

Section A

Specific instructions for Section A

Section A consists of 13 questions.

Answer **all** questions in this section.

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

Core : Data analysis

The following information relates to questions 1, 2 and 3

The smokers in a location were asked to count the number of cigarettes that they smoked on a particular day. The data for the 50 men and 35 women was recorded separately on the following back-to-back stemplot.

Men	Stem	Women
5 5 4	0	
9 8 8 7 7 6	0*	5 5 6 6 6 8 8 9
4 4 3 3 2 0	1	0 0 0 1 2 2 3 4 4 4 4
9 8 8 8 7 6 6 5	1*	5 5 5 7 8 9 9
4 4 4 3 3 2 2 1 0 0 0	2	0 2 2 3
9 8 8 6 5 5 5	2*	5 8
4 4 2 2	3	0
9 5	3*	6
4 0	4	0
5	4*	

Question 1

From the stemplot the distribution of women smokers could best be described as

- A symmetric
- B positively skewed
- C negatively skewed
- D bell-shaped
- E symmetrically skewed

Question 2

The median number of cigarettes smoked per day by the group of men is

- A 20 up to 25
- B 19
- C 20
- D 21
- E 22

Question 3

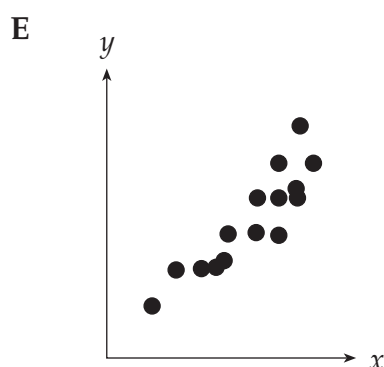
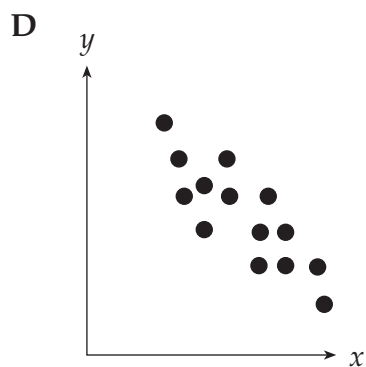
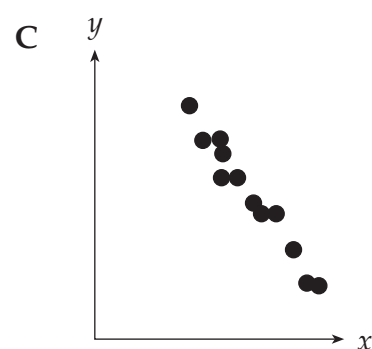
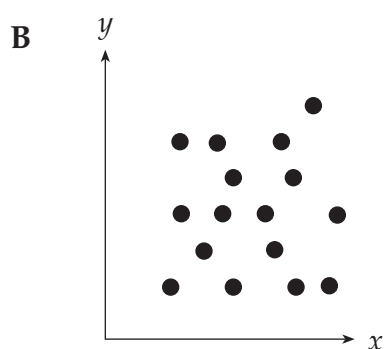
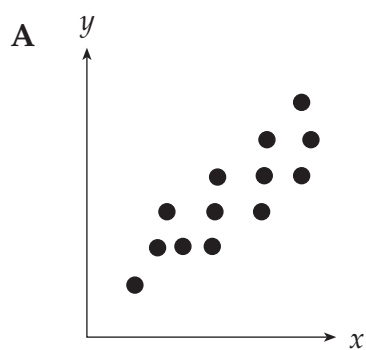
If the man who smoked 45 cigarettes made a mistake and he in fact smoked 25 cigarettes, which one of the following statistics would **not** be affected by this change of data?

- A The mean
- B The standard deviation
- C The range
- D The inter-quartile range
- E The median

Question 4

The value of the product-moment correlation co-efficient, r , between two variables x and y is calculated to be -0.7

Which of the following scatterplots would best show the association between the variables x and y ?



The following information relates to questions 5 and 6

A group of Year 11 students were asked if they participated in sport outside school and the results were organised in the following two-way frequency table.

Number of sports played outside school	Gender		Total
	<i>Female</i>	<i>Male</i>	
<i>None</i>	23	13	36
<i>One</i>	18	26	44
<i>More than one</i>	3	17	20
Total	44	56	100

Question 5

The percentage of females who play **at least one** sport outside school is closest to

- A 7
- B 21
- C 33
- D 40
- E 48

Question 6

The variables '**gender**' (male or female) and '**number of sports played outside school**' (none, one, more than one) are examples of

- A two numerical variables
- B a categorical and a numerical variable respectively
- C a numerical and a categorical variable respectively
- D two categorical variables
- E a categorical and a discrete numerical variable respectively

Question 7

A study has found that the coefficient of determination between the variables '*maximum daily temperature*' and '*number of pies sold*' is 0.35.

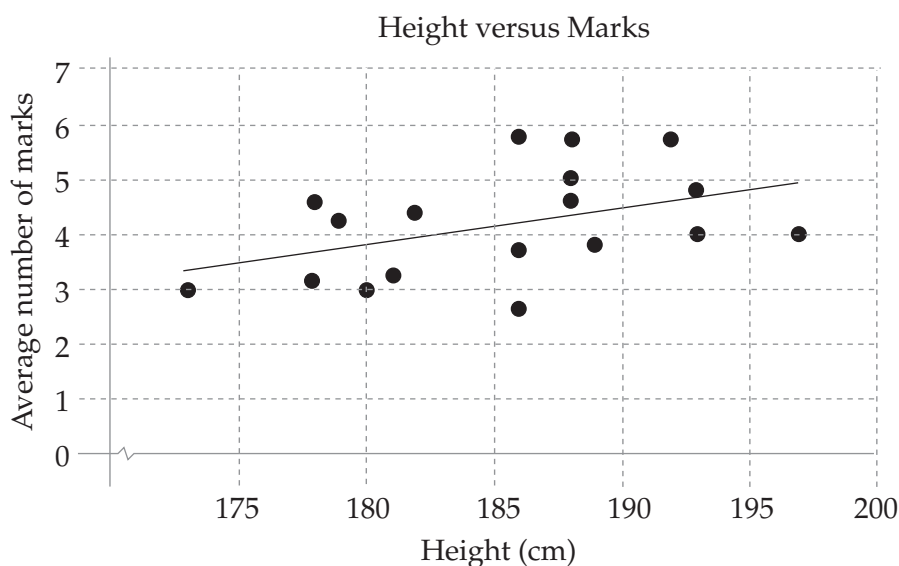
Which one of the following statements would always be a correct interpretation of this statistic?

- A There is weak correlation between the variables.
- B As the temperature increases the number of pies sold increases.
- C Approximately 35% of the variation in number of pies sold can be explained by the variation in maximum daily temperature.
- D Approximately 12% of the variation in number of pies sold can be explained by the variation in maximum daily temperature.
- E Approximately 59% of the variation in number of pies sold can be explained by the variation in maximum daily temperature.

The following information relates to questions 8 and 9

On the scatterplot below the 'average number of marks per football match' is plotted against the 'height', in centimetres, for each player.

A least squares regression line is fitted to the data and this is also shown on the scatterplot.



The equation of the regression line is:

$$\text{Average number of marks per football match} = -7.90 + 0.065 \times \text{Height}.$$

Question 8

Using the equation we can predict that the average number of marks per match taken by a player who is 188 centimetres tall will be

- A 4.32
- B 4.42
- C 4.60
- D 5.04
- E 5.75

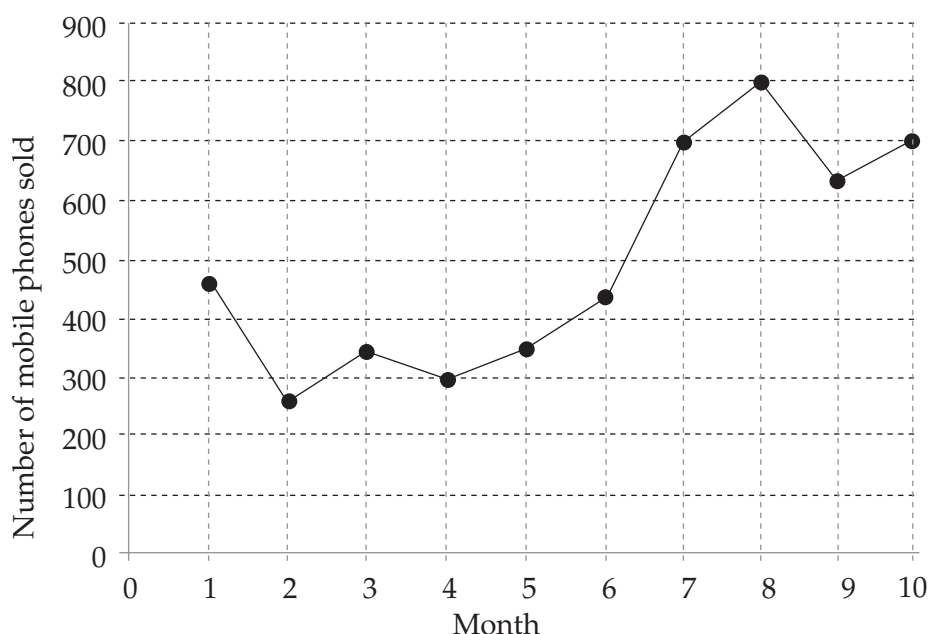
Question 9

Fitting this regression line to the data, the residual value of the data point (181, 3.16) will be closest to

- A 0.71
- B 1
- C 0.68
- D -0.68
- E -0.71

The following information relates to questions 10 and 11

The following graph shows the sales of mobile phones plotted for the first 10 months of operation of a shop.



Question 10

From this graph it can be said that mobile phone sales for the first ten months showed

- A seasonality only
- B random variation only
- C an increasing trend only
- D a decreasing trend only
- E an increasing trend with seasonality

Question 11

If a three-median regression line is used to fit a trend line to this time series data, its equation will be closest to

- A Number of mobile phones sold = $200 + 50 \times \text{Month}$
- B Number of mobile phones sold = $250 + 50 \times \text{Month}$
- C Number of mobile phones sold = $220 + 60 \times \text{Month}$
- D Number of mobile phones sold = $150 + 100 \times \text{Month}$
- E Number of mobile phones sold = $350 + 30 \times \text{Month}$

The following information relates to questions 12 and 13

The seasonal indices, based on several years of data, for the sales in a take-away food shop have been calculated and are shown in the table below. The seasonal index for *Spring* is missing.

Season	<i>Summer</i>	<i>Autumn</i>	<i>Winter</i>	<i>Spring</i>
Seasonal Index	0.87	0.94	1.12	

Question 12

The seasonal index for *Spring* will be

- A 0.93
- B 0.98
- C 1.00
- D 1.07
- E 1.10

Question 13

Comparing actual sales figures for *Autumn* and *Winter* to deseasonalised sales figures for these seasons, the deseasonalised sales figures will

- A increase and decrease respectively
- B decrease and increase respectively
- C both increase
- D both decrease
- E both be unchanged

Section B

Specific instructions for Section B

Section **B** consists of 5 modules. Each module contains 9 questions.

You should select **3 modules** and answer **all** questions within the modules selected on the answer sheet provided for multiple choice questions. Indicate each module selected on the answer sheet for multiple choice questions by ticking the corresponding box.

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

Module 1 : Number patterns and applications

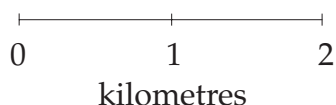
Question 1

If Peter, Paul and Mary share a \$10 000 lottery win in the ratio of 5 : 3 : 2 respectively then Paul compared to Peter will have

- A \$3 000 less
- B \$3 000 more
- C \$2 000 less
- D \$2 000 more
- E \$1 000 less

Question 2

Examine the scale below.



The scale has an equivalent ratio scale of

- A 1 : 2000
- B 1 : 5000
- C 1 : 20000
- D 1 : 50000
- E 1 : 200000

Question 3

Jennifer makes up a batch of cordial drink. She adds 250 ml of cordial to 2250 ml of water. The concentration/strength of the made up cordial drink is closest to

- A 10.0%
- B 11.1%
- C 12.5%
- D 22.5%
- E 25.0%

Question 4

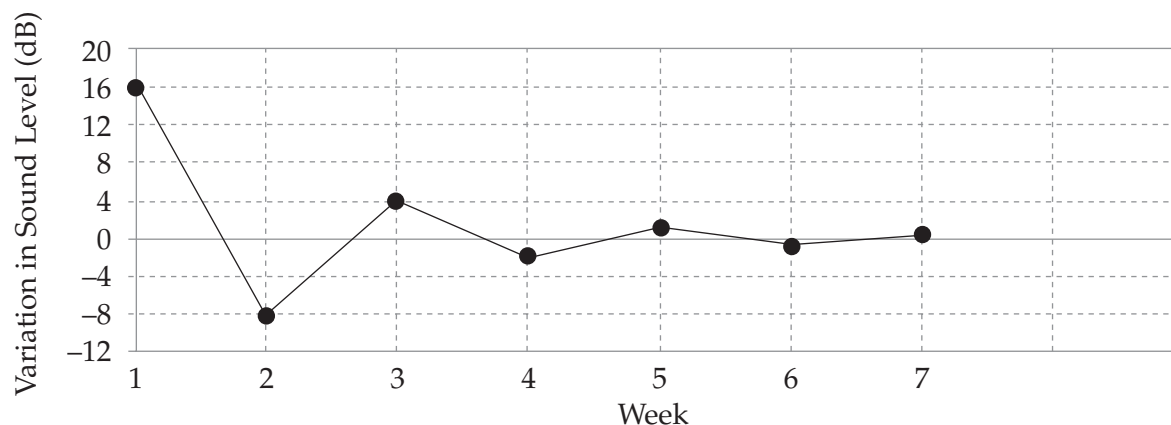
The first and second terms of an arithmetic sequence are 10 and 16 respectively. The sum of the first 15 terms of this sequence is

- A 94
- B 686
- C 770
- D 780
- E 1560

Question 5

A geometric sequence whose 5th term is 160 and whose 7th term is 10. The first term of the geometric sequence is

- A 640
- B 2560
- C 5120
- D 10240
- E 40960

Question 6

The pattern represented in the plot above is best described as

- A an arithmetic progression with positive d
- B an arithmetic progression with negative d
- C a geometric progression with positive r
- D a geometric progression with negative r
- E none of the above

Question 7

An oyster pearl is initially measured to be 5 mm in diameter. In the first year it increases by $\frac{1}{4}$ of its diameter. In the second and subsequent years it increases by $\frac{1}{4}$ of its growth in the previous year. The largest possible size the oyster pearl can expect to grow to is closest to

- A 5.50 mm
- B 6.00 mm
- C 6.67 mm
- D 8.75 mm
- E 9.33 mm

Question 8

For the sequence defined by $t_n = 4(5)^{n-1} + 3$, the value of t_4 is

- A 63
- B 503
- C 2 503
- D 13 503
- E 253

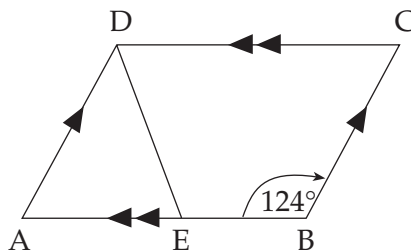
Question 9

It is estimated that the population in a large town over the next decade can be described as a difference equation where P_n is the population in the town in the n^{th} year. If the difference equation describing this situation is:

$$P_n = 1.1P_{n-1} - 800, \quad P_0 = 80000$$

the best description of the population trend is

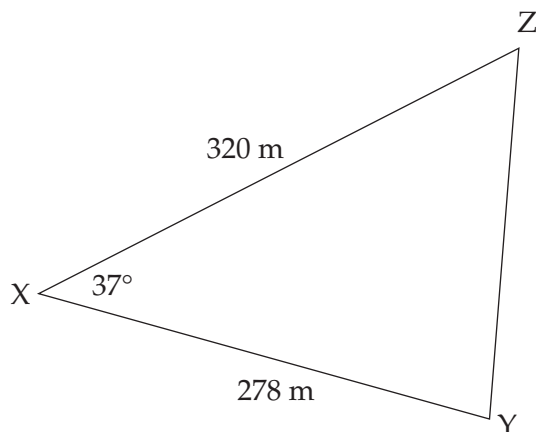
- A Initial Population of 80000, increasing by 1% per year with additional 800 births each year.
- B Initial Population of 80000, increasing by 10% per year with reduction of 800 due to deaths each year.
- C Initial Population of 80000, increasing by 110% per year with reduction of 800 due to deaths each year.
- D Initial Population of 80000, decreasing by 1% per year with additional 800 births each year.
- E Initial Population of 80000, decreasing by 10% per year with reduction of 800 due to deaths each year.

Module 2 : Geometry and trigonometry**Question 1**

In the parallelogram $ABCD$, $\angle ABC = 124^\circ$.

If $AD = DE$ then the size of $\angle ADE$ is

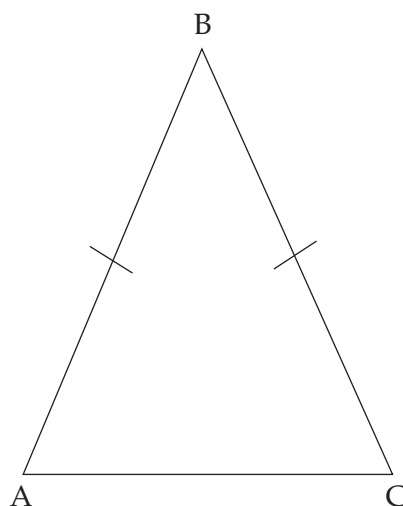
- A 28°
- B 56°
- C 62°
- D 68°
- E 116°

Question 2

In triangle XYZ : $XY = 278$ metres, $XZ = 320$ metres and $\angle ZXY = 37^\circ$

The length, in metres, of YZ is closest to

- A 194
- B 248
- C 269
- D 329
- E 355

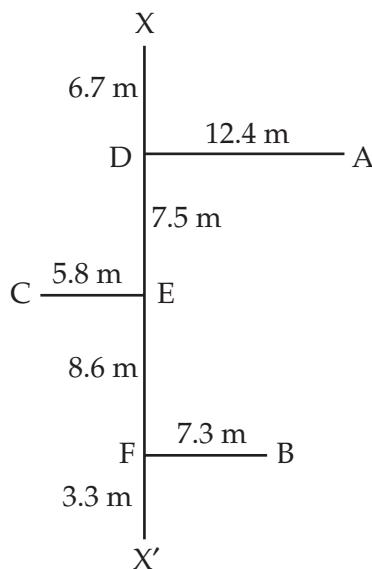
Question 3

Triangle ABC is isosceles with $AB = 8.5$ centimetres and $\angle BAC = 68^\circ$.
The **area** of triangle ABC, in square centimetres, is closest to

- A 25
- B 26
- C 33
- D 50
- E 67

The following information relates to questions 4 and 5

A traverse survey has been carried out on an irregularly shaped block of land and the measurements have been recorded on the following field sketch. All measurements are in metres.



Question 4

The straight line distance between points C and A, in metres correct to two decimal places, is

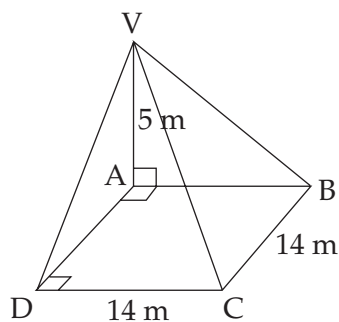
- A 15.69
- B 18.20
- C 19.68
- D 19.86
- E 25.70

Question 5

The area of section DABF, in square metres, is closest to

- A 41
- B 159
- C 200
- D 241
- E 317

Question 6

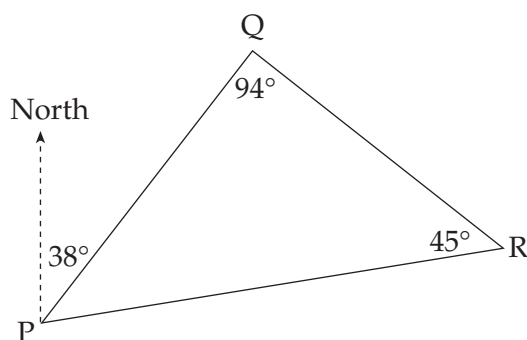


In the figure above, ABCD is a square of side length 14 metres. Point V is 5 metres vertically above point A.

The length of the sloping edge VC, in metres correct to one decimal place, is

- A 11.1
- B 14.9
- C 19.0
- D 20.4
- E 24.2

Question 7

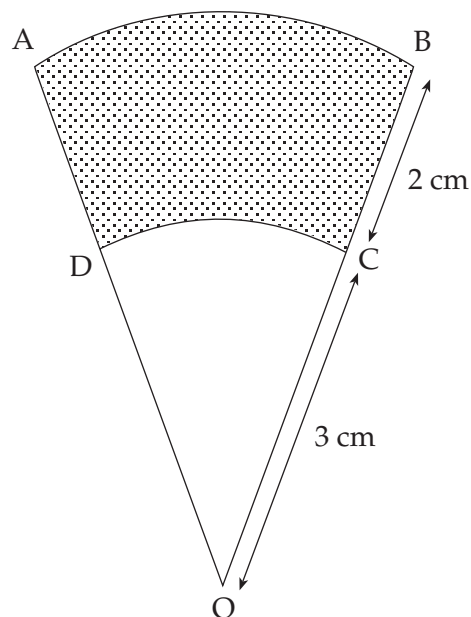


In the diagram the bearing of point Q from point P is 038° .

In triangle PQR, $\angle PQR = 94^\circ$ and $\angle QRP = 45^\circ$

The bearing of point P from point R is

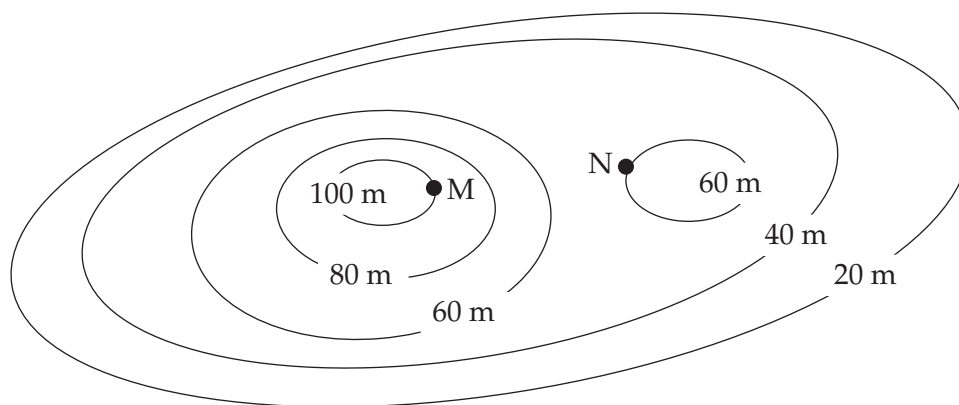
- A 079°
- B 083°
- C 101°
- D 268°
- E 259°

Question 8

OAB and ODC are sectors of a circle. $OC = 3\text{ cm}$ and $CB = 2\text{ cm}$.

If the area of sector OAB is 50 cm^2 then the area, in cm^2 , of the shaded region (ABCD) is

- A 20
- B 30
- C 18
- D 32
- E $33\frac{1}{3}$

Question 9

Scale 1 : 10 000

The diagram above shows a contour map of a section of land, the contour interval being 20 metres. Points M and N are as shown on the map. The ratio scale of the map is 1 : 10 000.

If the horizontal distance between points M and N measures 2.4 centimetres on the map then the **average slope**, when going from point N to point M is

- A $\frac{1}{6}$
- B $\frac{1}{4}$
- C $\frac{2}{5}$
- D $\frac{5}{3}$
- E 6

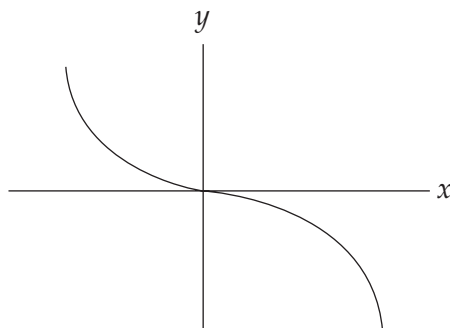
Module 3 : Graphs and relations

Question 1

The given graph has equation $y = kx^n$

The value of n could be

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

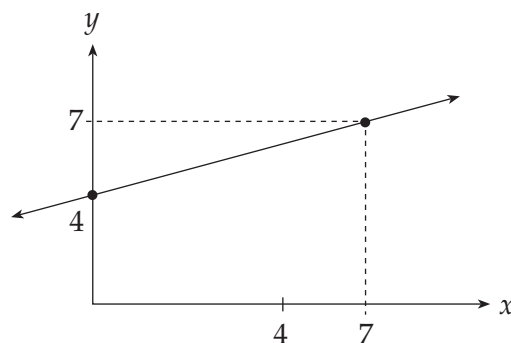


Question 2

Which of the following pairs of straight lines have a point of intersection?

- A $x + 2y = 1$ and $x - 2y = 1$
- B $x + 2y = 1$ and $x + 2y = 2$
- C $x - 2y = 1$ and $x - 2y = 5$
- D $2y - 4x = 6$ and $y - 2x = 3$
- E $x + 2y = 1$ and $x + 2y = 1$

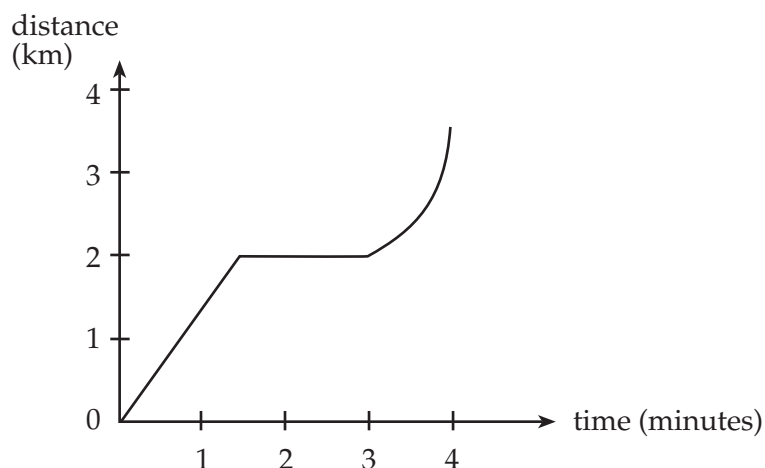
Question 3



The equation of the line shown above is

- A $4x + 7y = 1$
- B $7y - 3x = 28$
- C $7x - 3y = 28$
- D $7y - 3x = 4$
- E $y = \frac{7}{3}x + 4$

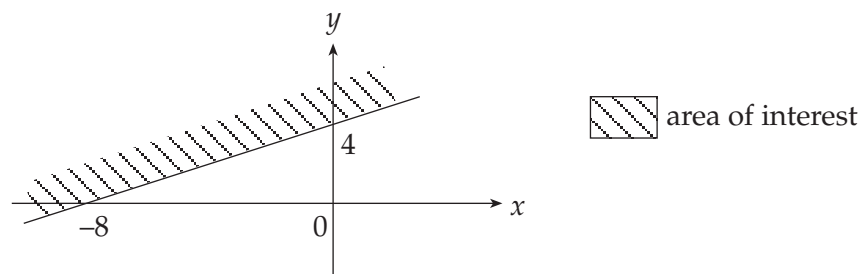
Question 4



The motion of a car described by this distance-versus-time graph over 4 minutes (shown above) is

- | | | | |
|---|-------------------|-----------------|-------------------|
| A | decreasing speed, | stopped, | constant speed. |
| B | increasing speed, | stopped, | constant speed |
| C | stopped, | constant speed, | stopped. |
| D | constant speed, | stopped, | constant speed. |
| E | constant speed, | stopped, | increasing speed. |

Question 5



The linear inequation represented by the shaded region is

- A $2y - x > 8$
- B $2y - x < 8$
- C $2y - x \geq 8$
- D $2y - x \leq 8$
- E $y - x > 4$

Question 6

The solution to the simultaneous equations $x - y = 2$ and $4x + y = 3$ is

- A (1, 1)
- B (0, 1)
- C (1, -1)
- D (-1, 1)
- E (1, 0)

Question 7

The cost of producing tubes of sunscreen (C) is related to the formula $C = 1100 + 2.4n$, where n is the number of tubes of sunscreen produced.

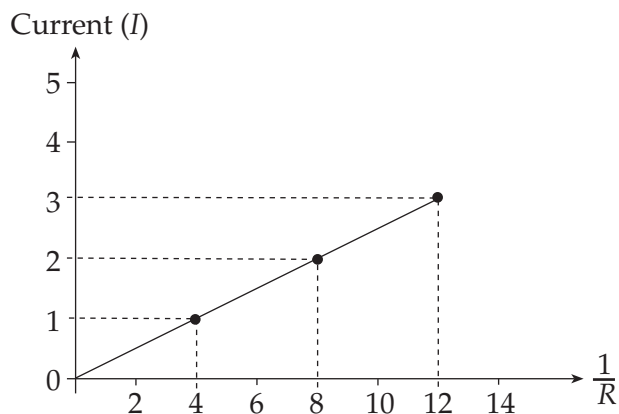
The revenue (R) made from selling n tubes of sunscreen is $R = 8.4n - 100$.

The number of tubes of sunscreen needed to be sold to break even is

- A 100
- B 200
- C 1100
- D 1200
- E 2400

Question 8

In physics, it can be shown that a relationship exists between the current (I) flowing through a resistor and different values of the resistance (R). For one such case, the plot of I against $\frac{1}{R}$, the following graph was obtained.

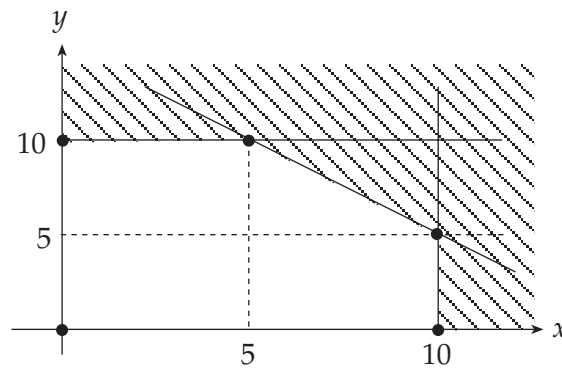


A relationship between I and R is:

- A** $I = 0.25R$
- B** $I = 4R$
- C** $I = \frac{1}{4R}$
- D** $I = \frac{R}{4}$
- E** $I = \frac{4}{R}$

Question 9

A linear programming problem has a solution region indicated by the non-shaded area shown in the figure below.



If the objective function is

$$Z = 22x + 35y,$$

then its maximum value over the solution region is

- A 220
- B 350
- C 395
- D 460
- E 570

Module 4 : Business related mathematics**Question 1**

Anthony invests \$8000 at 5.2% p.a. compounding quarterly. He wishes to determine the value, in dollars, of his investment after 2 years. An expression Anthony could use is

- A $8000 \times (1.052)$
- B $8000 \times (1.013)^2$
- C $8000 \times (1.052)^8$
- D $8000 \times (1.013)^2$
- E $8000 \times (1.013)^8$

Question 2

On January 1st 2001, the cost of mathematics tuition from Hannah tutors rose by 10% to \$99 for a three hour session. Prior to this date a three hour tutorial cost

- A \$63
- B \$89.10
- C \$90
- D \$90.90
- E \$108.90

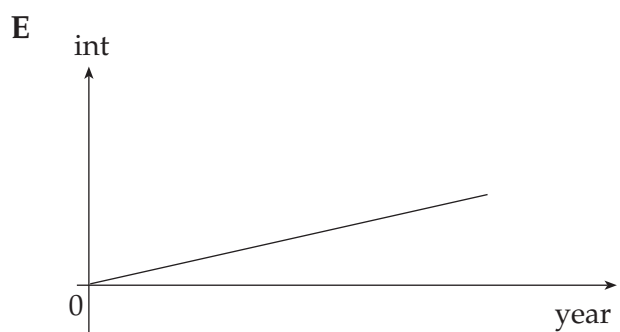
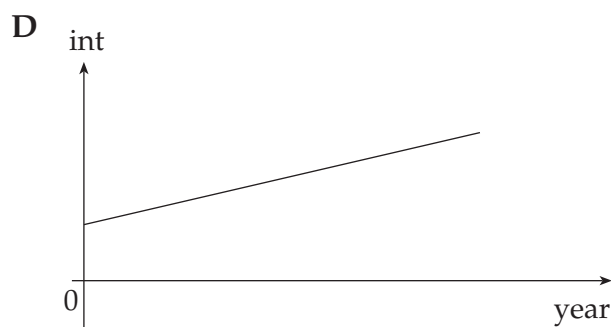
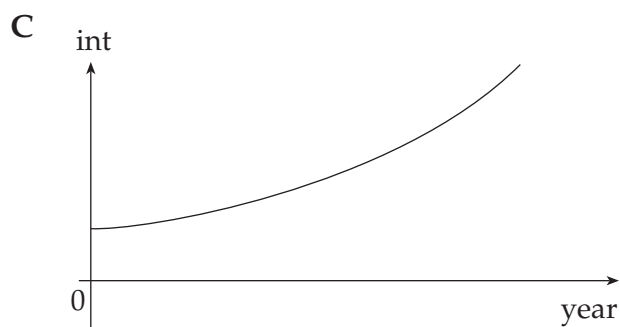
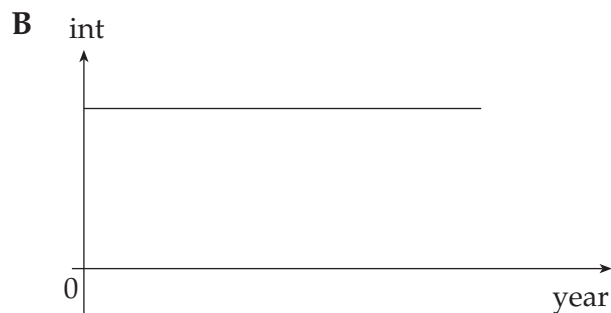
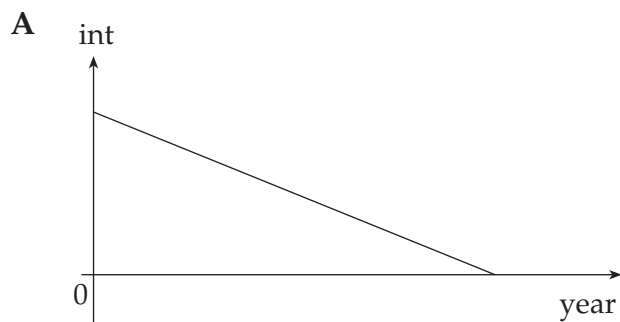
Question 3

Hec bought a utility for work purposes for \$25 000. It is to be depreciated by 25% each year on the reducing balance. Under this arrangement, its value after 3 years is

- A $25000 \times (0.75)^3$
- B $25000 \times (0.75)^2$
- C $25000 - (3 \times 750)$
- D $25000 \times (1.25)^3$
- E 25000×0.75

Question 4

Andrew invests a sum of money in an account paying simple interest per annum. Which of the following graphs best shows the trend in the interest payments over the next few years?

**Question 5**

Leonard opened an account on January 1st 2000 and deposited \$5000. On the 1st of January 2002 his balance was \$5300. No deposits or withdrawals were made during this time. The simple rate of interest, per annum, for Leonard's account is

- A** 1%
- B** 3%
- C** 5%
- D** 6%
- E** 15%

Question 6

Anne purchases a computer for \$2500 under a hire purchase agreement. She pays a deposit of \$300 and then pays the balance in equal monthly repayments over 3 years. The flat rate of interest charged is 10% per annum. The **effective** rate of interest that Anne is paying is closest to

- A 3.3%
- B 10%
- C 17%
- D 19.5%
- E 30%

Question 7

The following statement lists all transactions for Paul's bank account for the month of March. Interest is calculated at 3% per annum on the minimum monthly balance and is paid on the first day of the following month.

Date	Transaction	Debit	Credit	Balance
March 1	Balance brought forward			1135.00
March 3	Deposit		45.00	1180.00
March 7	Withdrawal	400.00		780.00
March 19	Deposit		600.00	1380.00
March 26	Withdrawal	550.00		830.00
March 31	Closing balance			830.00

The interest to be credited to this account on April 1 is

- A \$1.95
- B \$2.08
- C \$5.85
- D \$23.40
- E \$24.90

Question 8

Lisa is planning to go on a world tour in three years time which will cost her \$20 000. Her bank offers her an interest rate of 6.5% per annum compounded annually for the three year term.

The amount of money she will need to invest now to achieve her target, to the nearest dollar, is

- A \$15 546
- B \$16 557
- C \$18 754
- D \$19 573
- E \$20 000

Question 9

Harold has a reducing balance loan with monthly repayments. Which one of the following would **not** enable Harold to reduce the term of the loan?

- A a decrease in the interest rate
- B an increase in the repayment made each month
- C a one-off extra repayment midway through the term of the loan
- D a change to quarterly repayments
- E a change to fortnightly repayments

Module 5 : Networks and decision mathematics

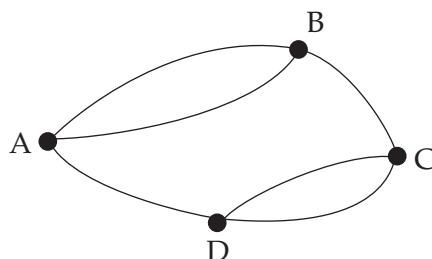
Question 1

The number of edges on a complete graph with 6 vertices is

- A 6
- B 10
- C 12
- D 15
- E 36

Question 2

A graph is drawn as follows



Which **one** of the following matrices could also represent this graph?

A $\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$

B $\begin{bmatrix} 0 & 2 & 0 & 1 \\ 2 & 0 & 1 & 0 \\ 0 & 1 & 0 & 2 \\ 1 & 0 & 2 & 0 \end{bmatrix}$

C $\begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$

D $\begin{bmatrix} 1 & 0 & 2 & 0 \\ 0 & 1 & 0 & 2 \\ 2 & 0 & 1 & 0 \\ 0 & 2 & 0 & 1 \end{bmatrix}$

E $\begin{bmatrix} 2 & 1 & 1 & 1 \\ 1 & 2 & 1 & 1 \\ 1 & 1 & 2 & 1 \\ 1 & 1 & 1 & 2 \end{bmatrix}$

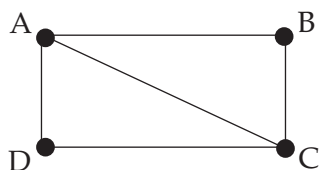
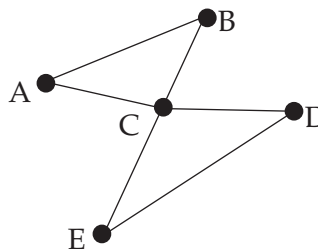
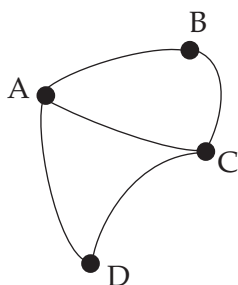
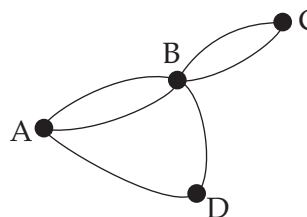
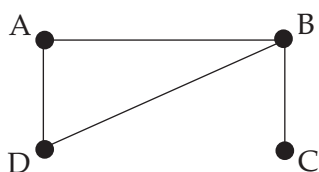
Question 3

A graph drawn with the edges not intersecting except at the vertices is a

- A simple graph
- B directed graph
- C planar graph
- D subgraph
- E bipartite graph

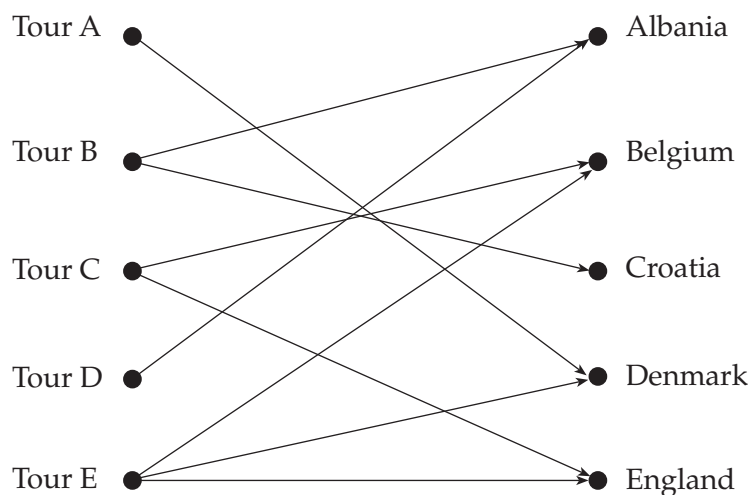
Question 4

Which one of the following graphs contains an Euler circuit?

A**B****C****D****E**

Question 5

Five companies offer European tours to various countries. The different options can be represented by the following bipartite graph.



Which one of the following is a **true** statement ?

- A Tour B travels to more countries than any other.
- B Tourists wishing to see Belgium must take Tour C.
- C Croatia may only be visited on Tour A.
- D Tours B and C offer the same number of countries.
- E Tours D and E together offer more countries than tours B and C together.

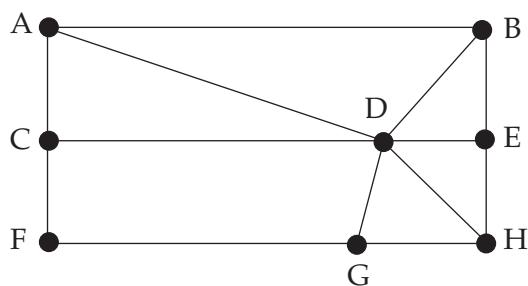
Question 6

A connected planar graph has 4 vertices and 3 faces. The number of edges for this graph is

- A 7
- B 5
- C 4
- D 3
- E 2

Question 7

Consider the following connected graph.

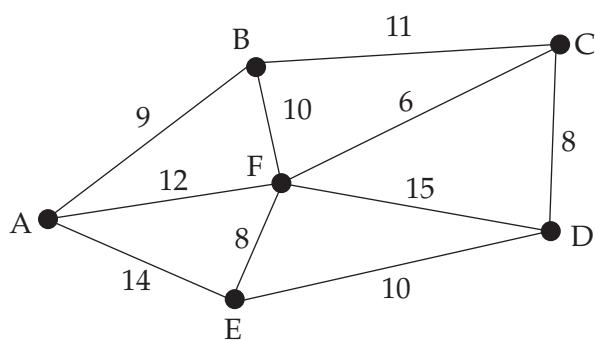


A Hamilton circuit for this graph is

- A $A \rightarrow D \rightarrow B \rightarrow E \rightarrow H \rightarrow G \rightarrow F \rightarrow C \rightarrow A$
- B $A \rightarrow B \rightarrow C \rightarrow D \rightarrow E \rightarrow F \rightarrow G \rightarrow H$
- C $A \rightarrow B \rightarrow D \rightarrow E \rightarrow H \rightarrow D \rightarrow G \rightarrow F \rightarrow C \rightarrow A$
- D $A \rightarrow C \rightarrow F \rightarrow G \rightarrow D \rightarrow E \rightarrow B \rightarrow A$
- E $A \rightarrow D \rightarrow G \rightarrow F \rightarrow C \rightarrow D \rightarrow H \rightarrow E \rightarrow B \rightarrow A$

Question 8

Consider the following weighted graph.

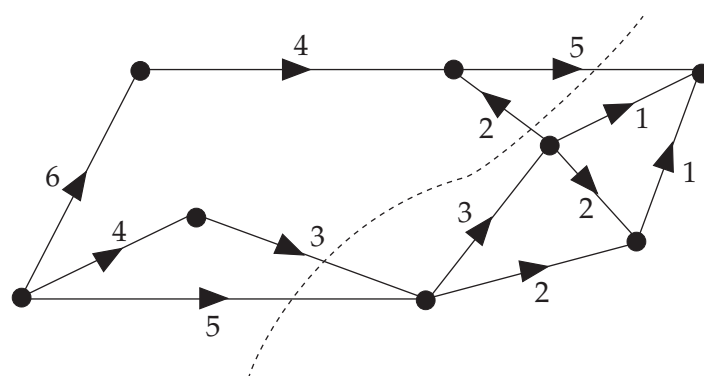


The weight of the minimum spanning tree that may be drawn is

- A 41
- B 43
- C 46
- D 51
- E 103

Question 9

The capacity of the cut on the digraph shown is



- A 5
- B 9
- C 11
- D 13
- E 15