# 2011

# VCE

# Further Mathematics

# Trial Examination 1

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# VICTORIAN CERTIFICATE OF EDUCATION
# 2011

# 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**

| 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 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 48 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 2011
# 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 2011
# 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 | | | | | | |
|---|---|---|---|---|---|---|
| **Number patterns** | **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 2 | | | | | | |
| **Geometry and trigonometry** | **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 3 | | | | | | |
| **Graphs and relations** | **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 turn over . . .**

# VCE FURTHER MATHEMATICS 2011
## 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** | **1** | A | B | C | D | E |
| **Networks and decision mathematics** | **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** | **1** | A | B | C | D | E |
| **Matrices** | **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.

2

# 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:
$$\text{residual value = actual value – predicted value}$$

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

## Module 1: Number patterns

arithmetic series:
$$a + (a+d) + \ldots + (a+(n-1)d) = \frac{n}{2}[2a+(n-1)d] = \frac{n}{2}(a+l)$$

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

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

## 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:                        $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

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

## Module 3: Graphs and relations

### Straight line graphs

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

equation:                         $y = mx + c$

## Module 4: Business-related mathematics

simple interest:                  $I = \dfrac{\Pr T}{100}$

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

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

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

## Module 5: Networks and decision mathematics

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

## Module 6: Matrices

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

**END OF FORMULA SHEET**

**Core**

**Question 1**

A class of 24 students has a mean test mark of 16.  Another class of 15 students who sat the same test has a mean test mark of 18.  The mean for the two classes combined is closest to

A.    16.1

B.    16.2

C.    16.5

D.    16.7

E.    16.8

**Core**

**Question 2**

The children in Mr. Clooney's Biology class were asked how many pets they owned. The results are shown in the graph below.
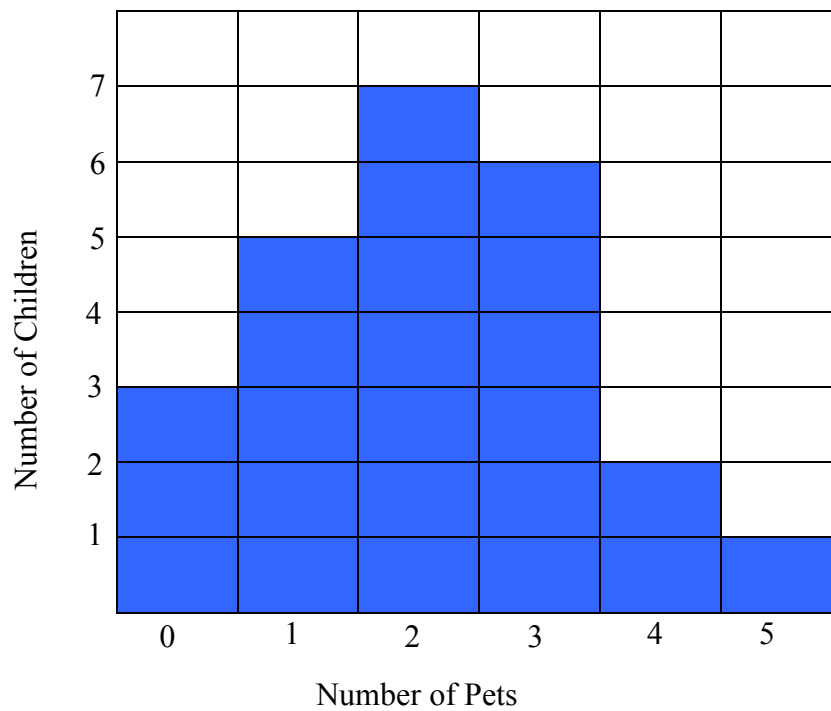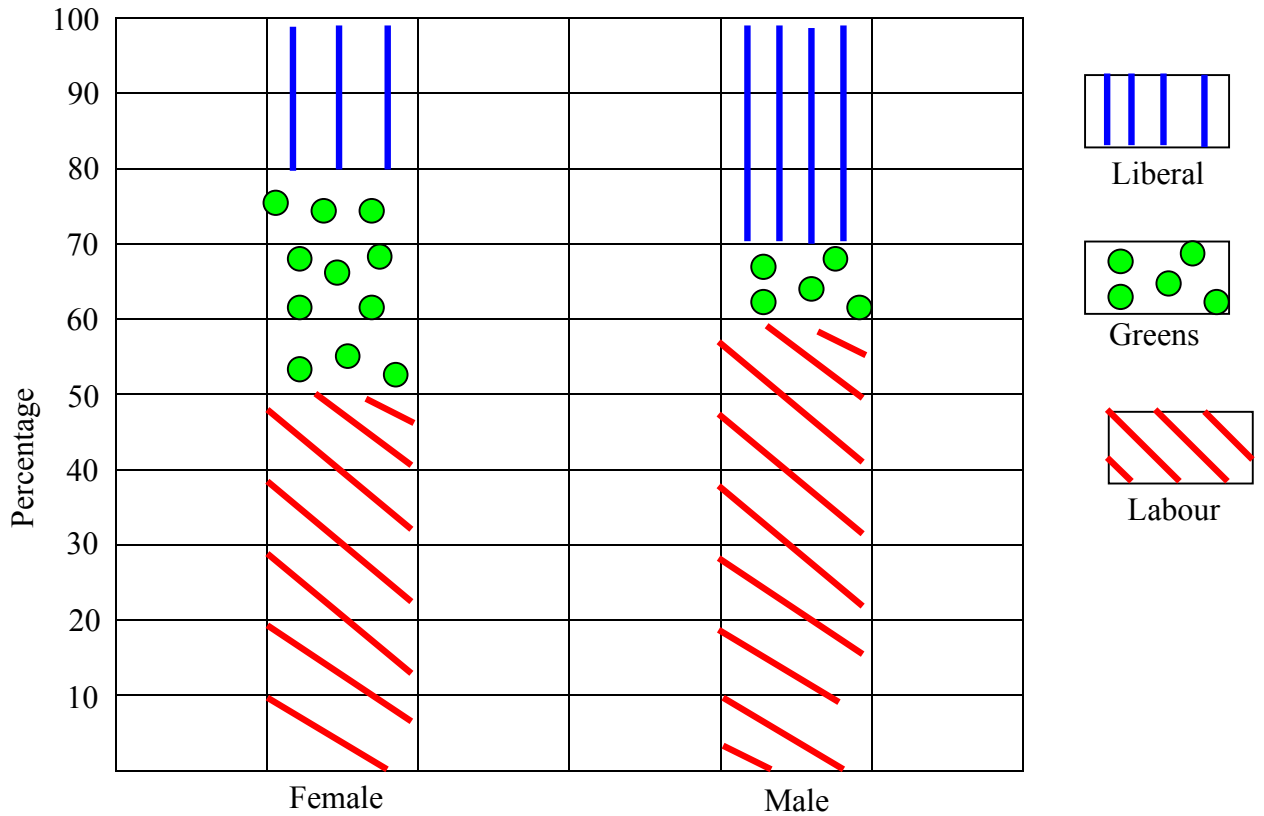


The total number of pets owned by these children is

**A.**     11

**B.**     24

**C.**     28

**D.**     50

**E.**     53

**Core**

**Question 3**



The results of an election where 85000 males and 70000 females voted is shown in the graph above. Which one of the following statements is correct?

**A.**     **1**2500 more males than females voted for the Greens

**B.**     **1**2500 more females than males voted for the Greens

**C.**     3500 more females than males voted for the Greens

**D.**     3500 more males than females voted for the Greens

**E.**     The number of females who voted for the Greens was three times the number of males who voted for the greens.

**Core**

**Question 4**

A student scores 35 on a test where the standard deviation is 5. If the student's standardized score is -1, then the mean mark for this test is

**A.**    25

**B.**    30

**C.**    40

**D.**    45

**E.**    50

**Question 5**

| Alcohol frequency | Age | | | | |
|---|---|---|---|---|---|
| | <12 years | $12 \le Age < 15$ | $15 \le Age < 18$ | $18 \le Age \le 21$ | Total |
| **> Once a week** | 25 | 41 | | 90 | 204 |
| **Once a week** | 32 | | 94 | 109 | 359 |
| **< Once a week** | 84 | 97 | | 46 | |
| **Never** | 59 | | 36 | 15 | 158 |
| **Total** | 200 | | | 260 | 1020 |

A survey asked people 21 years and younger how often they drank alcohol. The results are given in the table above. The percentage of these people who drink alcohol and are at least 15 years but less than18 years is closest to

**A.**    13%

**B.**    21%

**C.**    24%

**D.**    25%

**E.**    45%

**Core**

**Question 6**

The heights of 300 students are approximately normally distributed with a mean of 168 cm and a standard deviation of 4 cm. The number of students with a height between 164 cm and 176 cm is closest to

**A.** 204

**B.** 245

**C.** 264

**D.** 285

**E.** 298

**Core**

### The following information relates to questions 7 and 8

The heights of ten sports women have a mean of 175 cm and a standard deviation of 7 cm, while the weights of these women have a mean of 60 kg and a standard deviation of 6 kg. Pearson's correlation coefficient for this bivariate data where height is the independent variable is 0.93.

**Question 7**

The equation of the least squares regression line is closest to

A.  $Weight = 0.8 \times height - 79$

B.  $Weight = 0.8 \times height - 127$

C.  $Weight = 0.8 \times height - 60$

D.  $Weight = 1.1 \times height - 109$

E.  $Weight = 1.1 \times height - 133$

**Question 8**

From the given data it can be deduced that approximately

A.  93% of the variation in the weight of these sports women can be explained by the variation in their height.

B.  93% of the variation in the height of these sports women can be explained by the variation in their weight.

C.  86% of the variation in the weight of these sports women can be explained by the variation in their height.

D.  86% of the variation in the height of these sports women can be explained by the variation in their weight.

E.  9.6% of the variation in the weight of these sports women can be explained by the variation in their height.

**Core**

The table below shows the relationship between the number of runs Paul makes in a cricket match and the time he spends in practice before the match.

| Number of hours practice | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Number of runs in match | 3 | 7 | 19 | 39 | 67 |

**Question 9**

Which one of the following transformations is most likely to linearise the relationship?

**A.**   Number of runs in match $=$ log(number of hours of practice)

**B.**   Number of runs in match $= \dfrac{1}{\text{number of hours of practice}}$

**C.**   (Number of runs in match)$^2$ $=$ number of hours of practice

**D.**   Number of runs in match $=$ (number of hours of practice)$^2$

**E.**   log(number of runs in match) $=$ number of hours of practice

**Core**

**Question 10**

Points are plotted on a scatter plot and the least squares regression line is then drawn. This line passes through the points (0,10) and (8,4). If the residual value when $x = 6$ is -2.5, then the given point on the scatter plot when $x = 6$ is

**A.**      (6, -0.5)

**B.**      (6, 2)

**C.**      (6, 3)

**D.**      (6, 5.5)

**E.**      (6, 8)

### *The following information relates to Questions 11 and 12*

The monthly sales figures, in thousands of dollars, for a company are shown in the graph below.
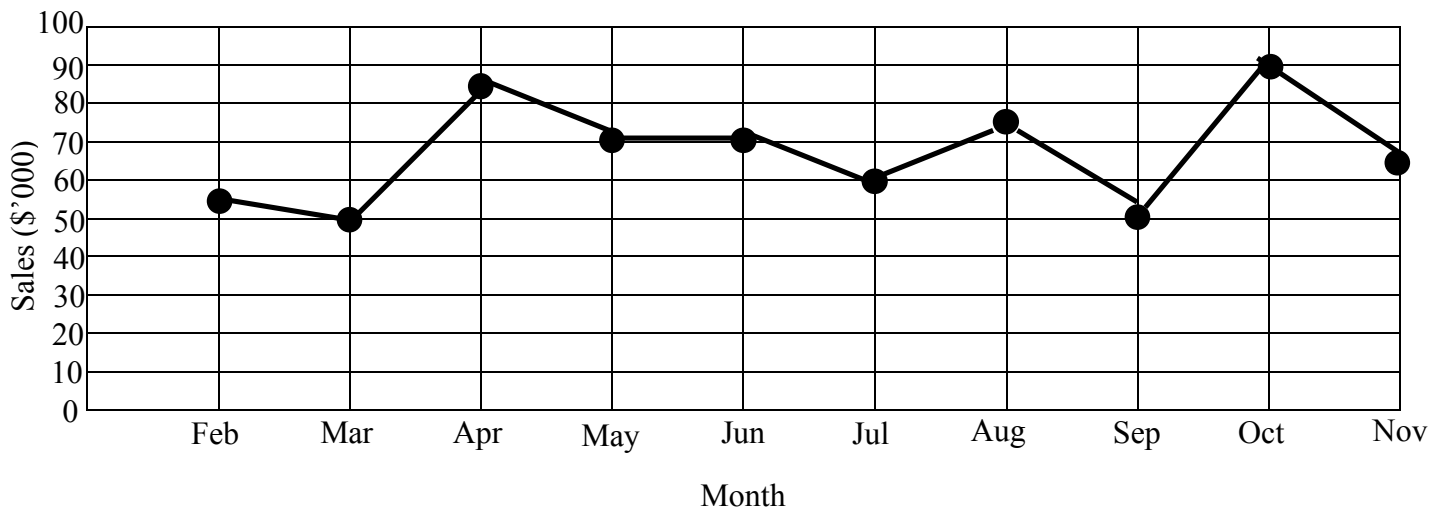
**Core**

## Question 11

The time series plot is to be smoothed using 3 point median smoothing.  The smoothed sales figure for October is

**A.**      $25000

**B.**      $50000

**C.**      $60000

**D.**      $65000

**E.**      $90000

## Question 12

If these figures are smoothed using a five point moving average, then the smoothed sales value for August is closest to

**A.**      $60000

**B.**      $62000

**C.**      $65000

**D.**      $67000

**E.**      $69000

**Core**

**Question 13**

Deseasonalised prices for petrol for one particular week are given in the following table.

| Day | Sun | Mon | Tues | Wed | Thurs | Fri | Sat |
|---|---|---|---|---|---|---|---|
| Price (cents/litre) | 102.6 | 101.5 | 100.1 | 99.8 | 99.9 | 103.4 | 105 |

The seasonal indices for the price of petrol are given in the following table.

| Day | Sun | Mon | Tues | Wed | Thurs | Fri | Sat |
|---|---|---|---|---|---|---|---|
| Seasonal Index | 1.2 | 0.9 | 0.8 | 0.7 | 0.8 | 1.3 | 1.3 |

The predicted price of petrol for the Wednesday of the following week is closest to

**A.**      71 cents

**B.**      73 cents

**C.**      102 cents

**D.**      104 cents

**E.**      149 cents

**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 1: Number patterns and applications**

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

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**Question 1**
Which one of the following is an arithmetic sequence?

**A.**    $\dfrac{1}{2}, \dfrac{1}{3}, \dfrac{1}{4}, \dfrac{1}{5}$

**B.**    2, 4 , 8, 16

**C.**    6, 2, -2, -6

**D.**    3, 0, -3, -9

**E.**    $1, 1\dfrac{1}{2}, 2\dfrac{1}{2}, 3\dfrac{1}{2}$

**Question 2**

The first three terms of a sequence are **5, 1.25, 0.3125.** The fifth term of this sequence is closest to

**A.**    0.01

**B.**    0.02

**C.**    0.04

**D.**    0.07

**E.**    0.08

**Module 1: Number patterns and applications**

**Question 3**

The next four terms in the sequence $t_n = 2t_{n-1} + t_{n-2}$          $t_1 = 1,\ t_2 = 3$ are

**A.**     $5, 13, 31, 75$

**B.**     $5, 13, 29, 61$

**C.**     $7, 15, 33, 69$

**D.**     $7, 15, 31, 63$

**E.**     $7, 17, 41, 99$

**Question 4**

The sixth term of a geometric sequence is 96 and the seventh term is 192. The value of the third term of this sequence is

**A.**     3

**B.**     6

**C.**     8

**D.**     12

**E.**     24

**Module 1: Number patterns and applications**

**Question 5**

A farmer records the amount of water present in his dam at the beginning of several weeks and notes that the amount of water present follows a pattern. The results for the first three weeks are listed in the table below.

| Week number | Number of litres present |
|:-----------:|:------------------------:|
| 1 | 80000 |
| 2 | 72000 |
| 3 | 64000 |

If there is no rain and the only loss of water is due to evaporation, then the number of litres of water in the dam at the beginning of week 10 will be

**A.**     0

**B.**     8000

**C.**     12000

**D.**     16000

**E.**     20000

**Question 6**

Jan adds the numbers 6 + 9 + 12 + ……. and keeps adding, following the pattern, until the sum of the numbers is 357. How many numbers does Jan add?

**A.**     11

**B.**     12

**C.**     13

**D.**     14

**E.**     15

**Module 1: Number patterns and applications**

**Question 7**
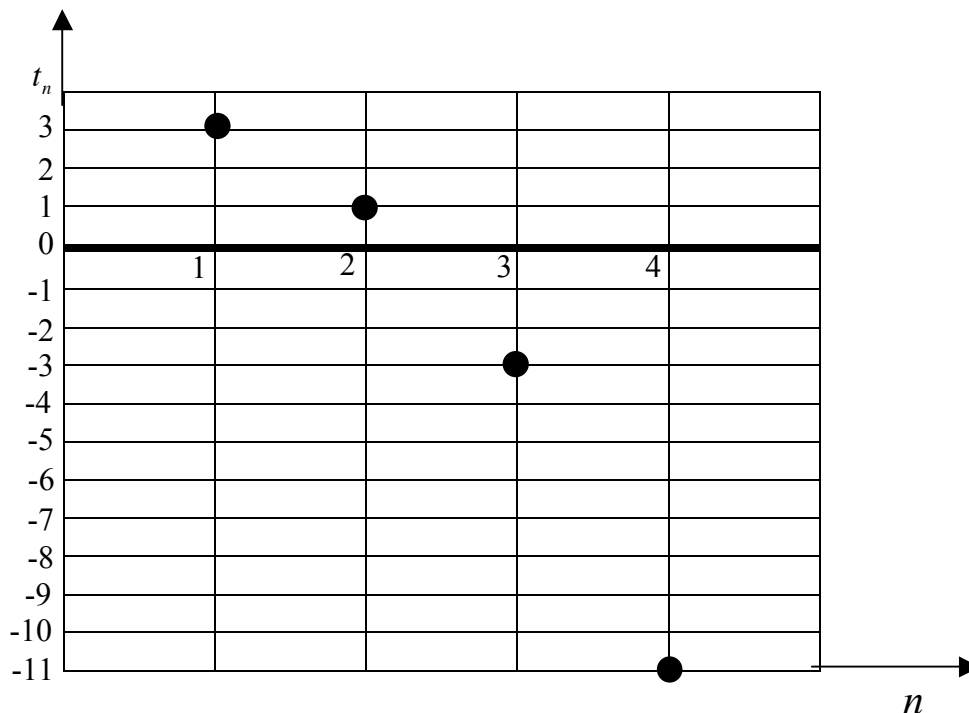


The graph of the difference equation, $t_n = at_{n-1} - b$       $t_1 = 3$ is shown above.
The values of $a$ and $b$ are

A.      $a = 2, b = 5$

B.      $a = 2, b = 7$

C.      $a = -2, b = 5$

D.      $a = -2, b = -5$

E.      $a = -2, b = 7$

**Question 8**

In a certain region there were 320 koalas at the beginning of 2011.  It is known that this koala population is decreasing each year by 15% of the previous year's population.  The total number of these koalas that will have disappeared by the beginning of 2020 is closest to

A.      74

B.      87

C.      233

D.      246

E.      25

**Module 1: Number patterns and applications**

**Question 9**

Ruby rides her bike so that each day she rides a certain percentage of the distance she rode the day before.  She finds that the total distance she has ridden after 4 days is 65 km.  If she keeps riding every day with this pattern, then the total distance she will ride will be 81km.  The distance that Ruby rode the first day was

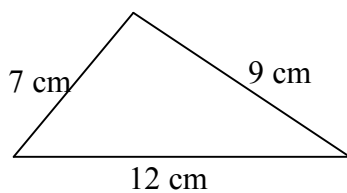A.      15 km

B.      27 km

C.      28 km

D.      30 km

E.      33 km

**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
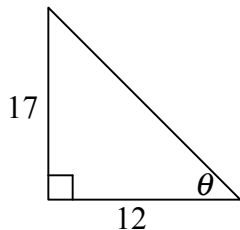
**Question 1**



The value of $\theta$ in the above triangle is closest to

**A.**    $34^0$

**B.**    $35^0$

**C.**    $45^0$

**D.**    $54^0$

**E.**    $55^0$

**Question 2**



The area of the above triangle is closest to

**A.**    $31 \text{ cm}^2$

**B.**    $32 \text{ cm}^2$

**C.**    $44 \text{ cm}^2$

**D.**    $980 \text{ cm}^2$

**E.**    $1960 \text{ cm}^2$

**Module 2: Geometry and trigonometry**

**Question 3**

3 cm
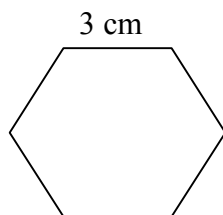


A regular hexagonal park was designed on paper where each side was drawn 3 cm in length. If the scale of the drawing was 1 : 20000, then the actual length of each side of the park is

**A.**     0.02 km

**B.**     0.06 km

**C.**     0.2 km

**D.**     0.6 km

**E.**     30000 cm

**Question 4**
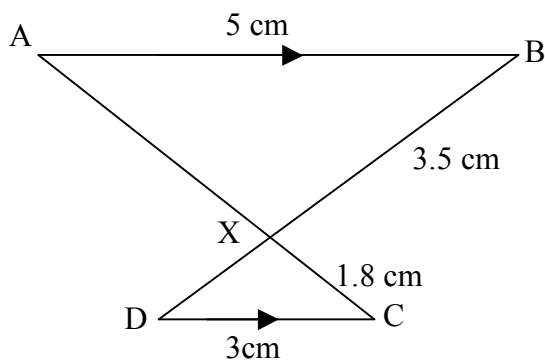


In the above diagram which is not drawn to scale, AB = 5 cm, BX = 3.5 cm, CX = 1.8 cm and DC = 3 cm. If AB is parallel to DC, then the length of AX is closest to

**A.**     1.08 cm

**B.**     1.54 cm

**C.**     2.1 cm

**D.**     3 cm

**E.**     4.3 cm

**Module 2: Geometry and trigonometry**

**Question 5**
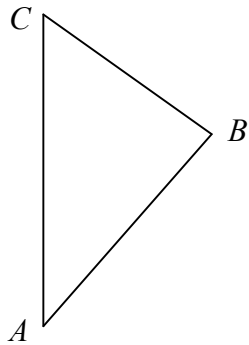


A ship sails from $A$ on a bearing of N30$^0$E to position $B$. It then heads N50$^0$W until it reaches $C$, which is due north of $A$.

The magnitude of angle $ABC$ is

**A.**     $30^0$

**B.**     $40^0$

**C.**     $50^0$

**D.**     $60^0$

**E.**     $100^0$

**Module 2: Geometry and trigonometry**

**Question 6**
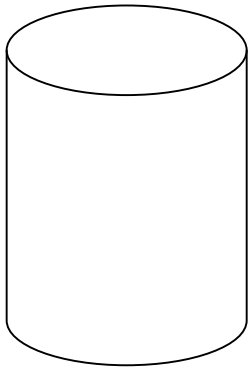


Cylinder A                                    Cylinder B

Cylinder B has a height of 3 cm and the diameter of its base is 2 cm.  The ratio of the side lengths of cylinder A to the side lengths of cylinder B is 3 : 1.

The volume of cylinder A in cubic cm is closest to

**A**      28

**B.**     254

**C.**     339

**D.**     678

**E.**     1018

**Module 2: Geometry and trigonometry**

**Question 7**
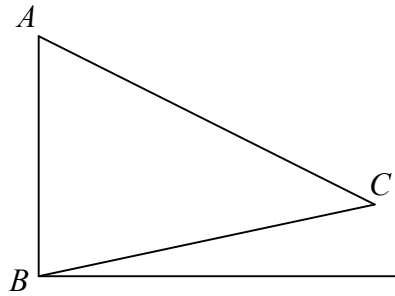


A building, $AB$, stands at the foot of a hill, $BC$, which slopes at $10^0$ to the horizontal. $C$ is a point 40 m up the hill from $B$ and $\angle ACB = 28^0$. The height of the building is closest to

**A.**     20 m

**B.**     23 m

**C.**     25 m

**D.**     28 m

**E.**     30 m

**Module 2: Geometry and trigonometry**

**Question 8**
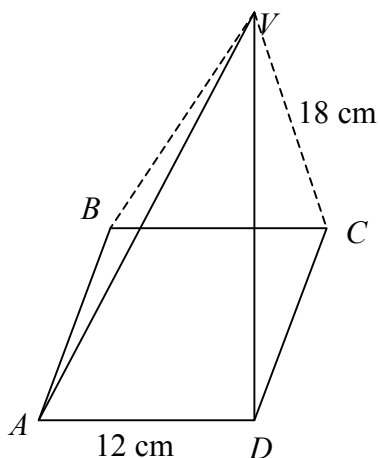


The above right pyramid has a slant height, *VC*, of 18 cm, and a square base with side length, *AD*, of 12 cm. Angle *VCA* is closest to

**A.**      $20^0$

**B.**      $25^0$

**C.**      $28^0$

**D.**      $62^0$

**E.**      $71^0$
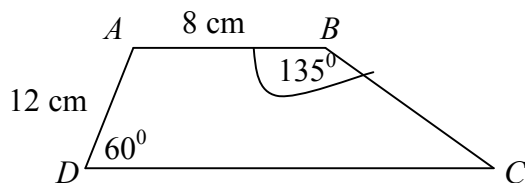
**Question 9**



*ABCD* is a trapezium where $\angle ADC = 60^0$, $\angle ABC = 135^0$, *AD* = 12 cm and *AB* = 8 cm.  The area of *ABCD* is closest to

**A.**      145 cm$^2$

**B.**      154 cm$^2$

**C.**      168 cm$^2$

**D.**      225 cm$^2$

**E.**      366 cm$^2$

**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
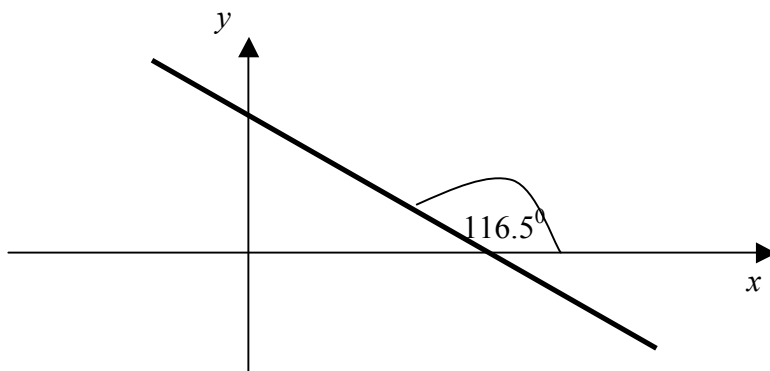
### Question 1

Two parallel lines have the equations

$$y - 3x - 2 = 0 \text{ and } 2y - ax - 15 = 0$$

The value of $a$ is

**A.**     -3

**B.**     -1.5

**C.**     1.5

**D.**     3

**E.**     6

### Question 2



The gradient of the above line is closest to

**A.**     -3

**B.**     -2

**C.**     -1

**D.**     1

**E.**     3

**Module 3: Graphs and relations**

**Question 3**

If $x - 3y \geq 6$, then

A.      $6y + 12 \leq 2x$

B.      $y \geq \dfrac{1}{3}x - 2$

C.      $y \geq -\dfrac{1}{3}x + 2$

D.      $y \leq -\dfrac{1}{3}x + 2$
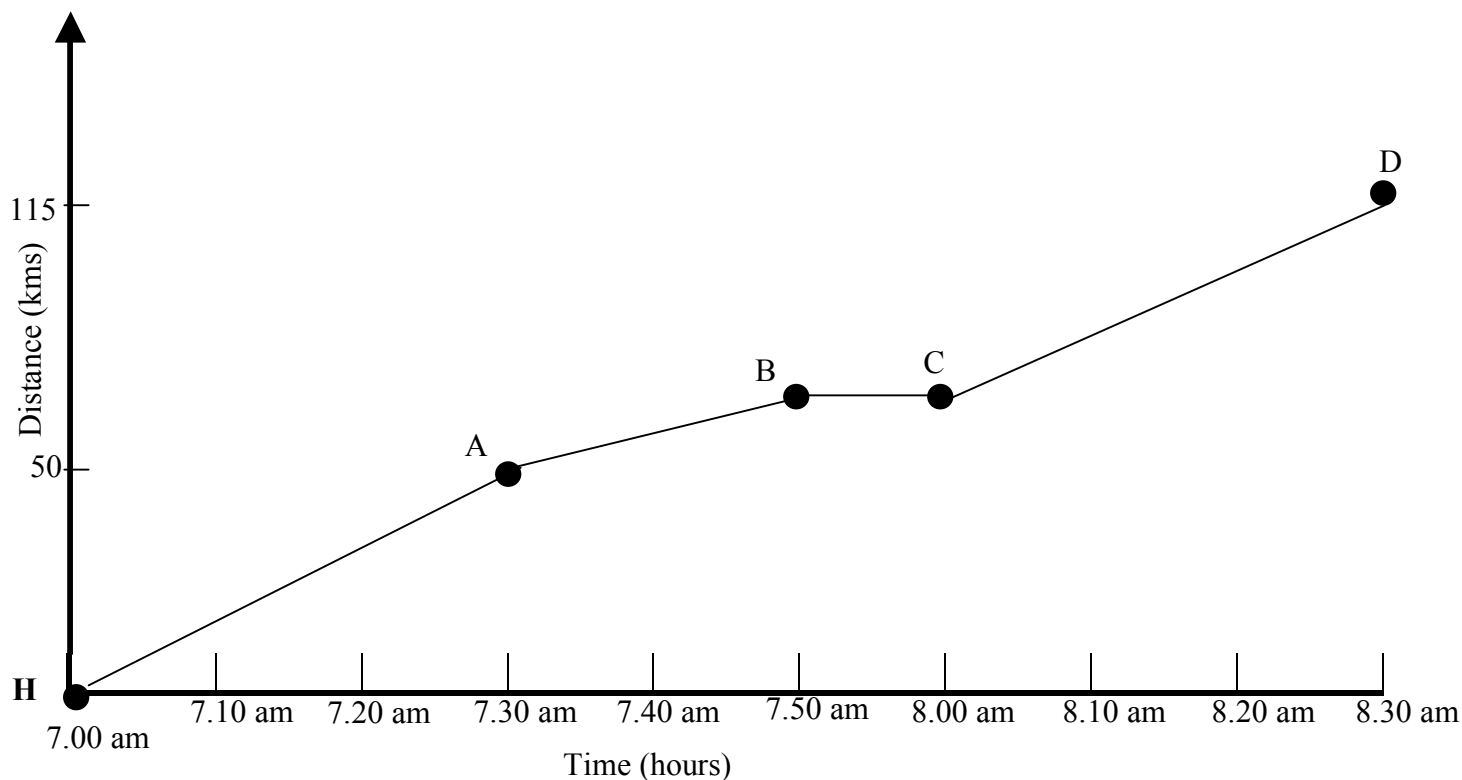
E.      $6y \geq 2x - 12$

**Question 4**

If the lines $y = 2x + p$ and $y = q - x$ intersect at the
point (1,3) then the values of $p$ and $q$ are

A.      $p = -1$ and $q = 2$

B.      $p = -1$ and $q = 4$

C.      $p = 1$ and $q = -2$

D.      $p = 1$ and $q = 4$

E.      $p = 1$ and $q = 2$

**Module 3: Graphs and relations**

*The following information refers to questions 5 and 6.*



The above graph shows the time it takes for George to get to his place of work at **D** from his home at **H** when he takes the 7.00 am train. Between sections **A** and **B** of the trip, the train can only travel at 60 km/hr.

**Question 5**

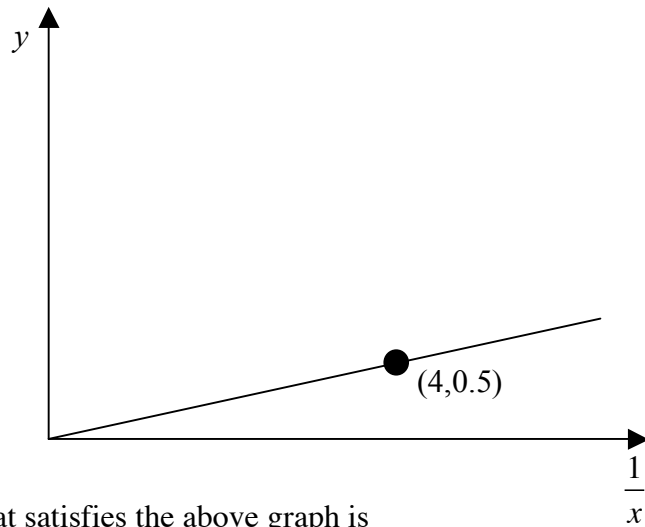The distance travelled between 7.00 am and 8.00 am is

**A.**      57.5 km

**B.**      70 km

**C.**      75 km

**D.**      80 km

**E.**      90 km

**Module 3: Graphs and relations**

**Question 6**

The maximum speed that the train reaches for the whole trip is

**A.**      76 km/hr

**B.**      77 km/hr

**C.**      90 km/hr

**D.**      100 km/hr

**E.**      115 km/hr

**Module 3: Graphs and relations**

**Question 7**



The rule that satisfies the above graph is

A.  $y = \dfrac{1}{2x}$

B.  $y = \dfrac{1}{2}x$

C.  $y = \dfrac{1}{8x}$

D.  $y = \dfrac{1}{8}x$
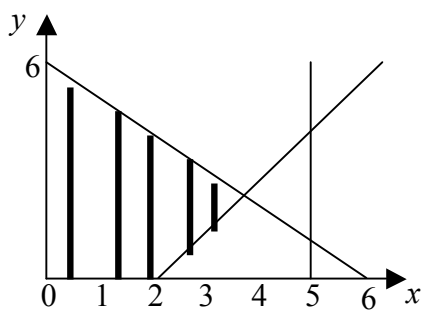
E.  $y = 2x$

## Module 3: Graphs and relations

## Question 8

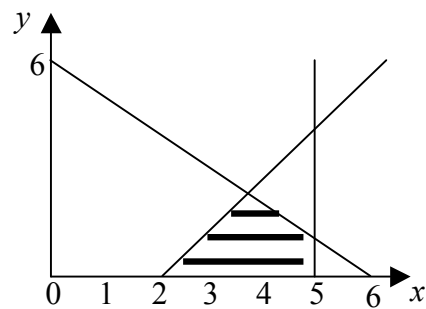The graph where the shading represents the region

$$x \geq 0$$
$$y \geq 0$$
$$x \leq 5$$
$$x + y \leq 6$$
$$3x - 2y \leq 6$$

is

**A**



**B**



**C**



**D**



**E**

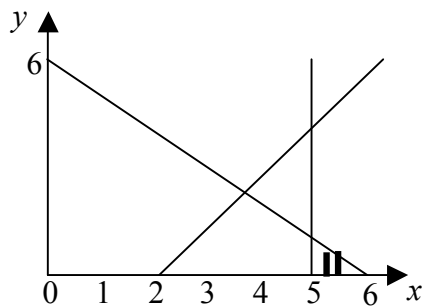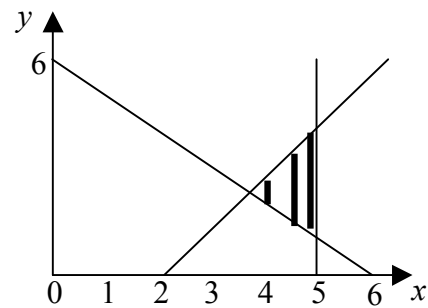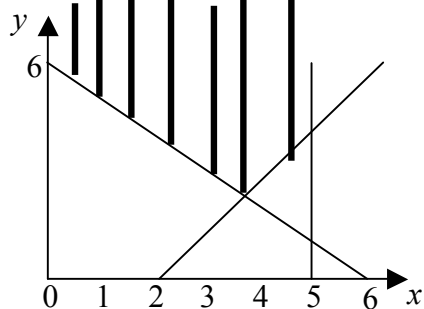**Module 3: Graphs and relations**

**Question 9**

On Valentine's day, a long stem rose costs $5.00 a stem and a short stem rose costs $3.00 a stem at Bloom's Flower shop.  The total number of roses sold that day at Bloom's Flower shop was 230 and the total price the customers paid for the roses was $850.  The number of long stem roses sold by Bloom's that day was

A.      60

B.      80

C.      90

D.      150

E.      170

**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

Stuart earns $1200 a week gross.  His employer deducts 9% of his gross pay for superannuation and 32% of his gross pay for tax.  Stuart's take home pay each week is

A.    $190

B.    $492

C.    $708

D.    $742.56

E.    $1010

### Question 2

Emma bought a computer for $1500.  The computer depreciates by 13% of its original value each year.  The amount of depreciation after two years is

A.    $195

B.    $390

C.    $720

D.    $780

E.    $1110

**Module 4: Business-related mathematics**

**Question 3**

Josh purchased office equipment on hire purchase. He paid a deposit of $2000 and then $500 a month for 3 years. The cash price for the office equipment was $13000. The amount of interest that Josh paid was

A.      $3000

B.      $5000

C.      $6000

D.      $7000

E.      $9500

**Question 4**

Gerry invests $20000 for four years at 8% per annum compound interest. The value of Gerry's investment at the end of the four years is

A.      $\dfrac{20000 \times 8 \times 4}{100}$

B.      $20000(1.08)^3$

C.      $20000(1.08)^4$

D.      $20000 + 20000(1.08)^3$

E.      $20000 + 20000(1.08)^4$

**Module 4: Business-related mathematics**

**Question 5**

Tina invests $30000 for 5 years.  At the end of the 5 years, the value of her investment is $39000. The simple interest rate per month that her investment earns is

A.     0.5%

B.     0.6%

C.     5%

D.     6%

E.     12%

**Question 6**

Jess takes out a reducing balance loan with monthly repayments.  This means that

A.      The amount of principal repaid each month increases.

B.      The amount of interest repaid each month increases.

C.      The amount of principal repaid each month is always the same.

D.      The amount of interest repaid each month is always the same.

E.      By the end of one year $\dfrac{1}{12}$ of the principal will be repaid.

**Question 7**

Laura increases her prices by 10% one year, then 8% the next year and 5% the following year.  The percentage increase from the original price after the three price rises is closest to

A.     7.7%

B.     13%

C.     22.6%

D.     23%

E.     24.7%

**Module 4: Business-related mathematics**

**Question 8**

Greta borrows $250000 at 6.4% interest per annum compounding monthly, with monthly repayments of $1850.  The amount of money owing after 15 years is closest to

**A.**     $24195

**B.**     $60298

**C.**     $75786

**D.**     $94512

**E.**     $10138

**Question 9**

Graham borrows $35000 at an interest rate of 8% per annum to buy a car.  If he repays $1000 per quarter and if interest is calculated quarterly on the reducing balance, the amount of the first repayment that is paid off the principal is

**A.**     $300

**B.**     $400

**C.**     $500

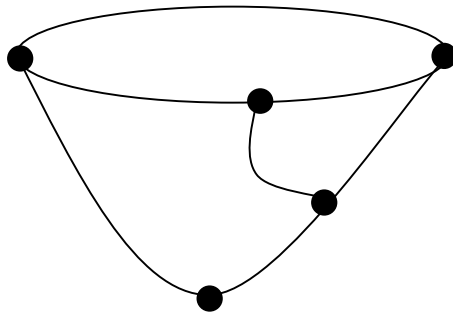**D.**     $600

**E.**     $700

**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.
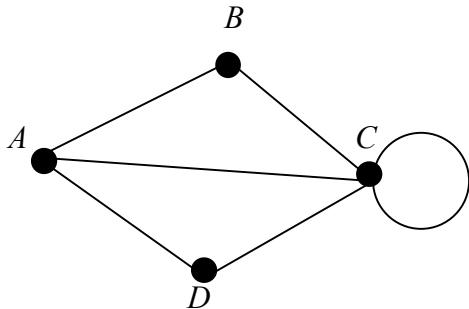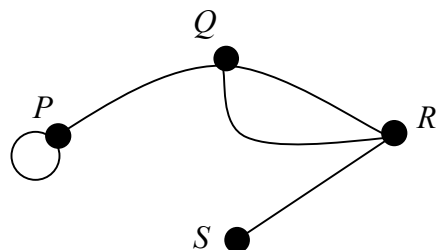
**Question 1**



The degree of vertex C is

**A.**    1

**B.**    2

**C.**    3

**D.**    4

**E.**    5

**Module 5: Networks and decision mathematics**

**Question 2**



The above network is

**A.**      A Hamiltonian path

**B.**      A Hamiltonian circuit

**C.**      An Eulerian path

**D.**      An Eulerian circuit

**E.**      Both a Hamiltonian path and an Eulerian path

**Module 5: Networks and decision mathematics**

**Question 3**



The adjacency matrix for the above network is

**A.**

$$\begin{array}{c} \\ P \\ Q \\ R \\ S \end{array} \begin{array}{cccc} P & Q & R & S \\ \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 0 & 2 & 0 \\ 0 & 2 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

**B.**

$$\begin{array}{c} \\ P \\ Q \\ R \\ S \end{array} \begin{array}{cccc} P & Q & R & S \\ \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 2 & 1 & 0 \\ 0 & 2 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

**C.**

$$\begin{array}{c} \\ P \\ Q \\ R \\ S \end{array} \begin{array}{cccc} P & Q & R & S \\ \begin{bmatrix} 2 & 1 & 0 & 0 \\ 1 & 2 & 1 & 0 \\ 0 & 2 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$
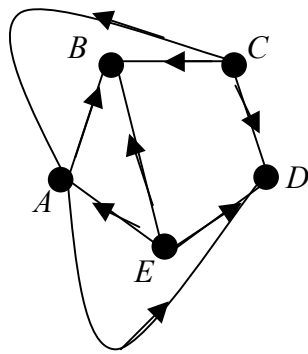
**D.**

$$\begin{array}{c} \\ P \\ Q \\ R \\ S \end{array} \begin{array}{cccc} P & Q & R & S \\ \begin{bmatrix} 2 & 1 & 0 & 0 \\ 1 & 2 & 2 & 0 \\ 0 & 2 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

**E.**

$$\begin{array}{c} \\ P \\ Q \\ R \\ S \end{array} \begin{array}{cccc} P & Q & R & S \\ \begin{bmatrix} 2 & 1 & 0 & 0 \\ 1 & 0 & 2 & 0 \\ 0 & 2 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix} \end{array}$$

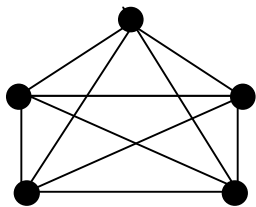**Module 5: Networks and decision mathematics**

**Question 4**



In the above directed graph, the number of other vertices reachable from vertex A is
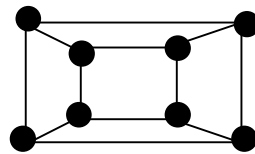
**A.**     0

**B.**     1

**C.**     2

**D.**     3

**E.**     4

**Question 5**

Which one of the following is not a planar graph?
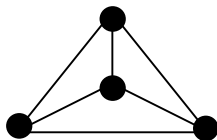
**A.**                                                      **B.**



**C.**                                                      **D.**



**E.**

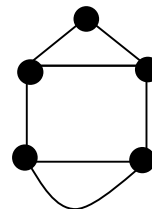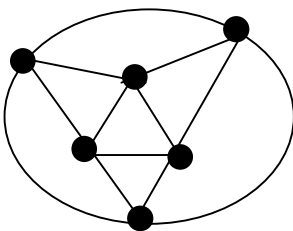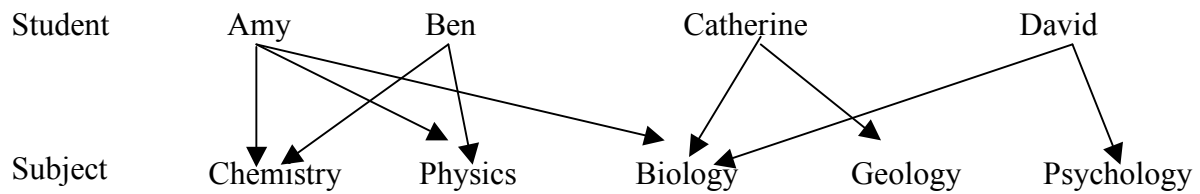**Module 5: Networks and decision mathematics**

**Question 6**

| Student | Amy | Ben | Catherine | David |
|---------|-----|-----|-----------|-------|

| Subject | Chemistry | Physics | Biology | Geology | Psychology |
|---------|-----------|---------|---------|---------|------------|

Amy, Ben, Catherine and David study some of the science subjects, namely, Chemistry, Physics, Biology, Geology and Psychology.

Which one of the following statements is **not** true with regard to the above students and their subjects.

A.	There are more students doing physics than geology.

B.	Amy and Catherine study four of the subjects between them.

C.	Amy studies more science subjects than any of the other students.

D.	Fewer students study psychology than any other subject.

E.	Biology is the most popular of these subjects.

## Module 5: Networks and decision mathematics

### Question 7
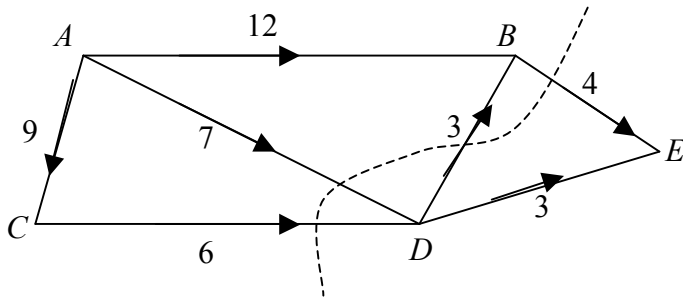


The capacity of the cut in the above graph is

**A.**     7

**B.**     9

**C.**     13

**D.**     17

**E.**     20

**Module 5: Networks and decision mathematics**

**Question 8**
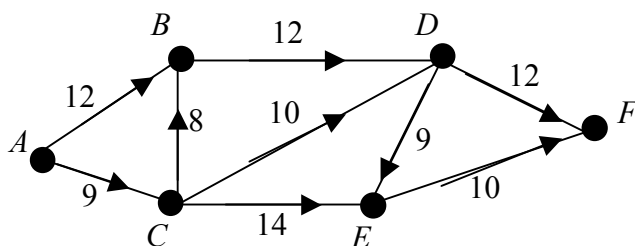


The above graph shows a number of one -way roads and the distances in kilometres along each road.  Fred wants to travel from A to F along the shortest route.  The number of kilometres that Fred will travel is

**A.**   28 km

**B.**   31 km

**C.**   33 km

**D.**   36 km

**E.**   44 km

**Module 5: Networks and decision mathematics**

**Question 9**
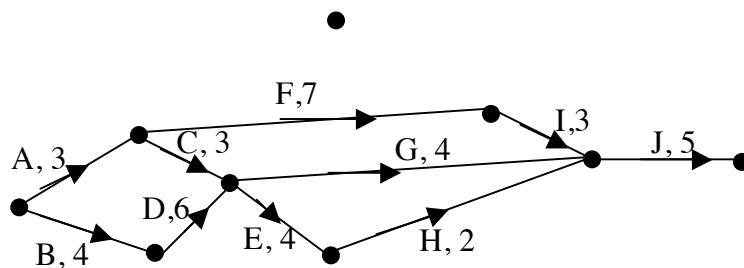


The critical path for the project above where the time for each activity is given in days is

**A.**      $B - D - E - H - J$

**B.**      $B - D - G - J$

**C.**      $A - F - I - J$

**D.**      $A - C - G - J$

**E.**      $A - C - E - H - J$

**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 $4\begin{bmatrix} a & 3 \\ 2 & -1 \end{bmatrix} = \begin{bmatrix} -2 & b \\ c & d \end{bmatrix}$ then the values of $a, b, c$ and $d$ respectively are

A.      $-2, 12, 8, -4$

B.      $-\dfrac{1}{2}, 12, 8, -4$

C.      $-2, \dfrac{4}{3}, \dfrac{1}{2}, -\dfrac{1}{4}$

D.      $-\dfrac{1}{2}, \dfrac{4}{3}, \dfrac{1}{2}, -\dfrac{1}{4}$

E.      $-\dfrac{1}{2}, \dfrac{3}{4}, \dfrac{1}{2}, -\dfrac{1}{4}$

**Question 2**

If $A$ is a $3 \times 1$ matrix and $B$ is a $1 \times 3$ matrix, then matrix $AB$ is a

A.      $3 \times 3$ matrix

B.      $1 \times 1$ matrix

C.      $1 \times 3$ matrix

D.      $3 \times 1$ matrix

E.      $4 \times 4$ matrix

**Module 6: Matrices**

**Question 3**

If $A = \begin{bmatrix} p & q \\ r & s \end{bmatrix}$ then the inverse of $A$ is

**A.** $\dfrac{1}{qr - ps} \begin{bmatrix} -p & r \\ q & -s \end{bmatrix}$

**B.** $\dfrac{1}{qr - ps} \begin{bmatrix} s & -q \\ -r & p \end{bmatrix}$

**C.** $\dfrac{1}{ps - qr} \begin{bmatrix} s & -r \\ -q & p \end{bmatrix}$

**D.** $\dfrac{1}{ps - qr} \begin{bmatrix} -p & r \\ q & -s \end{bmatrix}$

**E.** $\dfrac{1}{ps - qr} \begin{bmatrix} s & -q \\ -r & p \end{bmatrix}$

**Module 6: Matrices**

**Question 4**

The value of $t$ for which the simultaneous equations

$$tx + 2y = 9$$
$$2x + 3y = 12$$

have no solution is

**A.** $\dfrac{2}{3}$

**B.** $\dfrac{3}{2}$

**C.** $\dfrac{4}{3}$

**D.** $\dfrac{3}{4}$

**E.** $\dfrac{1}{2}$

**Module 6: Matrices**

**Question 5**

If $PA + B = C$ where

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

then $P$ equals

A. $\begin{bmatrix} 5 & -13 \\ 8 & -19 \end{bmatrix}$

B. $\begin{bmatrix} 9 & -10 \\ -3 & 3 \end{bmatrix}$

C. $\begin{bmatrix} -9 & 10 \\ 3 & -3 \end{bmatrix}$

D. $\begin{bmatrix} 11 & -25 \\ 10 & -23 \end{bmatrix}$

E. $\begin{bmatrix} -11 & 25 \\ -10 & 23 \end{bmatrix}$

**Module 6: Matrices**

**Question 6**

If $A = \begin{bmatrix} 2 & 5 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 2 \\ 6 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 6 \\ 4 \\ 2 \end{bmatrix}$ then

**A.** $AC$ exists and $B^{-1}$ does not exist

**B.** $CA$ exists and $B^{-1}$ does not exist

**C.** $B^{-1}$ exists and $AB$ exists

**D.** $B^{-1}$ does not exist and $BA$ does exist

**E.** $BC, BA$ and $CA$ do not exist

**Module 6: Matrices**

**Question 7**

When Martha is on time for school one day, she has a 90% chance of being on time for school the next day. When Martha is late for school one day she has a 60% chance of being late for school the next day. The probability that Martha will be late for school on Wednesday if she is on time for school on Monday is

The element in the second row first column of the answer to

**A.**
$$\begin{bmatrix} 0.9 & 0.4 \\ 0.1 & 0.6 \end{bmatrix}^2 \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

The element in the first row second column of the answer to

**B.**
$$\begin{bmatrix} 0.9 & 0.4 \\ 0.1 & 0.6 \end{bmatrix}^2 \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

The element in the second row first column of the answer to

**C.**
$$\begin{bmatrix} 0.9 & 0.4 \\ 0.1 & 0.6 \end{bmatrix}^3 \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

The element in the first row second column of the answer to

**D.**
$$\begin{bmatrix} 0.9 & 0.4 \\ 0.1 & 0.6 \end{bmatrix}^3 \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

The element in the second row first column of the answer to

**E.**
$$\begin{bmatrix} 0.9 & 0.4 \\ 0.1 & 0.6 \end{bmatrix}^2 \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

**Module 6: Matrices**

**Question 8**

The number of apples, oranges and bananas sold at a market for two successive weeks is given in the matrix below.

$$\begin{array}{c} \quad\quad\quad\quad \textit{apples} \quad \textit{oranges} \quad \textit{bananas} \\ \textit{Week} \begin{array}{c} 1 \\ 2 \end{array} \left[ \begin{array}{ccc} 200 & 150 & 300 \\ 300 & 80 & 250 \end{array} \right] \end{array}$$

If the cost of an apple, orange and banana is $2.00, $1.50 and $1.80 respectively, then the total amount of money taken for the two week period is

A.      $850

B.      $1165

C.      $1170

D.       $1485

E.       $2335

**Module 6: Matrices**

**Question 9**

Cinema tickets are \$20 for adults and \$8 for children. When a total of 3200 people attended the cinema, the receipts from all the tickets were \$40900. The number of adults, $x$, and the number of children, $y$, who attended the cinema can be found by evaluating

A. $\begin{bmatrix} 20 & 8 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 40900 \\ 3200 \end{bmatrix}$

B. $\begin{bmatrix} 1 & -8 \\ -1 & 20 \end{bmatrix} \begin{bmatrix} 40900 \\ 3200 \end{bmatrix}$

C. $\dfrac{1}{12} \begin{bmatrix} 40900 \\ 3200 \end{bmatrix} \begin{bmatrix} 1 & -8 \\ -1 & 20 \end{bmatrix}$

D. $\dfrac{1}{12} \begin{bmatrix} 2 & -1 \\ -5 & 1 \end{bmatrix} \begin{bmatrix} 3200 \\ 10225 \end{bmatrix}$

E. $-\dfrac{1}{3} \begin{bmatrix} 2 & -1 \\ -5 & 1 \end{bmatrix} \begin{bmatrix} 3200 \\ 10225 \end{bmatrix}$

**End of Module 6**

**End of 2011 Further Mathematics Trial Examination 1**
**Multiple Choice Question Book**