Section A

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?
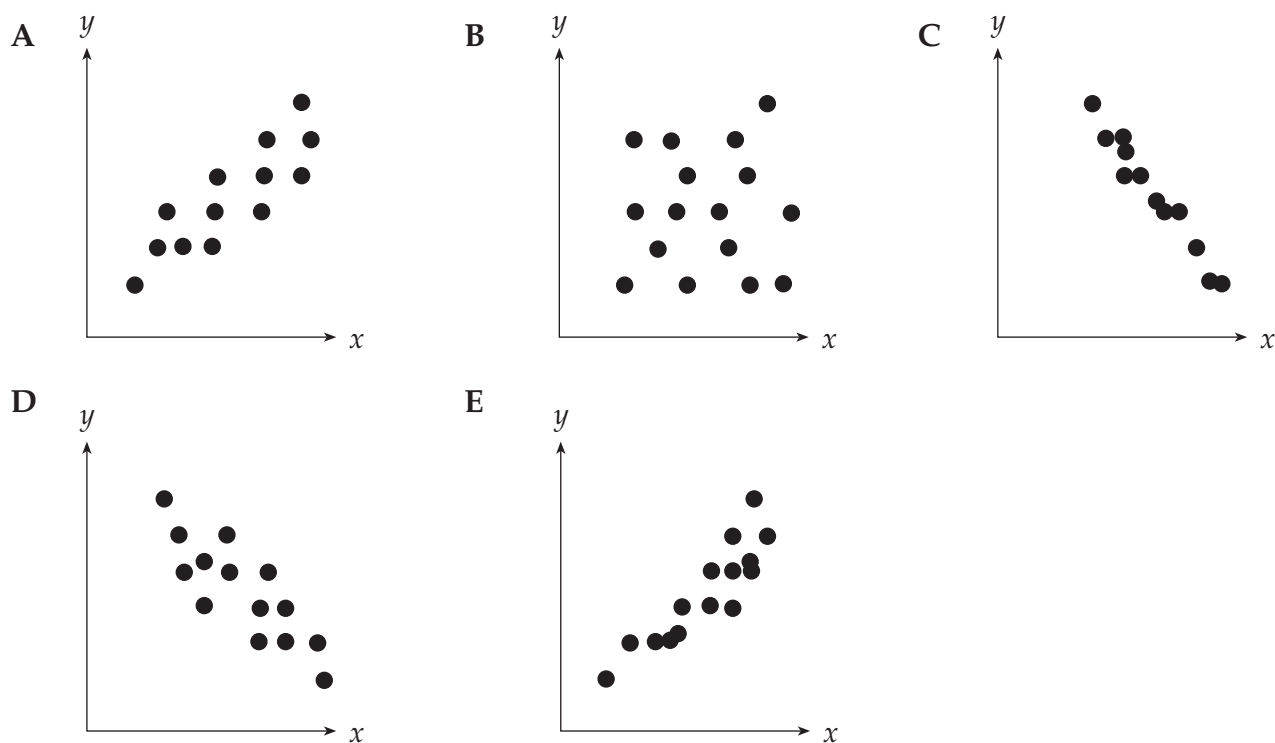
The following information relates to questions 5 and 6

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
	Female	*Male*	
None	23	13	**36**
One	18	26	**44**
More than one	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.

Height versus Marks
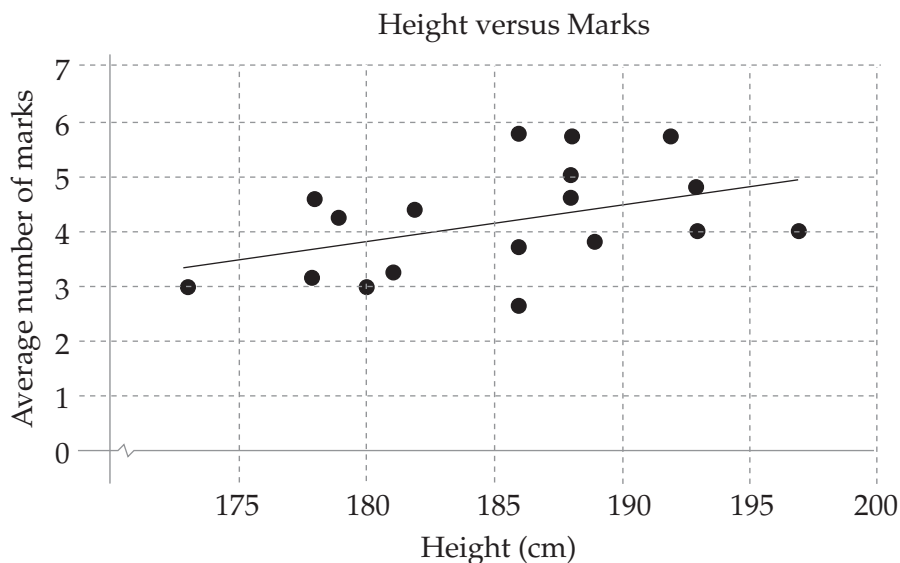
The equation of the regression line is:

Average number of marks per football match = –7.90 + 0.065 × *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
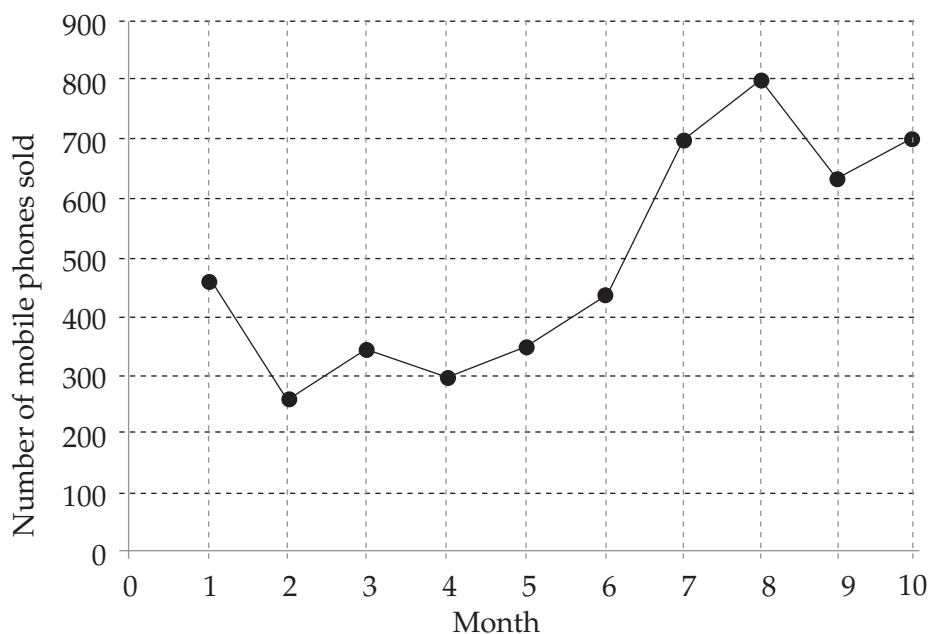- **B** 4.42
- **C** 4.60
- **D** 5.04
- **E** 5.75

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 $= 200 + 50 \times$ Month

    B   Number of mobile phones sold $= 250 + 50 \times$ Month

    C   Number of mobile phones sold $= 220 + 60 \times$ Month

    D   Number of mobile phones sold $= 150 + 100 \times$ Month

    E   Number of mobile phones sold $= 350 + 30 \times$ 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	Summer	Autumn	Winter	Spring
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

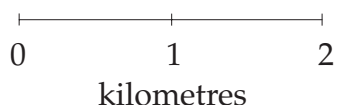## Module 1 : Number patterns and applications

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.

```
|--------------+--------------|
0              1              2
         kilometres
```

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%
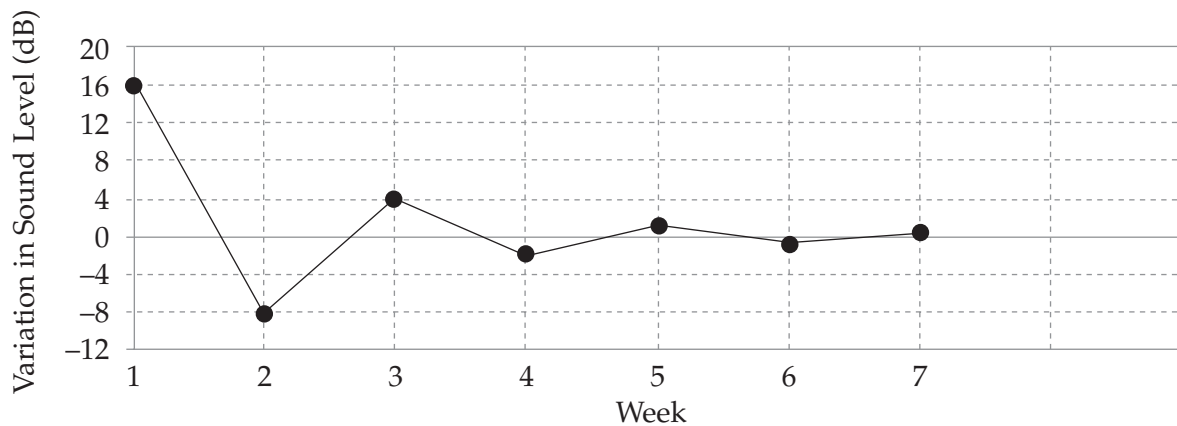
    E   25.0%

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 nth 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.

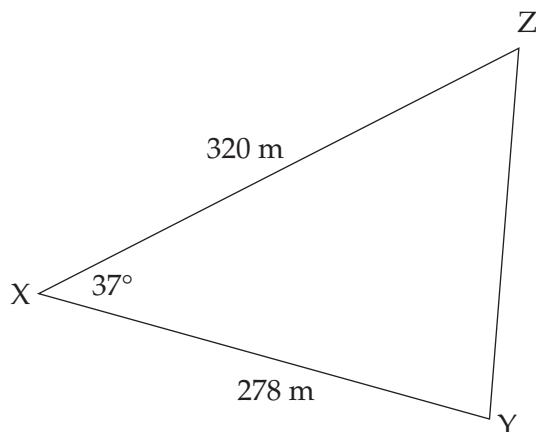## Module 2 : Geometry and trigonometry

Question 1
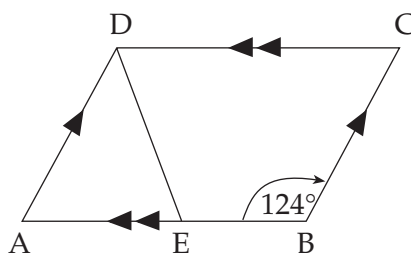
In the parallelogram ABCD, ∠ABC = 124°.
If AD = DE then the size of ∠ADE is

    A 28^0

    B 56^0

    C 62^0
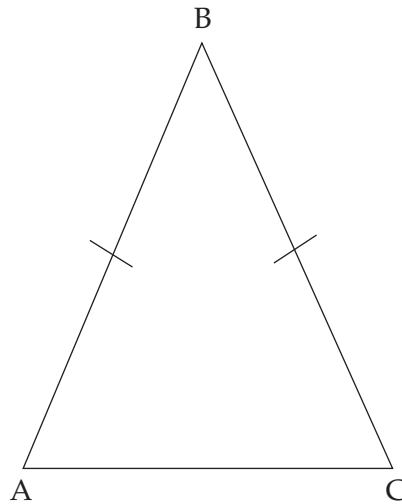
    D 68^0

    E 116^0

Question 2

In triangle XYZ :   XY = 278 metres, XZ = 320 metres and ∠ZXY = 37°
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 ∠BAC = 68°.
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.
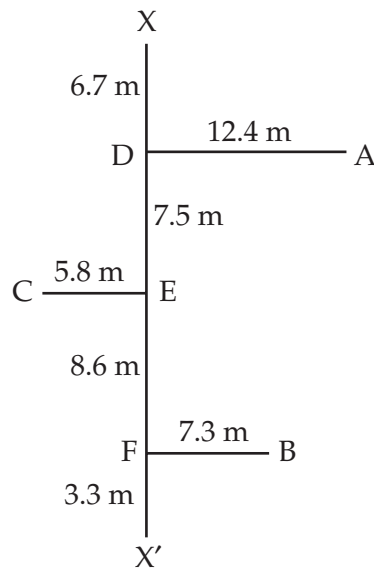
Question 4

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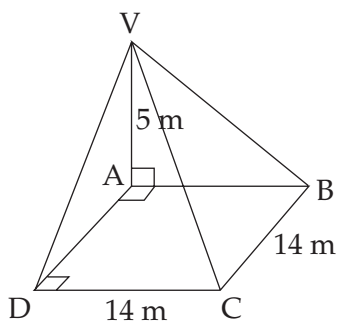
In the figure above, ABCD is a square of side length 14 metres. Point V is 5 metres vertically above point A.

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

    A   11.1

    B   14.9

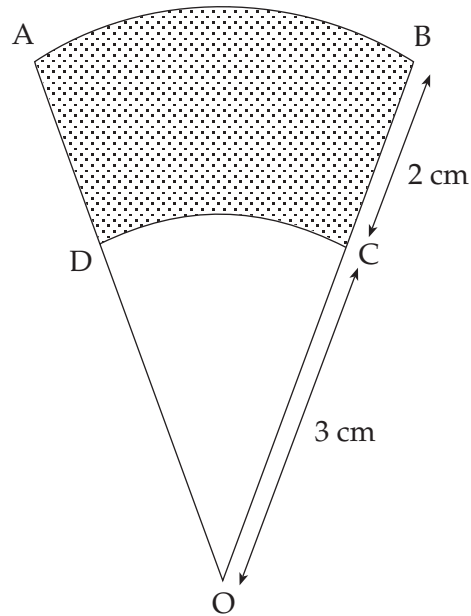   **C**   19.0

    D   20.4

    E   24.2

Question 7
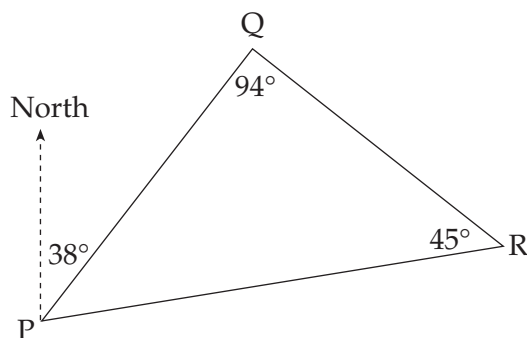
In the diagram the bearing of point Q from point P is 038°.
In triangle PQR, $\angle PQR = 94°$ and $\angle QRP = 45°$
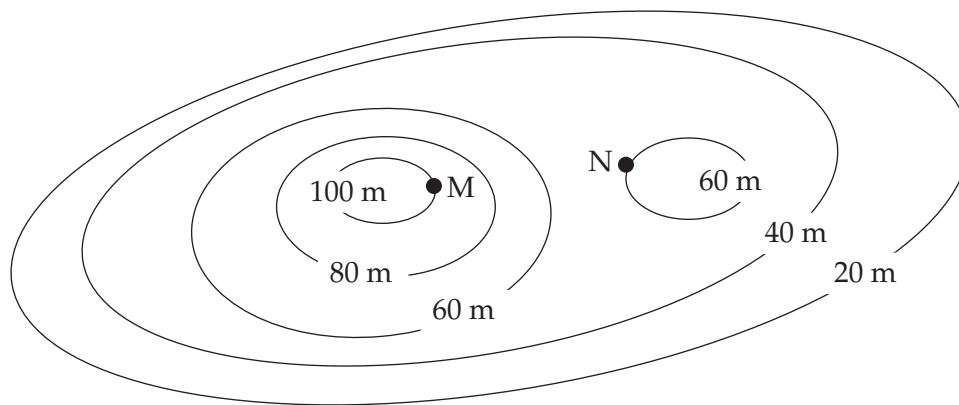
The bearing of point P from point R is

    A   079°

    B   083°

    C   101°

    D   268°

    E   259°

Question 8

OAB and ODC are sectors of a circle. OC = 3 cm and CB = 2cm.

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 $\dfrac{1}{6}$
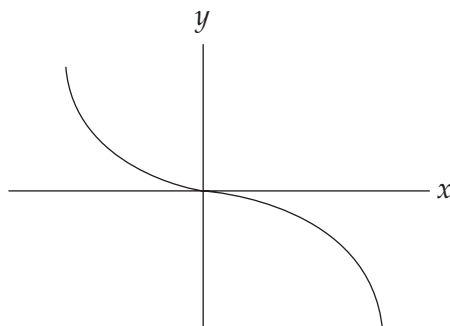
B $\dfrac{1}{4}$

C $\dfrac{2}{5}$

D $\dfrac{5}{3}$

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
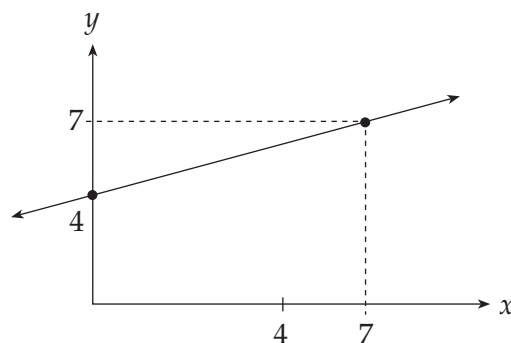
    D   2

    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 $y - 2x = 3$
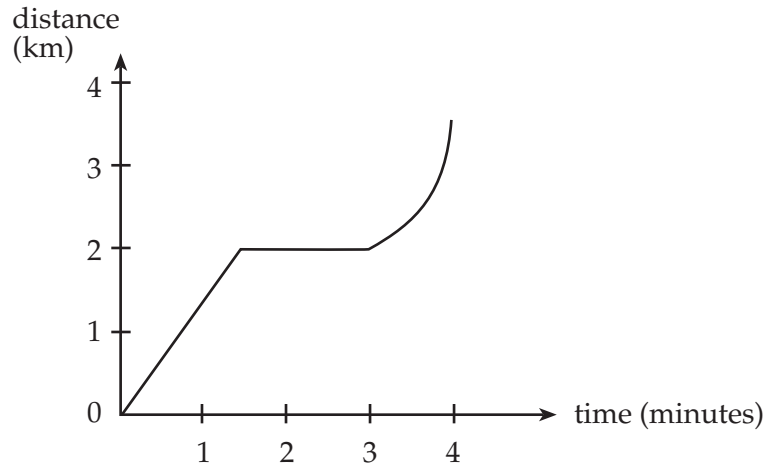
    E $x + 2y = 1$ and $x + 2y = 1$

Question 3

The equation of the line shown above is

    A $4x + 7y = 1$

    B $7y - 3x = 28$

    C $7x - 3y = 28$

    D $7y - 3x = 4$

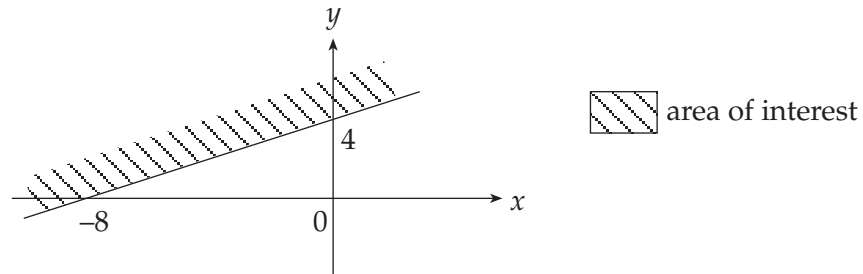   E $y = \dfrac{7}{3}x + 4$

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.
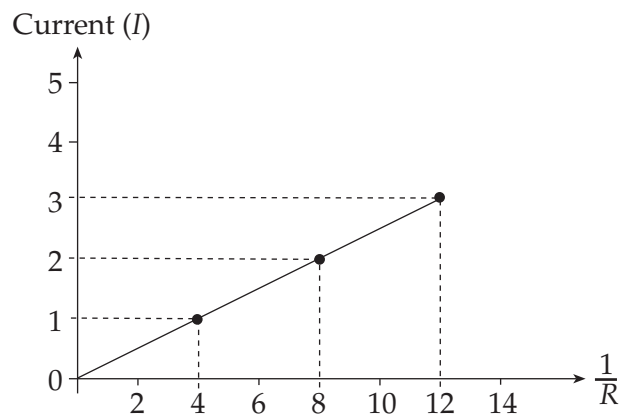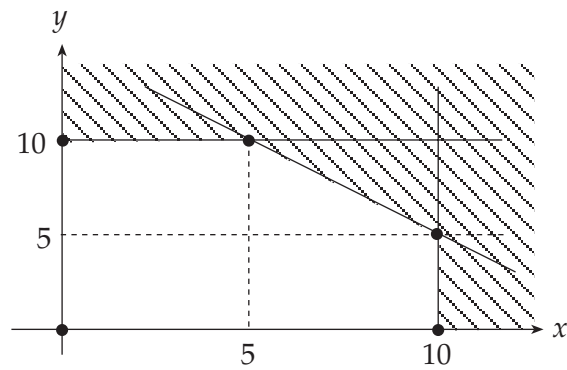

A relationship between I and R is:

    A $I = 0.25R$

    B $I = 4R$

    C $I = \dfrac{1}{4R}$

    D $I = \dfrac{R}{4}$

    E $I = \dfrac{4}{R}$

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

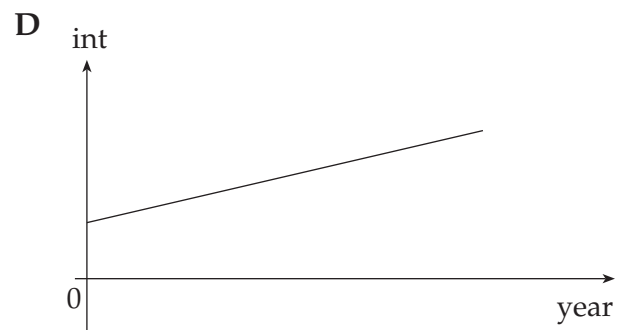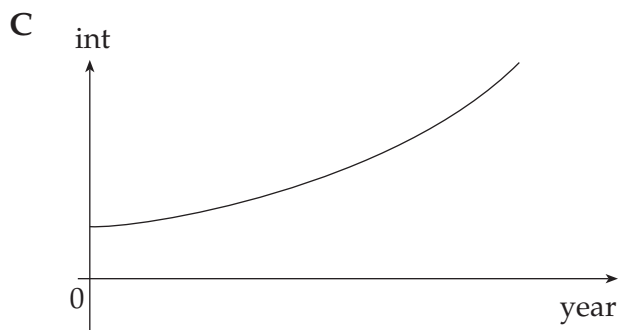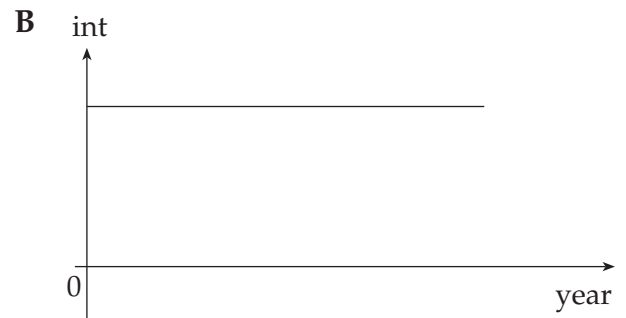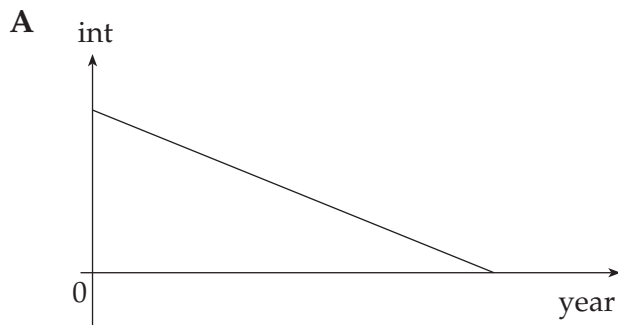### Question 3

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?

A

B

C

D

E
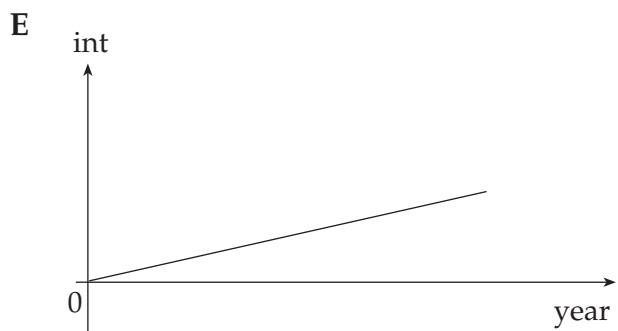
Question 5

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

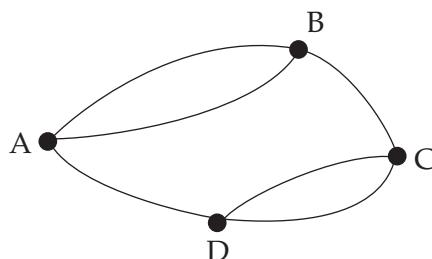## Module 5 : Networks and decision mathematics

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
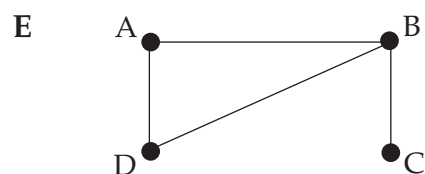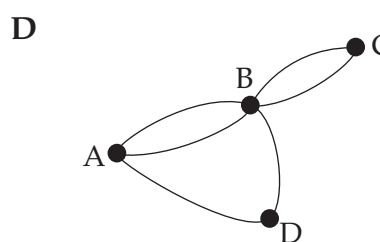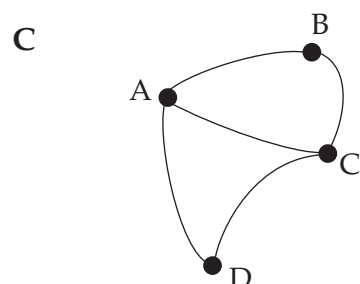$$\begin{bmatrix} 2 & 1 & 1 & 1 \\ 1 & 2 & 1 & 1 \\ 1 & 1 & 2 & 1 \\ 1 & 1 & 1 & 2 \end{bmatrix}$$
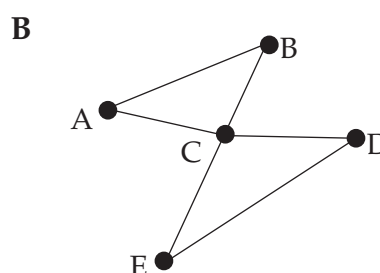
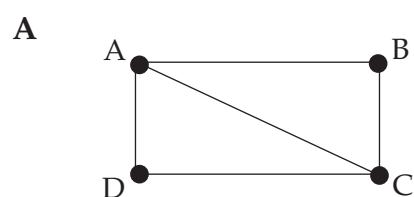## Question 3

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

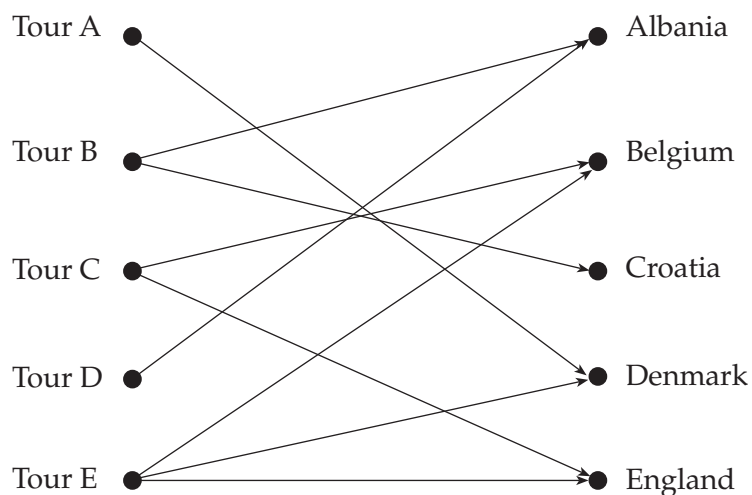   **E**   bipartite graph

Question 4

Which one of the following graphs contains an Euler circuit ?

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.

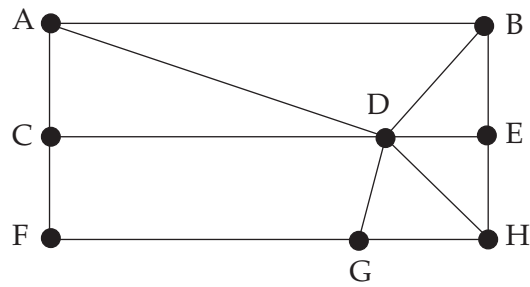   **E**   Tours D and E together offer more countries than tours B and C together.

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

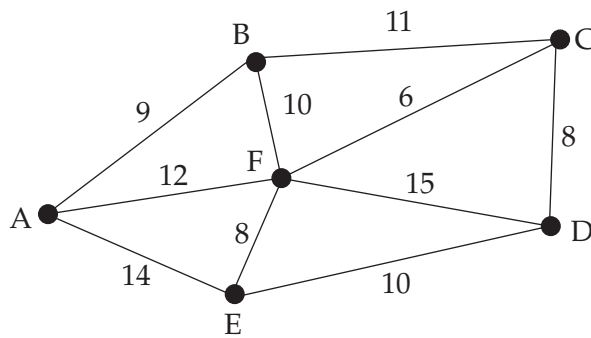Consider the following connected graph.

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

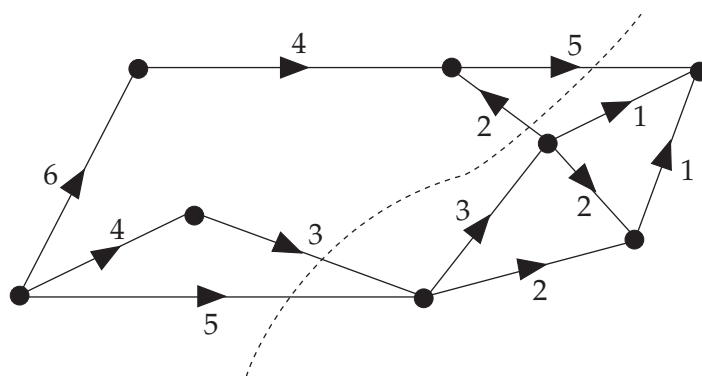Consider the following weighted graph.

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