $t_{n+1} = -t_n \; ; \; t_1 = 2$

**Question 4**

The floor of a pergola is paved with 20 rows of brick pavers. The number of pavers in each row increases according to an arithmetic sequence. The first row has 14 brick pavers and the last row has 71 brick pavers.

The total number of brick pavers used for the floor are

**A.** 570
**B.** 800
**C.** 820
**D.** 850
**E.** 880

**Question 5**

The number of offices on subsequent floors in a high-rise building follows an arithmetic sequence.
There are 29 offices on the $5^{th}$ floor and 248 offices in total on the first eight floors.
The number of offices on the first floor is

**A.** 49
**B.** 45
**C.** 41
**D.** 36
**E.** 32

**Question 6**

A Fibonacci related sequence begins 1, 3, 4, 7, 11, 18, . . .

A number which does not appear in this sequence is

**A.** 47
**B.** 76
**C.** 199
**D.** 320
**E.** 521

**Question 7**

The difference equation $T_{n+1} = 3T_n + b, \quad T_1 = 4$ generates a sequence with a first term of 4 and third term 48.

The value of b is

**A.** 8
**B.** 6
**C.** 3
**D.** 2
**E.** 1

**Question 8**

The O'Connell household has reduced the amount of tap water used by $x$ % per month.

If 500 kilolitres of water is used in the first month and 4367 kilolitres of water is used in a year, the percentage reduction per month, $x$, is closest to

**A.** 6
**B.** 34
**C.** 36
**D.** 64
**E.** 94

**Question 9**

The surface area of a cookie placed in the oven is initially 25 square centimetres. In the first minute the area increased by 12 square centimetres. Each minute after that the surface area increased by 20% of the previous increase.

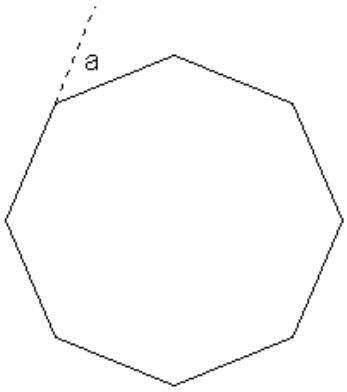
If this pattern continues, the largest surface area, to the nearest square centimetre, the cookie can have is

**A.** 31
**B.** 40
**C.** 52
**D.** 60
**E.** 85

**END OF MODULE 1**
**TURN OVER**

## MODULE 2 Geometry and Trigonometry

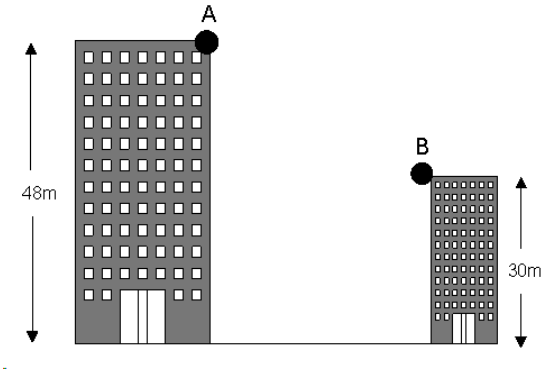
### Question 1




Consider the regular octagon shown above.
The magnitude of angle a, in degrees, is

**A.** 15
**B.** 30
**C.** 45
**D.** 48
**E.** 60

### Question 2




The angle of elevation from the top of building B to the top of building A is $42°$.
The distance between the two buildings, in metres, is closest to

**A.** 12
**B.** 16
**C.** 20
**D.** 24
**E.** 27

**Question 3**

Using Heron's formula $\sqrt{s(s-a)(s-b)(s-c)}$ the area of a triangle, in square centimetres was found to be $\sqrt{8\times1\times3\times4}$.

The lengths of the three sides of the triangle, in centimetres, are

**A.** 4, 5 and 7

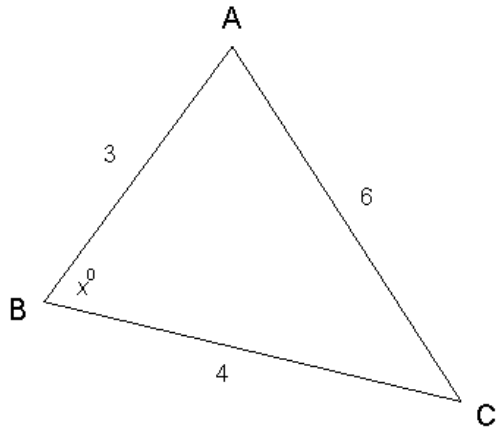
**B.** 4, 5 and 8

**C.** 3, 4 and 8

**D.** 3, 4 and 7

**E.** 1, 3 and 4

**Question 4**




Consider triangle ABC as shown in the diagram

The cosine of the angle $x°$ is equal to

**A.** $\frac{3}{6}$

**B.** $\frac{4}{6}$

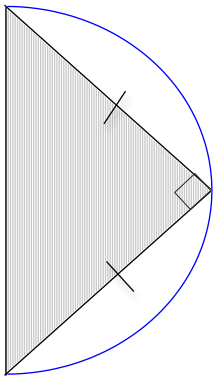
**C.** $\frac{29}{36}$

**D.** $\frac{-11}{12}$

**E.** $\frac{-11}{24}$

*Use the following information to answer Questions 5 and 6*

A right angle triangle is cut out of a semi-circle of radius 6 cm as shown in the diagram below



**Question 5**

The perimeter of the triangle in centimetres, is closest to

**A.** 14.5

**B.** 18

**C.** 20.5

**D.** 24

**E.** 29

**Question 6**

The area, in $cm^2$, of the unshaded region is equal to

**A.** $9\pi - 36$

**B.** $18\pi - 18$

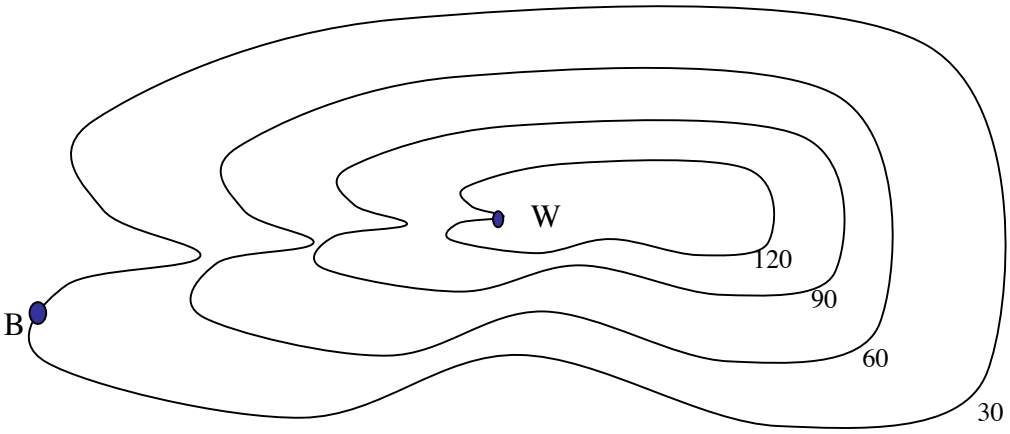
**C.** $18\pi - 36$

**D.** $36\pi - 18$

**E.** $36\pi - 72$

**Question 7**

The contour map shown below uses 30 metre intervals.




The average slope of BW is found to be $\frac{2}{3}$.

The direct distance, in metres, from B to W can be determined using which one of the following calculations ?

**A.** $\sqrt{60^2 + 90^2}$

**B.** $\sqrt{90^2 + 135^2}$

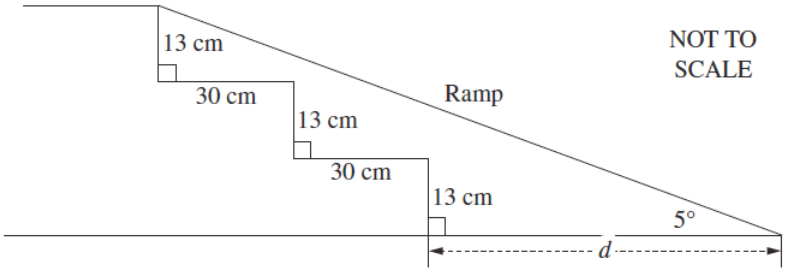
**C.** $\sqrt{80^2 + 120^2}$

**D.** $\sqrt{120^2 + 90^2}$

**E.** $\sqrt{180^2 + 120^2}$

**Question 8**

A disability ramp is to replace the steps as shown in the diagram.




The angle of inclination of the ramp is 5°. The extra distance, $d$ centimetres, that the ramp will extend beyond the bottom step is closest to

**A.** 446

**B.** 387

**C.** 386

**D.** 343

**E.** 297

**Question 9**

Marija sets out from point O and walks 3 km on a bearing 035° to point X. She then walks 7 km on a bearing 060° to point Y. The total distance, in kilometres, north that Marija has travelled in walking from O to Y can be calculated using

**A.** $3\cos 35^\circ - 7\cos 60^\circ$

**B.** $3\sin 55^\circ + 7\sin 30^\circ$

**C.** $58 + 42\cos 155^\circ$

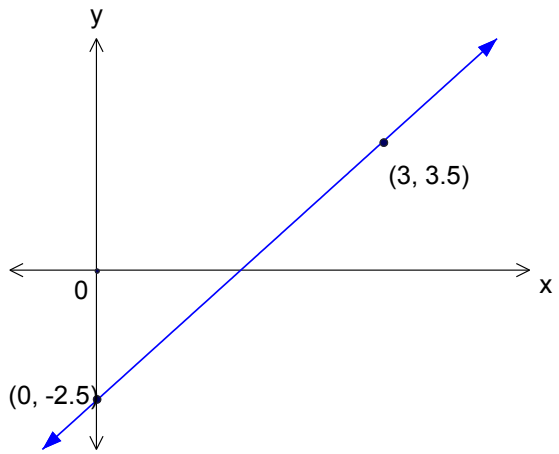
**D.** $3\sin 35^\circ + 7\sin 60^\circ$

**E.** $3\cos 55^\circ + 7\cos 30^\circ$

**END OF MODULE 2**

## MODULE 3 Graphs and relations

### Question 1




The equation of the line shown above is

**A.** $y = x - 2.5$

**B.** $4x + 2y = 5$

**C.** $x - 2y = 5$

**D.** $7x - 6y = 15$

**E.** $4x - 2y = 5$

### Question 2

A line is drawn joining two points with coordinates $(a, 2b)$ and $(b, 2a)$.
The slope of this line is equal to

**A.** $a - b$

**B.** $a + b$

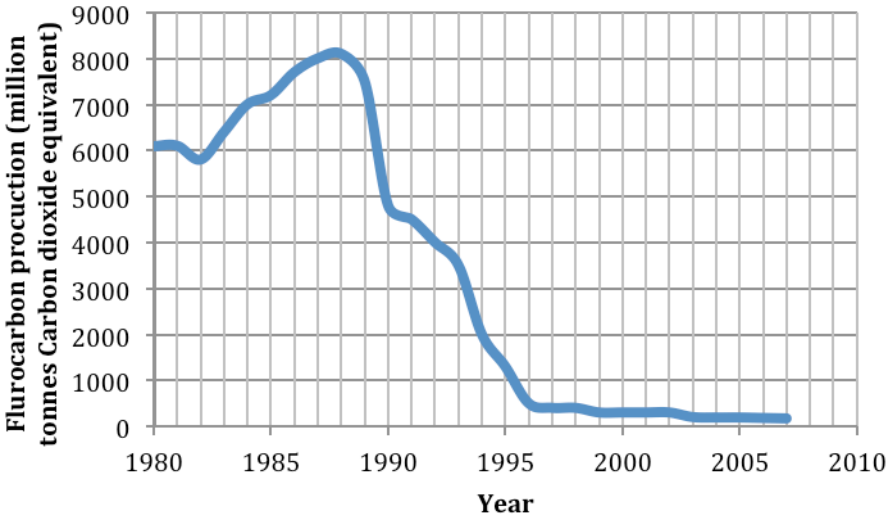
**C.** -1

**D.** 2

**E.** -2

**Question 3**

The following graph shows the production of fluorocarbons between 1980 and 2007.




The average rate of change in the production of Fluorocarbons is a maximum between the years

**A.** 1987 and 1988
**B.** 1988 and 1990
**C.** 1990 and 1992
**D.** 1992 and 1996
**E.** 1996 and 2000

**Question 4**

The graph of $y = 3x^n$ passes through the points $(1,3)$ and $(\frac{1}{2},6)$.

The value of $n$ is

**A.** -2
**B.** -1
**C.** 1
**D.** 2
**E.** 3

**Question 5**

Leonardo sells chicken sandwiches for \$5 each and ham sandwiches for \$4.50 each from his delicatessen. In one day Leonardo sold a total of 75 sandwiches and he received a total revenue of \$355.

If $x$ chicken sandwiches were sold and $y$ ham sandwiches were sold then two simultaneous linear equations that can be formed are

**A.** $x + y = 75$
$10x + 9y = 710$

**B.** $x + y = 75$
$9x + 10y = 710$

**C.** $2x + 2y = 75$
$10x + 9y = 710$

**D.** $x + y = 75$
$4.5x + 5y = 355$

**E.** $x + y = 355$
$5x + 4.5y = 75$

**Question 6**

The cost of hiring a small generator from Hodgetts' Hire is \$100 for each of the first ten days, then \$80 per day thereafter. A rule for determining the cost, $C$ dollars, in terms of the number of days, $n$, for a person hiring the generator for more than ten days is

**A.** $C = 200 + 80n$

**B.** $C = 200 + 100n$

**C.** $C = 1000 + 80n$

**D.** $C = 100 + 80n$

**E.** $C = 180$

*The information below is relevant for Questions 7 and 8*

Consider the journey of a passenger train travelling to Melbourne as shown by the graph below.
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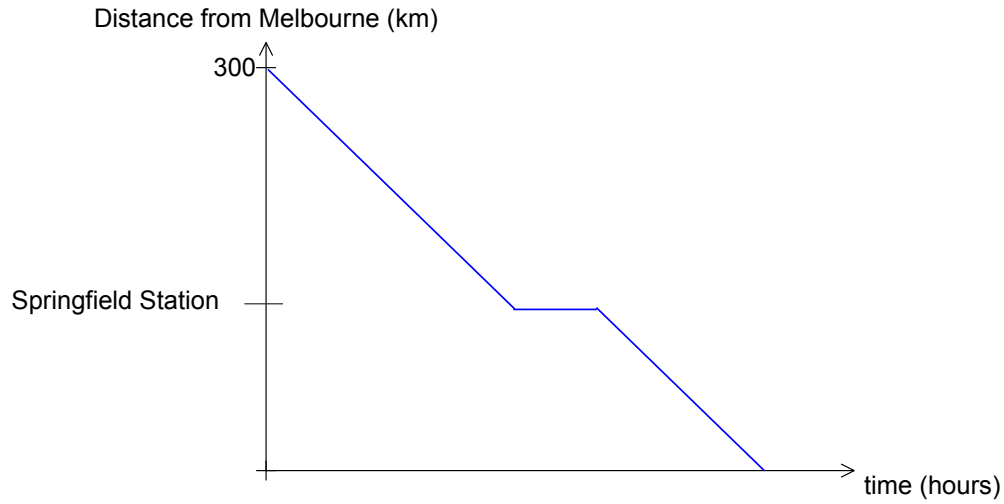



The passenger train travels at 80km/hr, stops at Springfield station for 45 minutes before it continues its journey again at 80 km/hr towards Melbourne. Springfield station is 120 km from Melbourne.

**Question 7**

The duration of the entire journey is

**A.** 3.5 hours
**B.** 4 hours
**C.** 4.5 hours
**D.** 5 hours
**E.** 5.5 hours

**Question 8**

A freight train leaves Melbourne the same time as the passenger train started its journey and travels without stopping towards the passenger train at a constant speed of $x$ km/hr

The freight train will not pass the passenger train at Springfield station if $x$ is

**A.** 40
**B.** 45
**C.** 50
**D.** 53
**E.** 55

**Question 9**

A region is defined by the following inequalities

$$x \geq 0$$
$$y \geq 0$$
$$y \leq 6 - x$$
$$y \geq \frac{x}{2}$$

A point that does **not** lie within this region is

**A.** (1,3)
**B.** (1,5)
**C.** (3,2)
**D.** (4,1)
**E.** (3,3)

**END OF MODULE 3**
**TURN OVER**

## Module 4 Business-related mathematics

### Question 1

David received 8% discount on a shirt marked at $150 and 6% discount on a jacket marked at $250.
The percentage discount received by David for the two items combined is

**A.** 6.25%
**B.** 6.75%
**C.** 7%
**D.** 7.25%
**E.** 14%

### Question 2

A computer that was bought for $4000 is depreciated at 15% per annum under the reducing balance method.
The amount by which the computer has been depreciated after three years is

**A.** $1800
**B.** $2200
**C.** $2456.50
**D.** $1543.50
**E.** $3955

### Question 3

A loan at 5.5% per annum simple interest is taken out for 112 days and attracts $95 interest.

The amount borrowed is closest to

**A.** $5629
**B.** $1727
**C.** $3432
**D.** $2019
**E.** $6003

**Question 4**

Randy has borrowed $250 000 to buy a block of land and will repay the loan in full with monthly repayments over 25 years. Interest is charged at 6.5% compounding monthly. The amount that Randy needs to pay each month is closest to

**A.** $1807
**B.** $1688
**C.** $1402
**D.** $1192
**E.** $833

**Question 5**

Dietmar invested $120000 in a perpetuity that returned $1500 per quarter. Interest is calculated quarterly. The annual interest rate of Dietmar's investment is

**A.** 1.25%
**B.** 4%
**C.** 5%
**D.** 6%
**E.** 7.2%

**Question 6**

A motor mechanic charged $85 for parts and $140 per hour for labour. A Goods and Services tax (GST) of 10% is also added to the charge.

If the mechanic spent 4 hours working on the car, the total amount charged is found by calculating

**A.** 85 + 140 x 4 x 1.1
**B.** (85 + 140 x 4) x 1.1
**C.** (85 + 140) x 4 x 1.1
**D.** (85 + 140 x 4) x 0.1
**E.** 85 + 140 x 4 x 0.1

**Question 7**

Steve invests \$10 000 into an account that pays 6.6% interest per annum compounding monthly.
After 12 months the balance in Steve's account is now an amount $A$ where $A = 10000 \times R^{12}$.
The correct value for $R$ is

**A.** 1.0055
**B.** 1.55
**C.** 0.066
**D.** 1.066
**E.** 0.55

**Question 8**

The value of an office printer will depreciate by 12 cents for every 1000 sheets printed.
The value of the printer is \$860 after printing 3 million sheets.

The initial value of the printer is

**A.** $860 + \frac{12 \times 3 \times 1\,000\,000}{1000}$

**B.** $860 + \frac{12 \times 3 \times 1\,000\,000}{100\,000}$

**C.** $860 + \frac{12 \times 1000 \times 3 \times 1\,000\,000}{100}$

**D.** $\frac{12 \times 3 \times 1\,000\,000}{100\,000}$

**E.** $\frac{12 \times 3 \times 1000}{100}$

**Question 9**

Phil is comparing the value of an investment in two accounts.

Account 1 pays 7.5% per annum simple interest (paid monthly)
Account 2 pays 7% per annum interest compounding monthly (and paid monthly)

Phil notices that the month in which the amount accumulated in Account 2 first exceeds the amount in Account 1 is

**A.** 24
**B.** 25
**C.** 26
**D.** 27
**E.** 28

**END OF MODULE 4**

## Module 5 Networks and decision mathematics

### Question 1

A simple graph has 8 edges. The sum of the degrees of the vertices for this graph is

**A.** 7
**B.** 8
**C.** 14
**D.** 16
**E.** 28

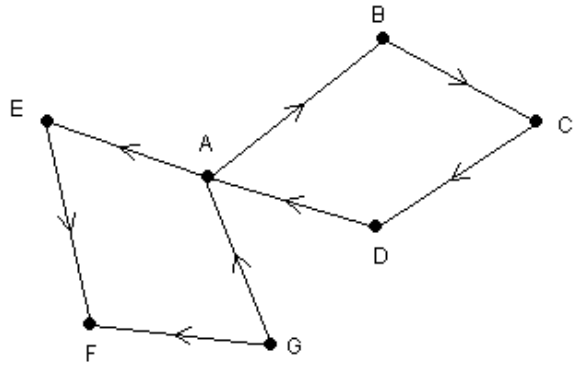
### Question 2

A connected planar graph has equal numbers of vertices and regions.
The number of edges in this graph is equal to

**A.** the number of regions
**B.** twice the number of regions
**C.** half the number of regions
**D.** twice the number of regions minus two
**E.** half the number of regions plus two

### Question 3

Consider the following directed graph




The number of vertices that can reach every other vertex is

**A.** 0
**B.** 1
**C.** 2
**D.** 3
**E.** 4

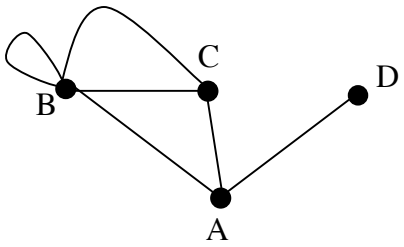
**Question 4**

An adjacency matrix is shown below.

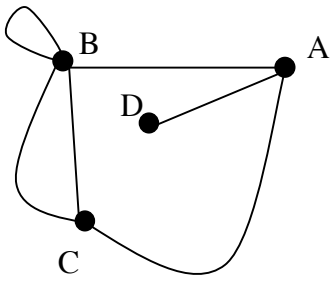
$$\begin{array}{c} \\ A \\ B \\ C \\ D \end{array} \begin{array}{c} \begin{array}{cccc} A & B & C & D \end{array} \\ \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 1 & 2 & 0 \\ 1 & 2 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

The graph that does **not** represent the adjacency matrix is

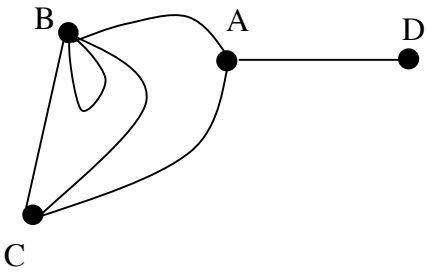
**A.**



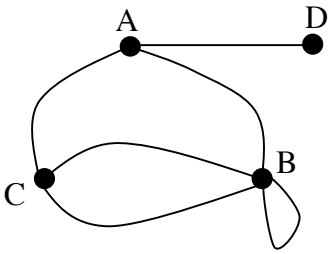

**B.**



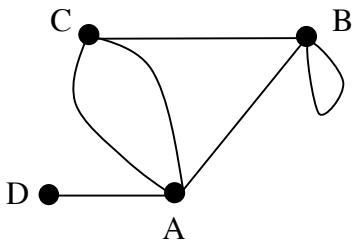

**C.**



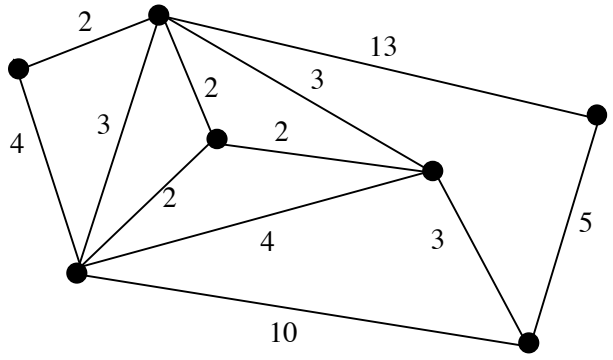

**D.**




**E.**



**Question 5**




The length of the minimum spanning tree of the graph shown above is

**A.** 16
**B.** 17
**C.** 18
**D.** 19
**E.** 20

**Question 6**

Four council workers are assigned one of the four tasks: mowing, trimming, planting and mulching. The time, in minutes, it takes each to perform the task is recorded in the following table

| | **Mowing** | **Trimming** | **Planting** | **Mulching** |
|---|---|---|---|---|
| **Michael** | 40 | 25 | 20 | 32 |
| **Nigel** | 35 | 35 | 25 | 38 |
| **Oscar** | 60 | 30 | 18 | 40 |
| **Peter** | 40 | 28 | 22 | 30 |

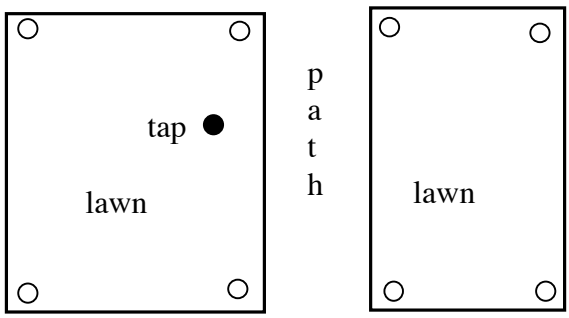
Each person is assigned to a different task so that the overall time for the completion of the tasks was minimised.

The task assigned with the longest completion time was

**A.** Mowing with 35 minutes
**B.** Mulching with 38 minutes
**C.** Mowing with 40 minutes
**D.** Mulching with 40 minutes
**E.** Mowing with 60 minutes

**Question 7**

Mark wants to install a sprinkler system in his front garden. He decides to have a sprinkler installed in each corner of the two rectangular sections of lawn as shown in the diagram.

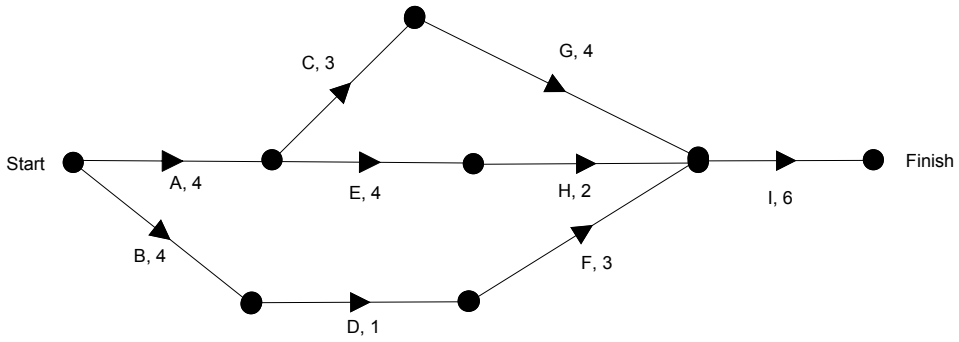



To find the minimum length of hose needed from the tap to the eight sprinklers, he must find

**A.** The shortest Euler path
**B.** The shortest Hamiltonian path
**C.** The perimeter of each rectangular lawn area
**D.** The critical path
**E.** The minimum spanning tree

*The information below is relevant to Questions 8 and 9*

The directed graph below shows the activities and their respective duration in days for completing the project.




**Question 8**

The earliest start time, in days, for activity I is

**A.** 8
**B.** 9
**C.** 10
**D.** 11
**E.** 12

**Question 9**

The slack time in days for activity D will be

**A.** 1
**B.** 2
**C.** 3
**D.** 4
**E.** 5

**END OF MODULE 5**
**TURN OVER**

## MODULE 6 Matrices

### Question 1

Consider the following four matrices

$$A = \begin{bmatrix} 3 \\ 2 \end{bmatrix} \qquad B = \begin{bmatrix} 1 & 7 \\ -2 & 4 \end{bmatrix} \qquad C = \begin{bmatrix} 2 & 4 & 1 \end{bmatrix} \qquad D = \begin{bmatrix} 2 & -2 \end{bmatrix}$$

A matrix product which is not defined is

**A.** AB

**B.** AC

**C.** DA

**D.** DB

**E.** BA

### Question 2

The matrix $B^2$ will exist if matrix B is:

**A.** $\begin{bmatrix} 2 \end{bmatrix}$

**B.** $\begin{bmatrix} 1 \\ 4 \end{bmatrix}$

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

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

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

### Question 3

Consider the matrix $\begin{bmatrix} 4 & x \\ 2 & y \end{bmatrix}$. The inverse of this matrix will not exist if

**A.** $x = 3$ and $y = 2$

**B.** $x = 4$ and $y = 2$

**C.** $x = 2$ and $y = 3$

**D.** $x = 2$ and $y = 4$

**E.** $x = 0$ and $y = 1$

**Question 4**

A matrix product $A \times B$ is performed and the resulting matrix is $\begin{bmatrix} 2 & 5 & 7 \\ 3 & 4 & 0 \end{bmatrix}$.

The number 7 in the product matrix was found by multiplying

**A.** the first row of $A$ × the third column of $B$

**B.** the second row of $A$ × the third column of $B$

**C.** the third row of $A$ × the first column of $B$

**D.** the third of $A$ × the second column of $B$

**E.** the third row of $A$ × the third column of $B$

**Question 5**

For which one of the following matrices is the value of the determinant the smallest?

**A.** $\begin{bmatrix} 0 & 2 \\ 3 & 0 \end{bmatrix}$

**B.** $\begin{bmatrix} 7 & 9 \\ 3 & 4 \end{bmatrix}$

**C.** $\begin{bmatrix} -1 & -3 \\ 3 & 4 \end{bmatrix}$

**D.** $\begin{bmatrix} 5 & 7 \\ 3 & 0 \end{bmatrix}$

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

*The following information is relevant to Question 6 and 7*

In the Galland region, in Autumn, the weather is changeable from day-to-day as can be seen from the following transition matrix

$$\begin{array}{cc} & \begin{array}{cc} \text{Today} & \\ \text{Fine} & \text{Showers} \end{array} \\ \begin{array}{c} \text{Next day} \\ \begin{array}{c} \text{Fine} \\ \text{Showers} \end{array} \end{array} & \begin{bmatrix} 0.3 & 0.4 \\ 0.7 & 0.6 \end{bmatrix} \end{array}$$

**Question 6**

Given that day 1 is fine, the state matrix that represents day 3 is

**A.** $\begin{bmatrix} 0.3 \\ 0.7 \end{bmatrix}$

**B.** $\begin{bmatrix} 0.37 \\ 0.63 \end{bmatrix}$

**C.** $\begin{bmatrix} 0.363 \\ 0.637 \end{bmatrix}$

**D.** $\begin{bmatrix} 0.36 \\ 0.64 \end{bmatrix}$

**E.** $\begin{bmatrix} 0.364 \\ 0.636 \end{bmatrix}$

**Question 7**

In the long term the chance of a particular day being fine is found by calculating

**A.** $\frac{0.4}{0.7}$

**B.** $\frac{0.4}{1.1}$

**C.** $\frac{0.3}{0.6}$

**D.** $\frac{0.3}{0.9}$

**E.** $\frac{0.7}{1.1}$

**Question 8**

The solution to a system of simultaneous linear equations is determined by evaluating

$$\begin{bmatrix} -4 & 3 \\ 3 & -2 \end{bmatrix} \begin{bmatrix} 3 \\ -1 \end{bmatrix}$$

The two linear equations are

**A.** $2x + 3y = 3$ and $3x + 4y = -1$

**B.** $2x + 4y = 3$ and $3x + 3y = -1$

**C.** $-4x + 3y = 3$ and $3x - 2y = -1$

**D.** $2x + 3y = 3$ and $3x - 2y = -1$

**E.** $-4x + 3y = 3$ and $3x + 4y = -1$

**Question 9**

Each night 300 holiday-makers at the Seniors Holiday Resort participate in one of three activities: dancing (D), lawn bowls (L) or bingo (B).

The activity that a holiday-maker participates in each night changes according to the transition matrix below.

$$\begin{array}{c} \\ \\ \begin{bmatrix} 0.6 & 0.5 & 0.2 \\ 0.3 & 0.1 & 0.3 \\ 0.1 & 0.4 & 0.5 \end{bmatrix} \end{array} \begin{array}{c} \textit{tonight} \\ D \quad L \quad B \\ \\ D \\ L \\ B \end{array} \quad \textit{next night}$$

On the first night an equal number of holiday-makers participate in each activity.

Which one of the following statements is **not** true?

**A.** 40% of the holiday-makers participated in the same activity on the second night

**B.** 40% of those who danced on the first night do not dance on the second night

**C.** 40% of the people who were at bingo on the second night were playing lawn bowls the night before

**D.** 40% of those who played lawn bowls the first night will play bingo on the second night

**E.** 40% of the holiday-makers will be dancing on the second night

**END OF MULTIPLE - CHOICE QUESTION BOOKLET**