

2012

VCE

Further Mathematics

Trial Examination 1



Kilbaha Multimedia Publishing
PO Box 2227
Kew Vic 3101
Australia

Tel: (03) 9018 5376
Fax: (03) 9817 4334
kilbaha@gmail.com
<http://kilbaha.com.au>

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VICTORIAN CERTIFICATE OF EDUCATION 2012

FURTHER MATHEMATICS

Trial Written Examination 1 (Facts, skills and applications)

Reading time: 15 minutes
Total writing time: 1 hour 30 minutes

MULTIPLE-CHOICE QUESTION BOOK

Structure of book

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of modules</i>	<i>Number of modules to be answered</i>	<i>Number of marks</i>
A	13	13			13
B	54	27	6	3	27
					Total 40

- Students are permitted to bring into the exam 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 book of 45 pages.
- Answer sheet for multiple-choice questions.
- There is a sheet of miscellaneous formula supplied.
- Working space is provided throughout the book.

Instructions

- Detach the formula sheet from the book during reading time.
- Check that your **name and student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

At the end of the examination

- You may keep this question book.

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

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VCE FURTHER MATHEMATICS 2012

Trial Written Examination 1

ANSWER SHEET

NAME: _____

STUDENT
NUMBER _____

SIGNATURE _____

Instructions

- Write your name in the space provided above.
- Write your student number in the space provided above. Sign your name.
- Use a **PENCIL** for **ALL** entries.
If you make a mistake, **ERASE** it - **DO NOT** cross it out.
- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- All answers must be completed like **THIS** example.

A	B	C	D	E
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VCE FURTHER MATHEMATICS 2012

Trial Written Examination 1

ANSWER SHEET

NAME: _____

STUDENT
NUMBER _____

SIGNATURE _____

Instructions

- Write your name in the space provided above.
- Write your student number in the space provided above. Sign your name.
- Use a **PENCIL** for **ALL** entries.
If you make a mistake, **ERASE** it - **DO NOT** cross it out.
- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- All answers must be completed like **THIS** example.

A	B	C	D	E
---	---	---	---	---

Section A

1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E
13	A	B	C	D	E

Please turn over . . .

VCE FURTHER MATHEMATICS 2012

Trial Written Examination 1

ANSWER SHEET

Section B

(Shade the boxes of the three modules selected. There are a total of six from which to choose)

☐	Module 1	1	A	B	C	D	E
	Number patterns	2	A	B	C	D	E
		3	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E
☐	Module 2	1	A	B	C	D	E
	Geometry and trigonometry	2	A	B	C	D	E
		3	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E
☐	Module 3	1	A	B	C	D	E
	Graphs and relations	2	A	B	C	D	E
		3	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E

Please turn over . . .

VCE FURTHER MATHEMATICS 2012

Trial Written Examination 1

ANSWER SHEET

Section B

(Shade the boxes of the three modules selected. There are a total of six from which to choose)

	Module 4 Business-related mathematics	1	A	B	C	D	E
		2	A	B	C	D	E
		3	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E
	Module 5 Networks and decision mathematics	1	A	B	C	D	E
		2	A	B	C	D	E
		3	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E
	Module 6 Matrices	1	A	B	C	D	E
		2	A	B	C	D	E
		3	A	B	C	D	E
		4	A	B	C	D	E
		5	A	B	C	D	E
		6	A	B	C	D	E
		7	A	B	C	D	E
		8	A	B	C	D	E
		9	A	B	C	D	E

Please DO NOT fold, bend or staple this form

FURTHER MATHEMATICS

Written examinations 1 and 2

FORMULA SHEET

Directions to students

Detach this formula sheet during reading time.

This formula sheet is provided for your reference.

Further Mathematics Formulas

Core: Data analysis

standardised score:

$$z = \frac{x - \bar{x}}{s_x}$$

least squares line:

$$y = a + bx \text{ where } b = r \frac{s_y}{s_x} \text{ and } a = \bar{y} - b\bar{x}$$

residual value:

$$\text{residual value} = \text{actual value} - \text{predicted value}$$

seasonal index:

$$\text{seasonal index} = \frac{\text{actual figure}}{\text{deseasonalised figure}}$$

Module 1: Number patterns

arithmetic series:

$$a + (a + d) + \dots + (a + (n - 1)d) = \frac{n}{2}[2a + (n - 1)d] = \frac{n}{2}(a + l)$$

geometric series:

$$a + ar + ar^2 + \dots + ar^{n-1} = \frac{a(1 - r^n)}{1 - r}, r \neq 1$$

infinite geometric series:

$$a + ar + ar^2 + ar^3 + \dots = \frac{a}{1 - r}, |r| < 1$$

Module 2: Geometry and trigonometry

area of a triangle:

$$\frac{1}{2}bc \sin A$$

Heron's formula:

$$A = \sqrt{s(s - a)(s - b)(s - c)} \text{ where } s = \frac{1}{2}(a + b + c)$$

circumference of a circle:

$$2\pi r$$

area of a circle:

$$\pi r^2$$

volume of a sphere:

$$\frac{4}{3}\pi r^3$$

surface area of a sphere:

$$4\pi r^2$$

volume of a cone:

$$\frac{1}{3}\pi r^2 h$$

volume of a cylinder:

$$\pi r^2 h$$

volume of a prism:

$$\text{area of base} \times \text{height}$$

volume of a pyramid:

$$\frac{1}{3} \text{ area of base} \times \text{height}$$

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: $I = \frac{\text{Pr}T}{100}$

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

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

annuities: $A = PR^n - \frac{Q(R^n - 1)}{R - 1}$, where $R = 1 + \frac{r}{100}$

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 $\det A \neq 0$

END OF FORMULA SHEET

Specific Instructions for Section A

Section A consists of 13 questions

Answer **all** questions in this section.

A correct answer scores 1 mark, an incorrect answer scores 0. No mark will be given for a question if two or more letters are shaded for that question. Marks will not be deducted for incorrect answers and you should attempt every question.

Core**Question 1**

For her research, Sally measured the lengths of 1000 worms over the period of 3 months. What is the best way for Sally to display the data she has collected?

- A. Time series graph
- B. Scatter Plot
- C. Histogram
- D. Bar graph
- E. Back- to-Back Stem Plot

Core**Question 2**

A survey was carried out to see whether people worked full time or part time. The results are listed in the table below.

	Full - Time	Part - Time
Males	734	170
Females	391	205

The percentage of those interviewed who were female part – time workers is closest to

- A. 13.7%
- B. 18.2%
- C. 34.5%
- D. 54.7%
- E. 82.9%

Core**Question 3**

Stem	Leaf
15	0 3
16	1 1 2 7
17	4 5 6 6 6
18	2 2 5 5 5 5
19	4 4 7 7
20	9

18 | 2 represents 18.2

The median of the above stem and leaf is

- A. 17.6
- B. 17.8
- C. 17.9
- D. 18.2
- E. 18.5

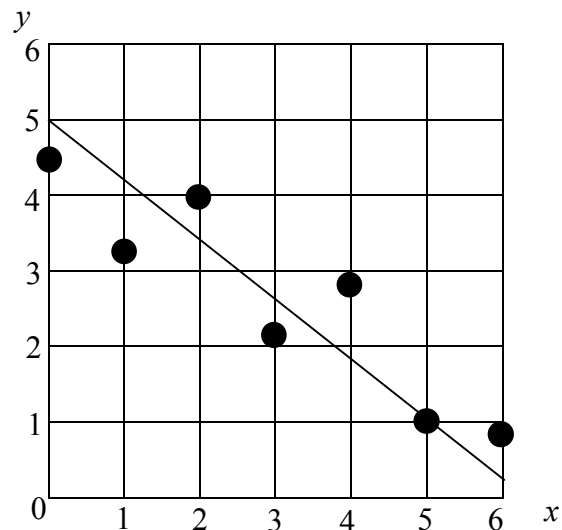
Question 4

The results of a maths test given to Year 12 students had a mean of 62.5 and a standard deviation of 5.3. What percentage of students would have a score between 57.2 and 73.1?

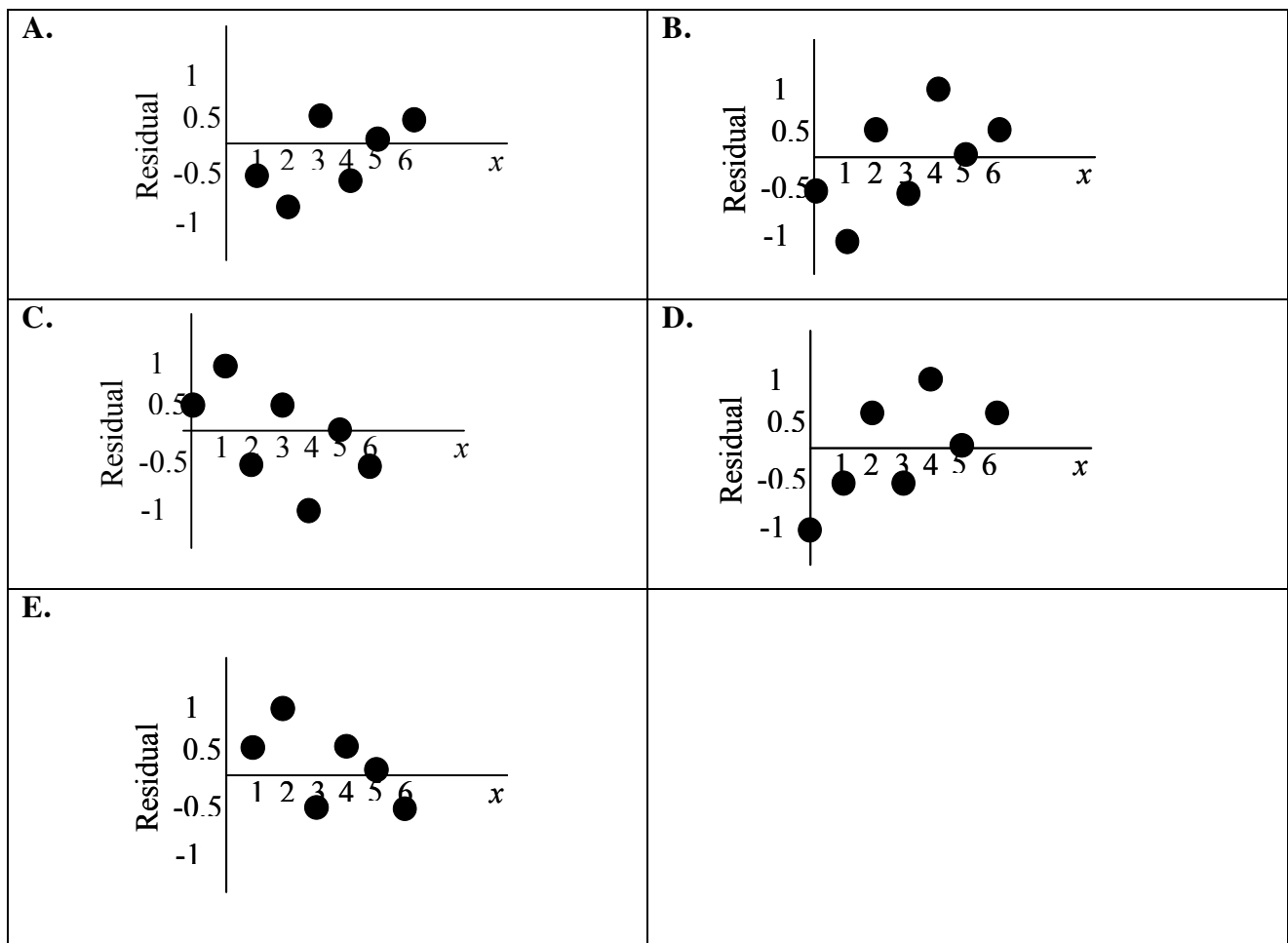
- A. 5%
- B. 16%
- C. 68%
- D. 81.5%
- E. 95%

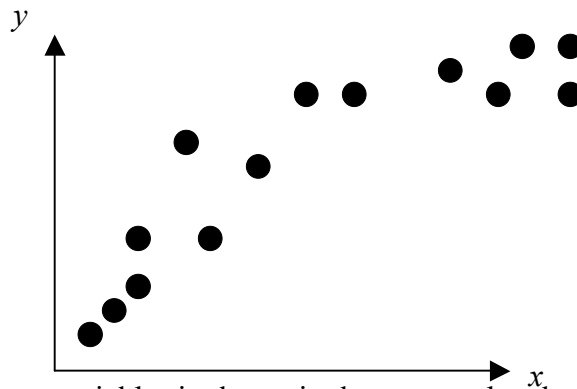
Core

Question 5



The regression line is fitted to the above scatter plot. The residual plot for this data would look like



Core**Question 6**

The relationship between two variables is shown in the scatter plot above. To transform the relationship to linearity, which one of the following transformations should be applied?

- A. A $\log y$ transformation
- B. An x^2 transformation
- C. A $\frac{1}{x}$ transformation
- D. A $\frac{1}{y}$ transformation
- E. A $\log x$ transformation

Core**Question 7**

x	1	2	3	4	5	6	7	8	9	10
y	22	21	20	23	28	27	30	33	37	35

The gradient of the three median regression line for the above data is closest to

- A. 2.0
- B. 2.1
- C. 2.2
- D. 2.3
- E. 2.4

Question 8

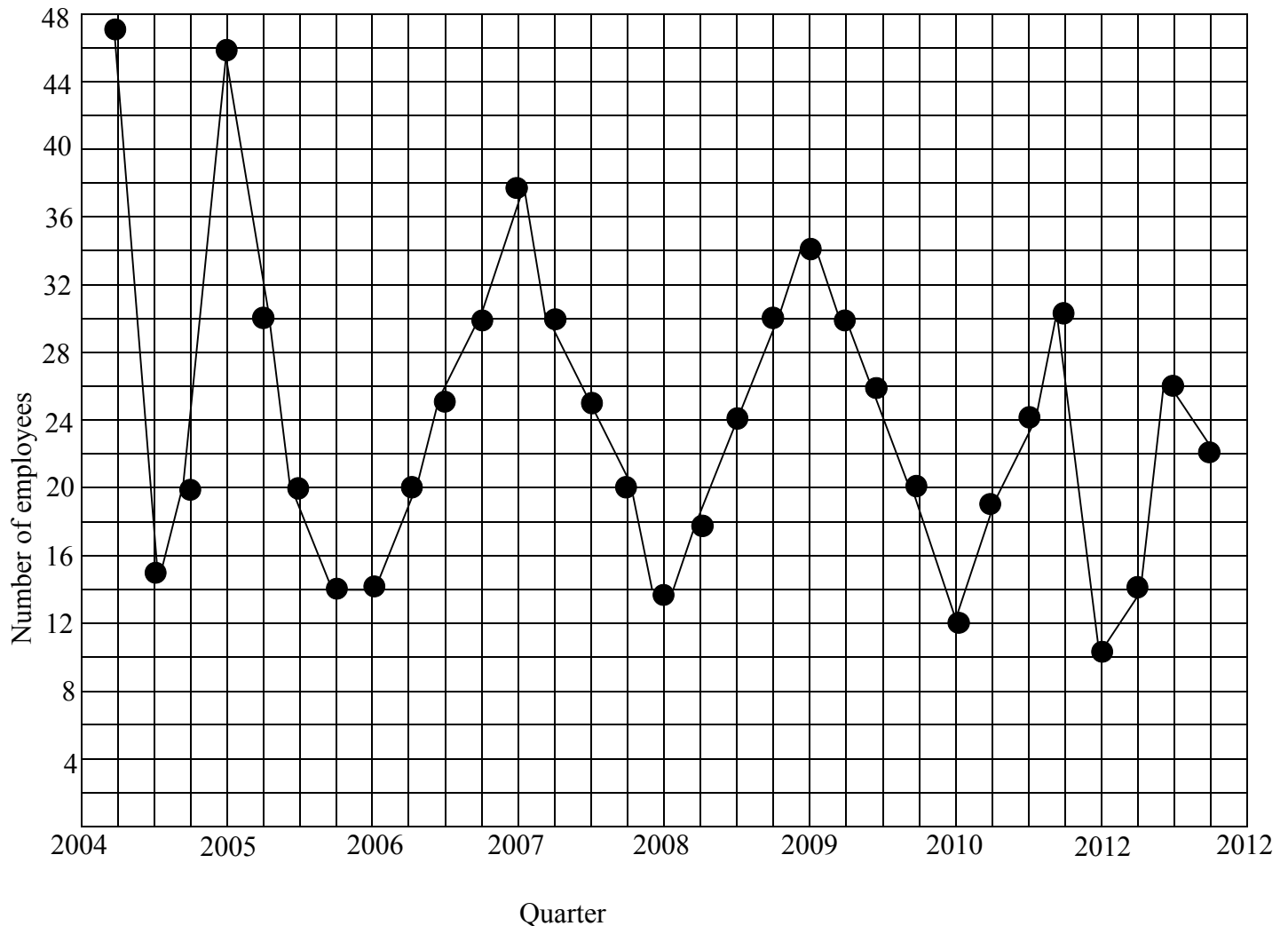
Summer	Autumn	Winter	Spring
2073	2414	2339	1967

The table above shows the number of people who stayed at a country hotel during each of the four seasons last year. To correct for seasonality, the percentage change that needs to be made for spring is

- A. Increase the number who stayed at this time last year by 5.7%
- B. Decrease the number who stayed at this time last year by 10.52%
- C. Decrease the number who stayed at this time last year by 5.7%
- D. Increase the number who stayed at this time last year by 10.52%
- E. Increase the number who stayed at this time last year by 89.48%

Core

The following information relates to Questions 9 and 10

**Question 9**

The number of employees in a computer company is shown in the time series plot above. Which one of the following statements best describes the time series plot for the period shown?

- A. The number of employees shows a decreasing trend with a decreasing variability.
- B. The number of employees shows an increasing trend with a decreasing variability.
- C. The number of employees shows an increasing trend with an increasing variability.
- D. The number of employees shows a decreasing trend with an increasing variability.
- E. The number of employees shows an increasing trend with a constant variability.

Core**Question 10**

If the equation for the least squares regression line is
 $\text{number of employees} = 23 - 0.3 \times \text{the quarter}$, what is the predicted number of employees for the third quarter of 2012?

- A. 12.5
- B. 12.8
- C. 13.1
- D. 13.4
- E. 20.3

Question 11

Year 1				Year 2			
Summer	Autumn	Winter	Spring	Summer	Autumn	Winter	Spring
30	20	8	15	35	25	12	20

The 4 - point moving average for autumn of year 2 is closest to

- A. 20.63
- B. 21.75
- C. 22.38
- D. 23.12
- E. 23.35

Core**Question 12**

The following data are obtained from the test marks of a large number of year 12 maths and physics students.

Mean maths mark = 59

Mean physics mark = 61

Standard deviation for maths = 29.3

Standard deviation for physics = 25.7

Correlation coefficient = 0.71

The equation of the least squares regression line that will enable the physics marks to be predicted from the maths marks, is closest to

- A. $\text{physics mark} = 9.59 + 0.81 \times \text{maths mark}$
- B. $\text{physics mark} = 23 + 0.81 \times \text{maths mark}$
- C. $\text{physics mark} = 34.9 + 0.44 \times \text{maths mark}$
- D. $\text{physics mark} = 32.2 + 0.44 \times \text{maths mark}$
- E. $\text{physics mark} = 24.4 + 0.62 \times \text{maths mark}$

Question 13

A new product is test marketed in several supermarkets. The number of units sold and the prices charged are noted and the correlation coefficient is found to be 0.89. Which one of the following statements is NOT true?

- A. The coefficient of determination is about 0.79
- B. Apart from the price of the product, there could be other factors that affect the number of units of the new product that are sold.
- C. The price of the new product is an important factor in predicting the number of units of the new product that will be sold
- D. There is a strong positive correlation between the number of sales of the product and the price charged.
- E. About 79% of the variation in the price of the product can be explained by the variation in the number of sales.

END OF SECTION A

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.

Choose the response that is **correct** for the question.

A correct answer scores 1 mark, an incorrect answer scores 0.

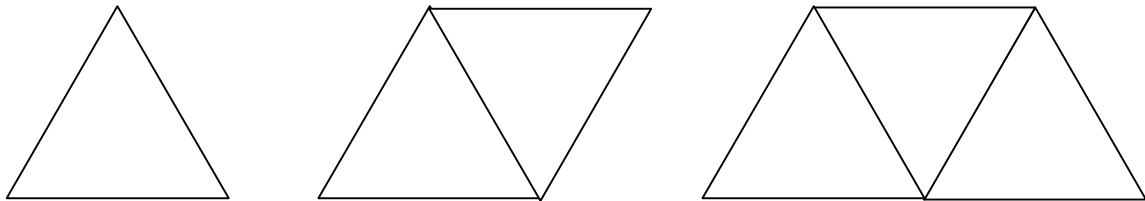
Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Module			Page
Module 1:	Number patterns		11
Module 2:	Geometry and trigonometry		16
Module 3:	Graphs and relations		21
Module 4:	Business-related mathematics		28
Module 5:	Networks and decision mathematics		33
Module 6:	Matrices		39

Module 1: Number patterns and applications

Before answering these questions you **must** shade the Number patterns box on the answer sheet for multiple-choice questions

Question 1

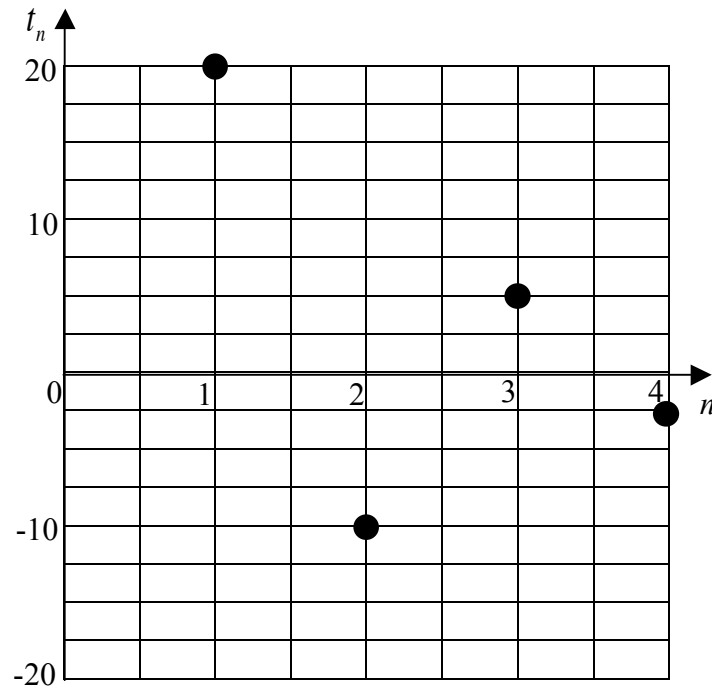
Tessa makes the above three shapes using matches. If she continues with this pattern how many matches will she need to make her fourth shape?

- A. 4
- B. 6
- C. 7
- D. 9
- E. 11

Question 2

In the sequence, 3, 6, 12, what is the value of the seventh term?

- A. 15
- B. 21
- C. 24
- D. 96
- E. 192

Module 1: Number patterns and applications**Question 3**

Which one of the following statements is true given the information in the above graph?

- A** The sum to infinity of all the terms in this sequence is $13\frac{1}{3}$
- B** The sum to infinity of all the terms in this sequence is 40
- C** This is a geometric sequence with the common ratio equal to 2
- D** This is a geometric sequence with the common ratio equal to 0.5
- E** This is an arithmetic sequence with a common difference of -0.5

Question 4

If $A_{n+2} = A_{n+1} - 3A_n$ where $A_1 = -6$ and $A_2 = 4$, then the next three terms are

- A.** 6, -24, 28
- B.** -22, -34, -100
- C.** 14, 26, -16
- D.** 14, -40, 2
- E.** -22, -10, 56

Module 1: Number patterns and applications**Question 5**

The number of terms in the sequence 193, 188, 183,68 is

- A. 25
- B. 26
- C. 27
- D. 29
- E. 30

Question 6

The third and sixth terms of a geometric sequence are 54 and 16 respectively. What is the value of the first term?

- A. 24
- B. 81
- C. 102.75
- D. 121.5
- E. 182.25

Module 1: Number patterns and applications**Question 7**

2400 people visited an art display on the opening day. On each successive day, the attendance fell by 4% of the number who visited on the previous day. The number who visited on the fifth day was closest to

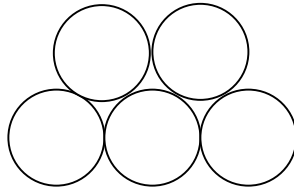
- A. 154
- B. 614
- C. 1956
- D. 2038
- E. 2123

Question 8

$n - 1$, $4n - 4$ and $12n + 16$ are the first three terms of a geometric sequence.

The sum of the first four terms is

- A. 595
- B. 634
- C. 672
- D. 728
- E. 734

Module 1: Number patterns and applications**Question 9**

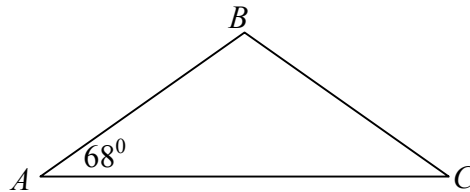
A shopkeeper displays 244 cans of soft drink by laying 34 cans on their side in the bottom row. He then places the next row of cans in the spaces between the cans in the bottom row. He continues in this way until he has all the cans displayed. How many cans are in the top row?

- A. 27
- B. 24
- C. 16
- D. 12
- E. 8

End of Module 1

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

Question 1

In triangle ABC , $AB = 18$ cm, $BC = 23$ cm and $\angle BAC = 68^\circ$. The magnitude of $\angle ACB$ is closest to

- A. 46°
- B. 47°
- C. 56°
- D. 57°
- E. 58°

Question 2

Gary walks 8 km due west and then 3 km due north. The bearing he must take to return to the start is closest to

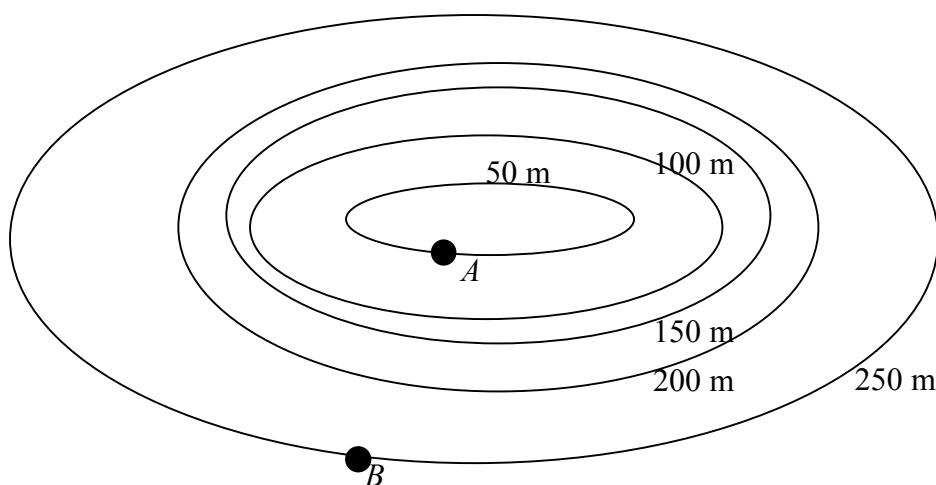
- A. 21° T
- B. 69° T
- C. 111° T
- D. 115° T
- E. 291° T

Module 2: Geometry and trigonometry**Question 3**

A sculptor makes a clay model of a dog that she is planning to create. The model is 20 cm high and the final sculpture will be 100 cm high. If the volume of the final sculpture is 1800 cm^3 , then the volume of the model is closest to?

- A. 14 cm^3
- B. 72 cm^3
- C. 360 cm^3
- D. 805 cm^3
- E. 9000 cm^3

Use the following information to answer questions 4 and 5



On the contour map above, 2 cm represents 1 km. The length of the line that joins AB on the contour map is 7 cm.

Question 4

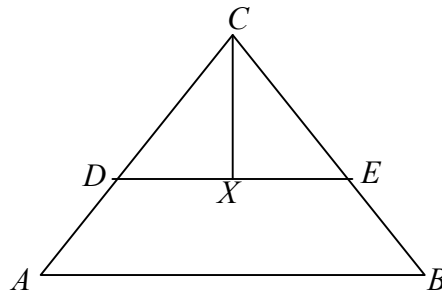
What is the distance from A to B in metres?

- A. 3.5
- B. 35
- C. 350
- D. 3500
- E. 35000

Module 2: Geometry and trigonometry**Question 5**

The gradient of the line joining AB is closest to

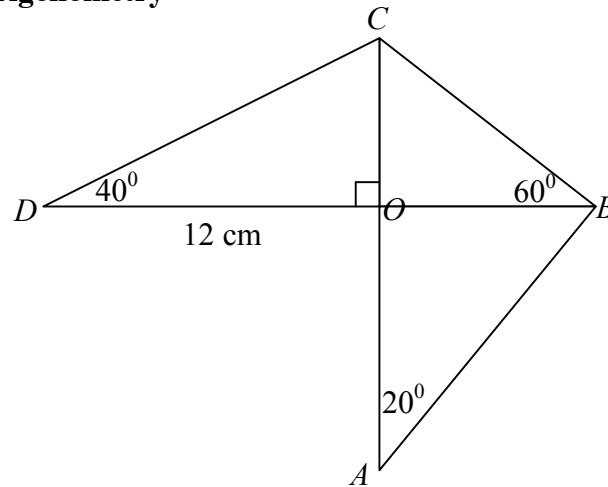
- A. 0.06
- B. 3.27
- C. 3.28
- D. 86.72
- E. 86.73

Question 6

ABC is an isosceles triangle with $AC = BC = 13$ cm. DE is parallel to AB and CX is perpendicular to DE . $CX = 8$ cm and $AB = 10$ cm. How many times larger is the area of triangle ABC to the area of triangle DEC ?

- A. 0.44
- B. 1.25
- C. 1.5
- D. 2.25
- E. 2.6

Module 2: Geometry and trigonometry

Module 2: Geometry and trigonometry**Question 7**

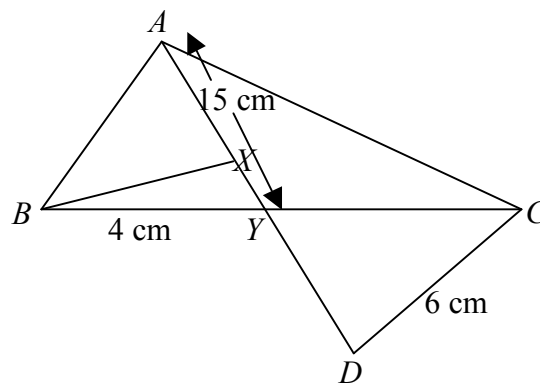
In the above diagram, $\angle CDO = 40^\circ$, $\angle CBO = 60^\circ$ and $\angle BAO = 20^\circ$. $DO = 12\text{ cm}$. The length of AB is closest to

- A. 5 cm
- B. 6 cm
- C. 12cm
- D. 16 cm
- E. 17 cm

Module 2: Geometry and trigonometry**Question 8**

A piece of wire 320 cm in length is bent to make an isosceles triangle where one of the angles is 102° . The length of the equal sides of the triangle is closest to

- A. 57 cm
- B. 67 cm
- C. 90 cm
- D. 114 cm
- E. 124 cm

Question 9

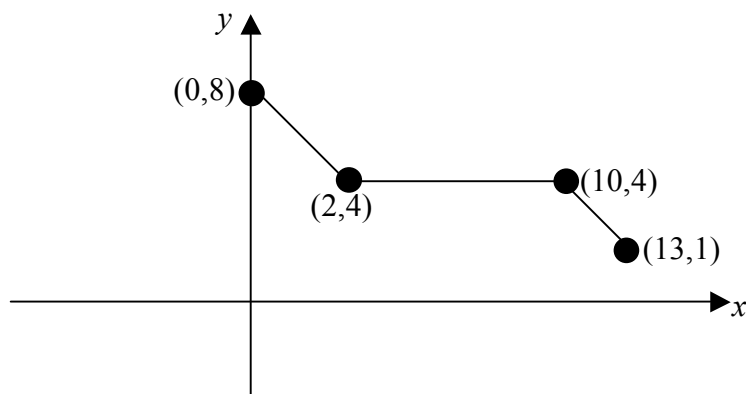
In the above diagram, $CD = 6$ cm, $AY = 15$ cm and $BY = 4$ cm. CD and BX are perpendicular to AD . The ratio of $AX:XY = 4:1$. The length of YC is closest to

- A. 2 cm
- B. 4.5 cm
- C. 4.8 cm
- D. 9 cm
- E. 22.5 cm

End of Module 2

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

Question 1

The graph above has the rule

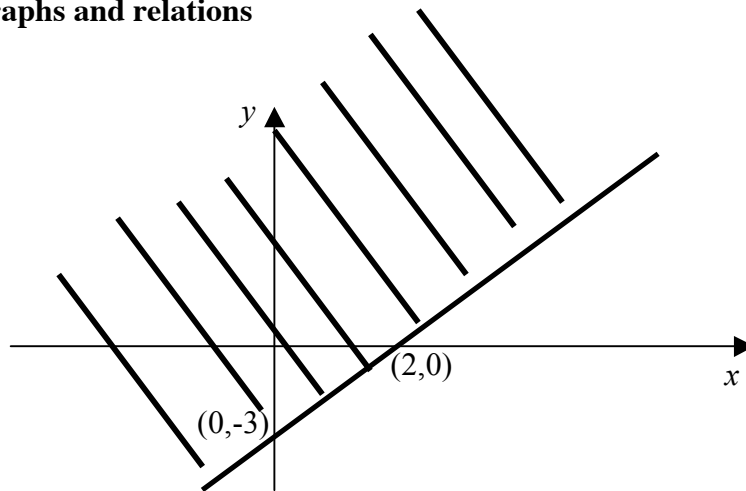
A. $y = \begin{cases} 2x + 8 & 0 \leq x \leq 2 \\ 4 & 2 < x \leq 10 \\ x + 14 & 10 < x \leq 13 \end{cases}$

B. $y = \begin{cases} 8 - 2x & 0 \leq x \leq 2 \\ 4 & 2 < x \leq 10 \\ 14 - x & 10 < x \leq 13 \end{cases}$

C. $y = \begin{cases} 2x + 8 & 0 \leq x \leq 2 \\ 8 & 2 < x \leq 10 \\ x + 14 & 10 < x \leq 13 \end{cases}$

D. $y = \begin{cases} 8 - 2x & 0 \leq x \leq 2 \\ 4 & 2 < x \leq 10 \\ 1 - x & 10 < x \leq 13 \end{cases}$

E. $y = \begin{cases} 8 - 2x & 0 \leq x \leq 2 \\ 2 & 2 < x \leq 10 \\ x + 14 & 10 < x \leq 13 \end{cases}$

Module 3: Graphs and relations**Question 2**

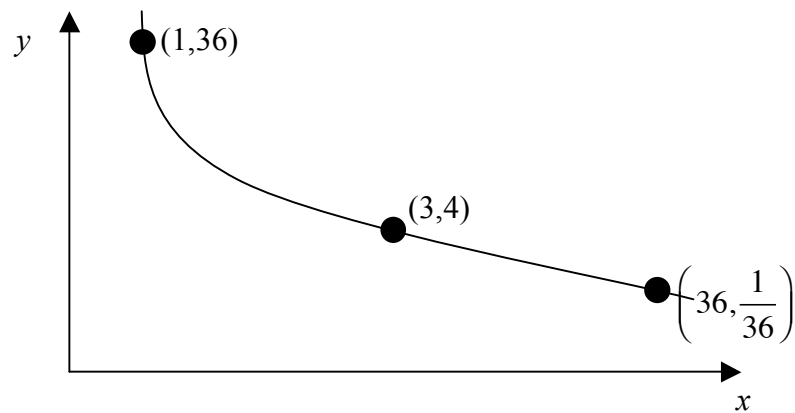
The shaded region above can be described by the inequality

- A. $3x - 2y \leq 6$
- B. $2x - 3y \leq 6$
- C. $-3x + 2y \geq 2$
- D. $2x - 3y \geq 6$
- E. $3x - 2y \geq 6$

Question 3

If the lines, AB and BC have the equations $3x + y = 15$ and $x - 3y = 12$ respectively, then which one of the following statements is true?

- A. The point $(3, 6)$ lies at the point of intersection of AB and BC .
- B. The point $(3, 3)$ lies on the line BC .
- C. The point $(3, -3)$ lies on the line AB .
- D. AB is parallel to BC .
- E. AB is perpendicular to BC .

Module 3: Graphs and relations**Question 4**

The rule connecting y and x for the above graph is

- A. $y = \frac{36}{x}$
- B. $x = \frac{36}{y^2}$
- C. $y = \frac{36}{x^2}$
- D. $y = 4x + 24$
- E. $y = \frac{4x}{3}$

Module 3: Graphs and relations**Question 5**

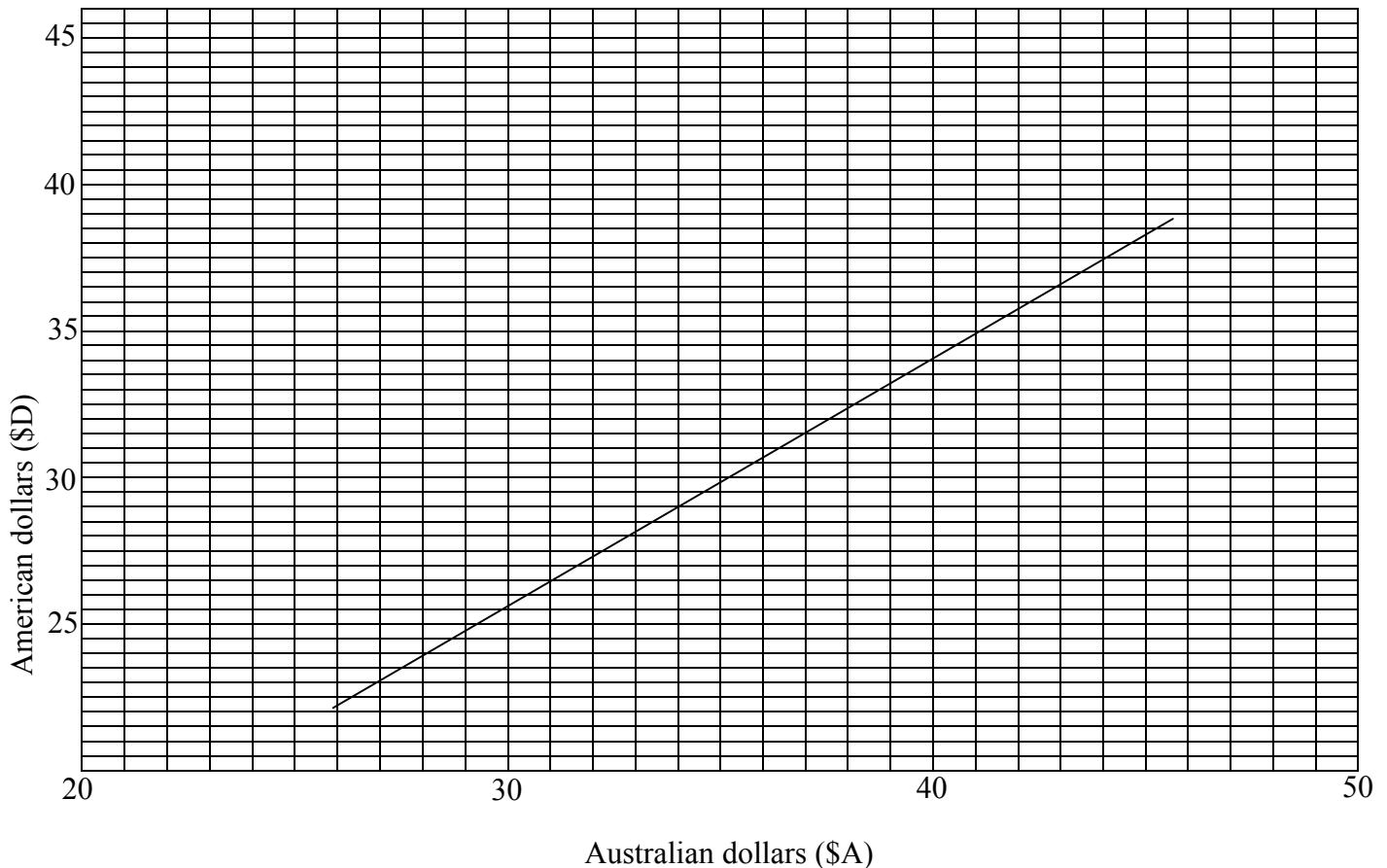
A line parallel to the line $4x + 2y - 12 = 0$ passes through the point of intersection of the lines with equations $3x + y - 5 = 0$ and $2x - 3y - 7 = 0$. The equation of the unknown line is

- A. $y = 2x + 5$
- B. $y = -2x + 5$
- C. $y = 2x + 3$
- D. $y = -2x + 3$
- E. $y = 2x - 3$

Question 6

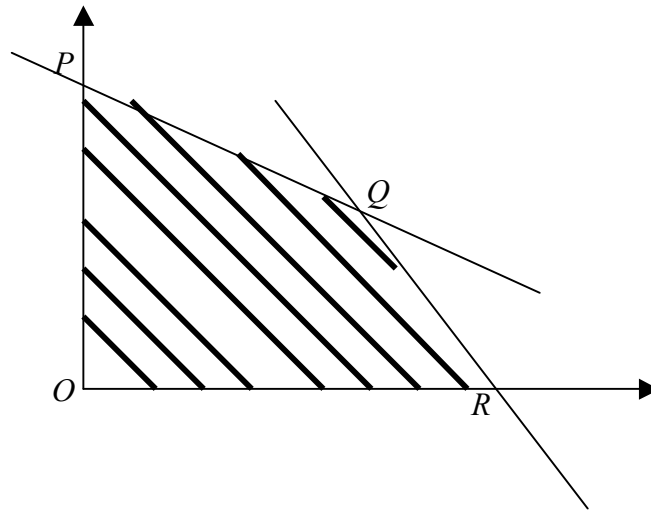
Which one of the following pairs of simultaneous equations has no solution?

- A. $3x + 2y = -1$
 $5x + 3y = -3$
- B. $x - 2y = 3$
 $3x + 10y = 7$
- C. $2y + 3x = 4$
 $3x + 2y = 1$
- D. $2x + 3y = 4$
 $6x + 9y = 12$
- E. $3x + 2y = -1$
 $4x - y = 6$

Module 3: Graphs and relations**Question 7**

Simon changed different amounts of Australian currency into American currency. He then used this information to plot the above graph. Which one of the following statements is true?

- A.** The gradient of the above graph shows the value of the American dollars received for the corresponding Australian dollars.
- B.** The gradient of the above graph shows the value of the Australian dollars received for the corresponding American dollars.
- C.** To change American dollars into Australian dollars, Simon would multiply the American dollars by the gradient.
- D.** To change Australian dollars into American dollars, Simon would multiply the Australian dollars by the gradient.
- E.** The equation of the above line is $D = 0.85A + 17$

Module 3: Graphs and relations**Question 8**

If $OPQR$ is the feasible region, then the **maximum** and **minimum** values of $x - y$ occur respectively at

- A. P and R
- B. R and P
- C. Q and R
- D. R and Q
- E. Q and P

Module 3: Graphs and relations**Question 9**

A company wants to make souvenir mugs for the London Olympics. Each mug will be sold for \$3.00. The costs of producing the mugs are listed in the table below.

Production	Variable Cost per unit (\$)	Total Fixed Costs (\$)
0 - 5000	0.80	8800
5001 - 10000	1.00	12000
10001 - 15000	2.10	14400

Assuming that all the mugs produced can be sold, then the number of mugs, x , that must be produced to give a profit is

- A. $x > 4000$
- B. $4000 < x \leq 5000 \cup 6000 \leq x \leq 10000 \cup 11000 < x \leq 15000$
- C. $4000 < x \leq 5000 \cup 6000 \leq x \leq 15000$
- D. $4000 < x \leq 5000 \cup 6000 < x \leq 10000$
- E. $4000 \leq x \leq 10000$

End of Module 3

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

Question 1

The price of a concert ticket is \$135. This price includes 10% GST. The amount of tax that goes to the government as GST from the sale of 600 of these concert tickets is closest to

- A. \$810
- B. \$7360
- C. \$7364
- D. \$8000
- E. \$8100

Question 2

Ian invested some money at 6% per annum simple interest for 36 months. If he earned \$486 interest, the amount of money he invested was

- A. \$2430
- B. \$2700
- C. \$4081
- D. \$8748
- E. \$9720

Module 4: Business-related mathematics**Question 3**

Ruby wants to buy a mobile phone for \$400. She pays \$120 deposit and agrees to pay the phone off over 2 years by paying \$20 a month. The interest per annum that she pays is closest to

- A. 10%
- B. 14%
- C. 32%
- D. 36%
- E. 40%

Question 4

Yuan invests \$4500 for five years at 7.2% per annum compounding monthly. The balance at the end of the five years is

- A. $4500 + (1.072)^{60}$
- B. $4500(1.06)^{60}$
- C. $4500(1.06)^5$
- D. $4500(1.072)^5$
- E. $4500(1.006)^{60}$

Module 4: Business-related mathematics**Question 5**

After 7 years, a car that was originally worth \$25000 was only valued at \$14500. If the car depreciated at a rate of 5 cents per kilometre, then the number of kilometres travelled by the car in the 7 year period was

- A. 2100
- B. 5250
- C. 52500
- D. 210000
- E. 525000

Question 6

Date	Deposit	Withdrawal	Balance
March 3 rd	200		\$465.20
March 8 th		80	385.20
March 12 th	200		585.20
March 21 st		130.70	454.50
March 30 th	300		754.50
April 4 th	120		874.50
April 20 th	100		974.50
April 30 th		160.50	814

The above is Lydia's bank statement. The amount of interest Lydia would receive for the months of March and April, where the bank pays 5.8% interest per annum at the end of each month on the minimum monthly balance is closest to

- A. \$1.28
- B. \$1.86
- C. \$4.93
- D. \$5.51
- E. \$5.79

Module 4: Business-related mathematics**Question 7**

At the beginning of 2010, the cost of Jack's house was \$300000. If the inflation rate for the next ten years is predicted to be 3.0% each year, then the value of Jack's house at the beginning of 2020 if it keeps pace with the inflation rate should be closest to

- A. \$345000
- B. \$390000
- C. \$391432
- D. \$399000
- E. \$403175

The following information relates to questions 8 and 9

Tessa borrows \$20000 and repays \$365.80 each month. The interest rate is 0.54% per month, compounding monthly.

Question 8

The amount that Tessa owes after 5 years is closest to

- A. \$1790
- B. \$1812
- C. \$1948
- D. \$18214
- E. \$18697

Module 4: Business-related mathematics**Question 9**

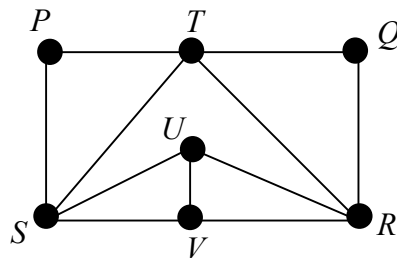
If, after 2 years, the interest increases to 0.65% per month, the amount that Tessa would now have to repay each month in order to repay the whole loan in the same time as it would have taken her had there been no increase in interest would be closest to

- A. \$254
- B. \$331
- C. \$374
- D. \$378
- E. \$558

End of Module 4

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.

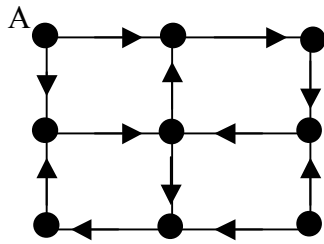
Question 1

For the graph above, which one of the following is a Hamiltonian circuit?

- A. T P S V R U Q T
- B. T Q R T P S V U T
- C. R V S P T Q R U
- D. U V S P T Q R
- E. U V S P T Q R U

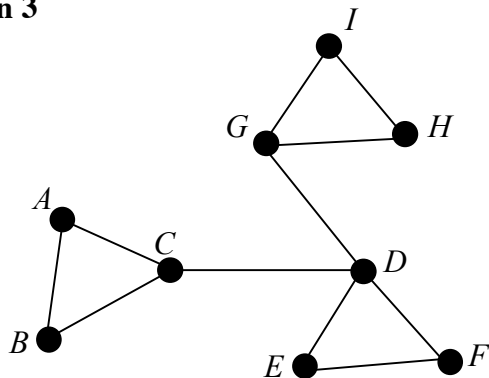
Module 5: Networks and decision mathematics

Question 2



The number of other vertices reachable from A is

- | | |
|-----------|---|
| A. | 1 |
| B. | 3 |
| C. | 5 |
| D. | 7 |
| B. | 8 |

Module 5: Networks and decision mathematics**Question 3**

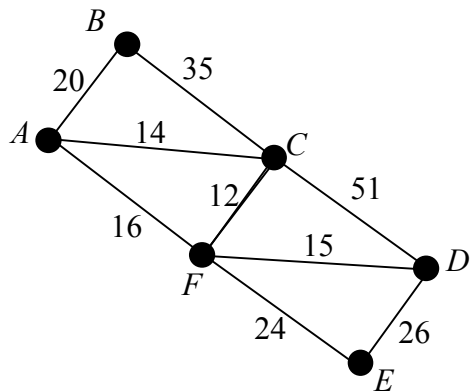
To change the above graph so that it has an Eulerian circuit, an edge could be added between

- A. C and G
- B. B and E
- C. D and H
- D. F and I
- E. A and I

Question 4

Jack has to make a decision about whether to sell his fruit in Pansy Parade or Wheelbarrow Lane. If he sells in Pansy Parade, there will be no competition and demand may be 1000, 2000 or 3000 pieces of fruit. If he sells in Wheelbarrow Lane, there may be competition and the demand for his fruit may be 100, 1000 or 2000 pieces of fruit. Prices in Wheelbarrow Lane will be \$3 or \$5 a piece of fruit, whereas in Pansy Parade the prices will be \$1 or \$4 a piece of fruit. Jack could represent this information as

- A. a complete graph
- B. an Euler path
- C. a tree
- D. a Hamiltonian circuit
- E. a critical path

Module 5: Networks and decision mathematics**Question 5**

The above graph shows the roads connecting six towns and the distances in kilometres along these roads. A water pipe has to be laid under existing roads to connect each of the six towns. The minimum length of pipe required is

- A. 77 km
- B. 85 km
- C. 87 km
- D. 96 km
- E. 112 km

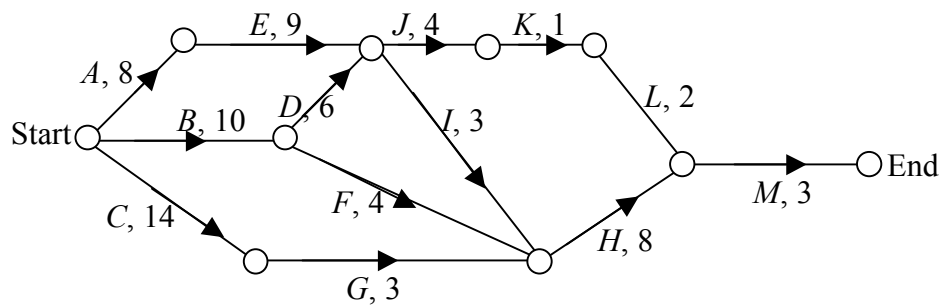
Question 6

A connected planar graph has 4 vertices and 6 faces. A number of edges is removed to give a connected graph with 2 vertices and 2 faces. The number of edges removed is

- A. 2
- B. 3
- C. 4
- D. 6
- E. 8

Module 5: Networks and decision mathematics

The following information relates to questions 7, 8 and 9



This network shows the number of days required to complete each stage of a project.

Question 7

The critical path for the above network is

- A. A-E-J-K-L-M
- B. A-E-I-H-M
- C. B-D-I-H-M
- D. B-F-H-M
- E. C-G-H-M

Module 5: Networks and decision mathematics

Question 8

The minimum time for completing the project is

- A. 25 days
- B. 26 days
- C. 27 days
- D. 28 days
- E. 31 days

Question 9

The float time for activity F is

- A. 1 day
- B. 2 days
- C. 4 days
- D. 5 days
- E. 6 days

End of Module 5

Module 6: Matrices

Before answering these questions you **must** shade the Matrices box on the answer sheet for multiple-choice questions.

Question 1

If $A = \begin{bmatrix} 3 & -1 \end{bmatrix}$ and $B = \begin{bmatrix} -2 \\ 3 \end{bmatrix}$

then which one of the following best describes AB

- A. $[-9]$
- B. $\begin{bmatrix} -6 & 9 \\ 2 & -3 \end{bmatrix}$
- C. $\begin{bmatrix} -6 & 2 \\ 9 & -3 \end{bmatrix}$
- D. $\begin{bmatrix} -6 \\ -3 \end{bmatrix}$
- E. AB is not defined.

Question 2

Which one of the following statements is true?

- A. All matrices have an inverse.
- B. An $m \times n$ matrix can be added to an $n \times m$ matrix for all values of m and n .
- C. Some matrices are commutative for multiplication.
- D. A $p \times q$ matrix can be multiplied by a $p \times q$ matrix for all values of p and q .
- E. A 4×1 matrix is a row matrix.

Module 6: Matrices**Question 3**

If $A = \begin{bmatrix} -3 & 0 \\ 7 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & -3 \\ -1 & 5 \end{bmatrix}$, then $A - 2B$ equals

A. $\begin{bmatrix} -11 & 6 \\ 5 & -8 \end{bmatrix}$

B. $\begin{bmatrix} -11 & 6 \\ 9 & -8 \end{bmatrix}$

C. $\begin{bmatrix} -5 & 6 \\ 9 & 12 \end{bmatrix}$

D. $\begin{bmatrix} -11 & 6 \\ 9 & 12 \end{bmatrix}$

E. $\begin{bmatrix} 5 & 6 \\ 9 & 12 \end{bmatrix}$

Module 6: Matrices**Question 4**

Which one of the following could be a transition matrix?

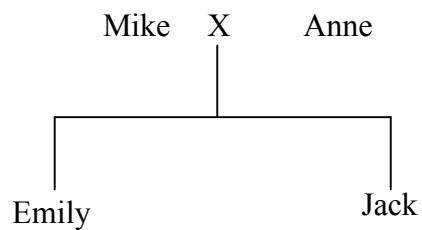
A. $\begin{bmatrix} 50 \\ 70 \end{bmatrix}$

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

C. $\begin{bmatrix} 0.2 & 0.8 \\ 0.3 & 0.2 \end{bmatrix}$

D. $\begin{bmatrix} 0.1 & 0.3 & 0.2 \\ 0.9 & 0.7 & 0.8 \end{bmatrix}$

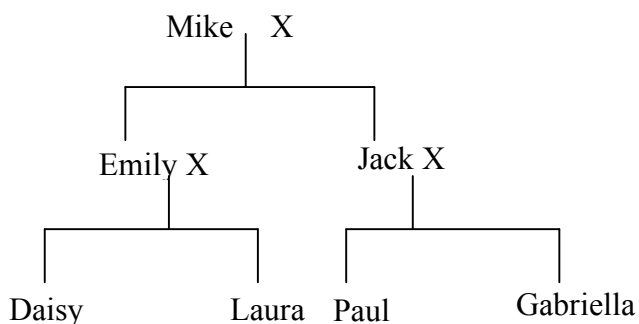
E. $\begin{bmatrix} 0.06 & 0.7 \\ 0.94 & 0.3 \end{bmatrix}$

Module 6: Matrices**Question 5**

The above family tree is used to create the following matrix, which shows “is the mother of”

$$\begin{array}{c}
 M \quad A \quad E \quad J \\
 \begin{array}{c} M \\ A \\ E \\ J \end{array} \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}
 \end{array}$$

The following family tree and corresponding matrix shows



$$\begin{array}{c}
 M \quad A \quad B \quad E \quad J \quad S \quad D \quad L \quad G \quad P \\
 \begin{array}{c} M \\ A \\ B \\ E \\ J \\ S \\ D \\ L \\ G \\ P \end{array} \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}
 \end{array}$$

- A. “is the father of”
- B. “is the brother of”
- C. “is the sister of”
- D. “is the grandmother of”
- E. “is the aunty of”

Module 6: Matrices**Question 6**

If $\begin{bmatrix} 1 & -3 \\ -1 & 2 \end{bmatrix} \times \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} -14 & -11 \\ 5 & 16 \end{bmatrix}$ then $b - c$ equals

- A. -35
- B. -17
- C. -16
- D. 27
- E. 79

Question 7

If A is an $m \times n$ matrix, B is an $n \times m$ matrix, C is an $m \times m$ matrix and D is an $n \times n$ matrix, then which one of the following is defined?

- A. CD^{-1}
- B. $D^{-1}A$
- C. $AB + D$
- D. $AB + C^{-1}$
- E. $(A + B)C$

Module 6: Matrices**Question 8**

$$\text{If } 2a + 3b - c = -4$$

$$a - 2b + 3c = 19$$

$$3a + 2b - 4c = -11$$

then $a + b + c$ equals

A. -5

B. -3

C. 2

D. 3

E. 5

Module 6: Matrices**Question 9**

Julie is an amateur triathlete. She can swim at 2 km per hour, cycle at 25 km/hr and run at 10 km/hr. The number of hours she spent training on 3 successive days is given in the matrix below

$$\begin{array}{c}
 \text{Run} \quad \text{Cycle} \quad \text{Swim} \\
 \begin{array}{l}
 \text{Day1} \\
 \text{Day2} \\
 \text{Day3}
 \end{array}
 \begin{bmatrix}
 2 & 3 & 1 \\
 4 & 2 & 0.5 \\
 1 & 4 & 1.5
 \end{bmatrix}
 \end{array}$$

The total distance travelled by Julie while swimming during these three days can be found by

- A.** Evaluating $\begin{bmatrix} 2 & 3 & 1 \\ 4 & 2 & 0.5 \\ 1 & 4 & 1.5 \end{bmatrix} \times \begin{bmatrix} 2 \\ 25 \\ 10 \end{bmatrix}$ and taking the answer in the third row first column of this answer.
- B.** Evaluating $\begin{bmatrix} 2 & 3 & 1 \\ 4 & 2 & 0.5 \\ 1 & 4 & 1.5 \end{bmatrix} \times \begin{bmatrix} 10 \\ 25 \\ 2 \end{bmatrix}$ and taking the answer in the third column first row of this answer.
- C.** Evaluating $\begin{bmatrix} 2 & 3 & 1 \\ 4 & 2 & 0.5 \\ 1 & 4 & 1.5 \end{bmatrix} \times \begin{bmatrix} 2 \\ 25 \\ 10 \end{bmatrix}$ and taking the answer in the third column first row of this answer.
- D.** Evaluating $\begin{bmatrix} 2 & 3 & 1 \\ 4 & 2 & 0.5 \\ 1 & 4 & 1.5 \end{bmatrix} \times \begin{bmatrix} 10 \\ 25 \\ 2 \end{bmatrix}$ and taking the answer in the third row first column of this answer.
- E.** Evaluating $\begin{bmatrix} 2 & 4 & 1 \\ 3 & 2 & 4 \\ 1 & 0.5 & 1.5 \end{bmatrix} \times \begin{bmatrix} 10 & 25 & 2 \end{bmatrix}$ and taking the answer in the third row first column of this answer.

End of Module 6

**End of 2012 Further Mathematics Trial Examination 1
Multiple Choice Question Book**

Kilbaha Multimedia Publishing
PO Box 2227
Kew Vic 3101
Australia

Tel: (03) 9018 5376
Fax: (03) 9817 4334
kilbaha@gmail.com
<http://kilbaha.com.au>