Section A

<div style="border:1px solid">

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.

</div>

Core : Data analysis

The following information relates to Questions 1 and 2

Parallel boxplots have been constructed, in the diagram below, to display the change in *median house prices*, from 2001 to 2002, for a group of Western suburbs in Melbourne.
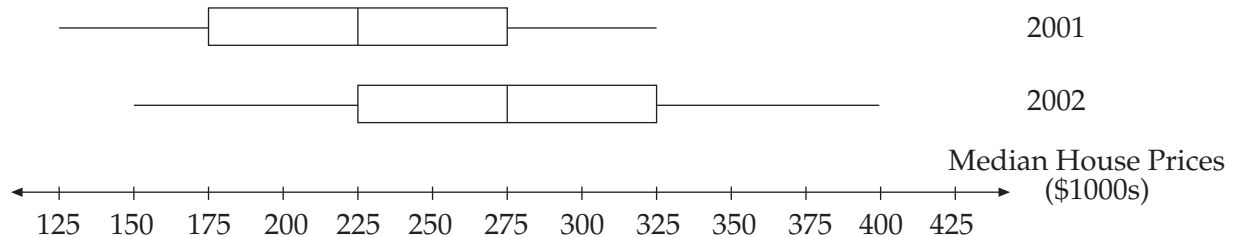
Question 1

The increase, from 2001 to 2002, in the median of the *median house prices* for this group of suburbs is closest to

    A $30 000

    B $40 000

    C $50 000

    D $60 000

    E $70 000

Question 2

Which one of the following statements is **not** a true observation from the boxplots?

    A   The centre and spread of *median house prices* have both increased from 2001 to 2002.

    B   The interquartile range of the *median house prices* has increased by approximately $50 000 from 2001 to 2002.

    C   The distribution of *median house prices* in 2002 is symmetrical.

    D   The increase in the minimum of *median house prices* is less than the increase in maximum from 2001 to 2002.

    E   The maximum value of the *median house prices* in 2002 is approximately $75 000 more than the maximum value in 2001.

Question 3

The time taken to complete a particular fitness test is recorded for a group of two hundred 16 year-old students.
The most appropriate graph to display the data would be a

    A   time series graph.

    B   line graph.

    C   pie graph.

    D   bar chart.

    E   histogram.

Question 4

The distribution of weights of 3 kilogram bags of apples is bell-shaped with a mean weight of 3kg. If 68% of the bags have a weight between 2.96 kg and 3.04 kg then the standard deviation of the weight of a 3kg bag of apples is

    A   20 grams.

    B   30 grams.

    C   40 grams.

    D   200 grams.

    E   400 grams.

Question 5

A $\frac{1}{y}$ transformation has been used to linearise a set of data. Which one of the following sets of data would be linearised using a $\frac{1}{y}$ transformation?

A
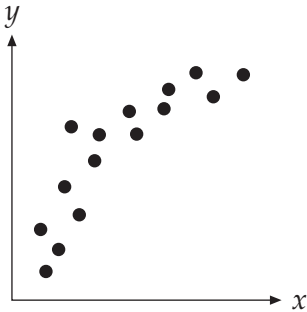
B
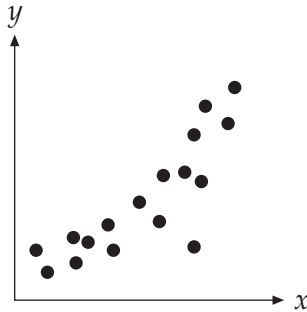
C
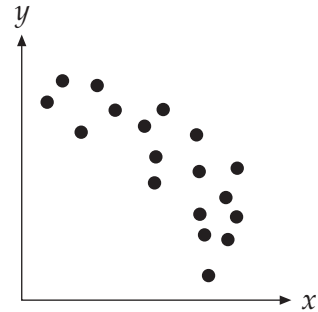
D
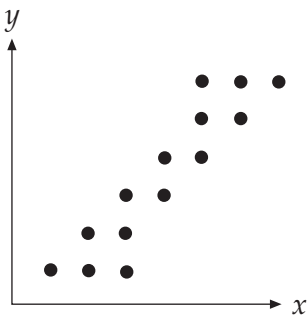
E
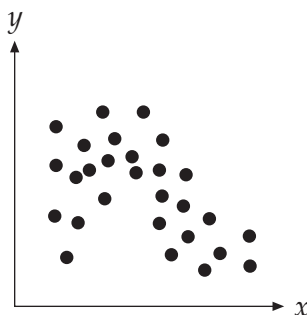
Question 6

A y^2 transformation has been used to linearise the following data.

x	1	2	3	5	9	12
y	0	1	2	3	4	5

The equation of the least-squares regression line (figures rounded to two decimal places) that fits this transformed data is

    A $y = 2.25x - 2.81$

    B $y = 0.42x + 0.27$

    C $y^2 = 2.25x - 2.81$

    D $y^2 = 0.42x + 0.27$

    E $y = 2.25x^2 - 2.81$

Question 7

Time Period	1	2	3	4	5	6
Data	205	274	305	288	327	312

The time series data above is to be smoothed using 3-median smoothing.
The table of smoothed data is

A

Time Period	2	3	4	5
Data	274	288	305	312

B

Time Period	1	2	3	4	5	6
Data	205	274	288	305	312	327

C

Time Period	2	3	4	5	6
Data	274	305	288	327	312

D

| Time Period	2	3	4	5
Data	274	305	288	327

E

Time Period	1	2	3	4
Data	274	288	305	327

The following information relates to Questions 8 and 9

The percentage segmented bar charts below display the results of a survey of daily newspaper readership in three suburbs of Melbourne. The three suburbs were chosen to represent the socio-economic groups:

Low : Scimpton
Medium : Middleton
High : Diamondville
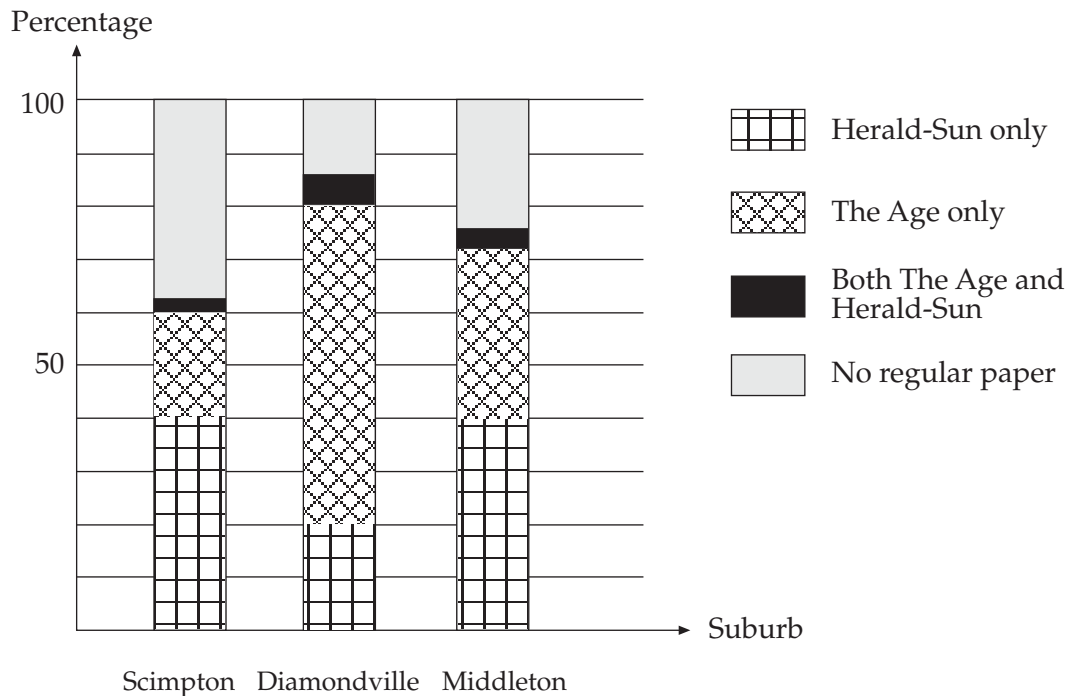
Question 8

Which one of the following statements is **not** a true conclusion that can be observed from this graph.

A Approximately 65% of those surveyed in Diamondville read The Age.

B The percentage of Herald-Sun readers in both Scimpton and Middleton is approximately twice the percentage of Herald-Sun readers in Diamondville.

C In Scimpton the percentage of readers of The Age is approximately half the percentage of Herald-Sun readers.

D There are more people in Diamondville who read a newspaper than there are in Middleton.

E The percentage of the surveyed Scimpton residents who do not regularly read a newspaper is more than twice the percentage of surveyed Diamondville residents who do not regularly read a newspaper.
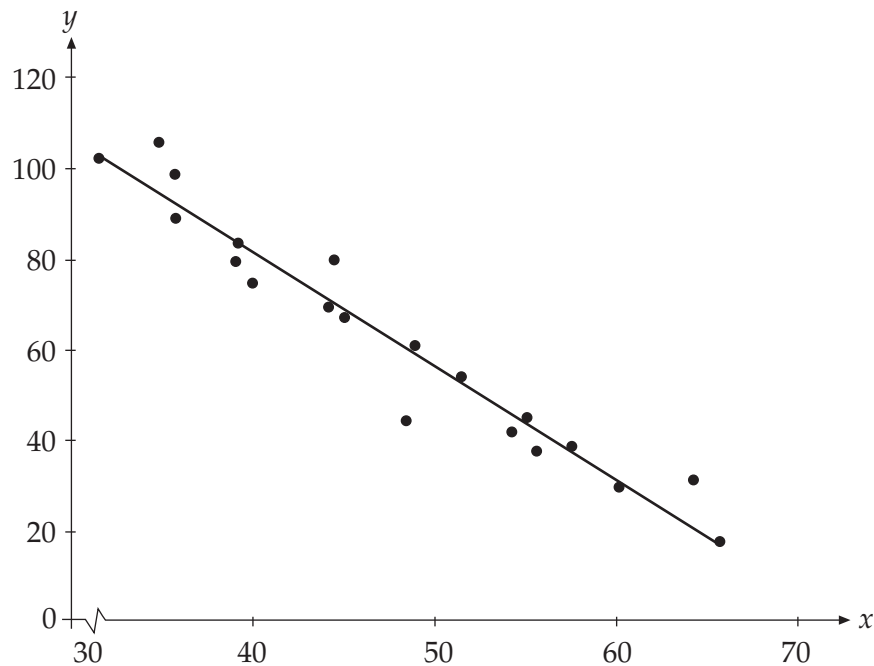
Question 9

Which one of the following is the most likely reason for this comparison of newspaper readership in the three suburbs?

A   To promote the sale of newspapers to Melbourne's residents.

B   To estimate the number of Melbourne residents who read each of the newspapers.

C   To investigate the association between newspaper preference and socio-economic group.

D   To investigate the association between the number of residents in a suburb and the preferred newspaper.

E   To investigate the association between the location of a suburb and the preferred newspaper.

The following information relates to Questions 10 and 11

A least-squares regression line has been fitted to a set of numerical bivariate data.
The data and the regression line have been graphed below.

Question 10

Which one of the following is closest to the equation of the regression line?

 A $y = 184 + 2.6x$

 B $y = 107 - 2.6x$

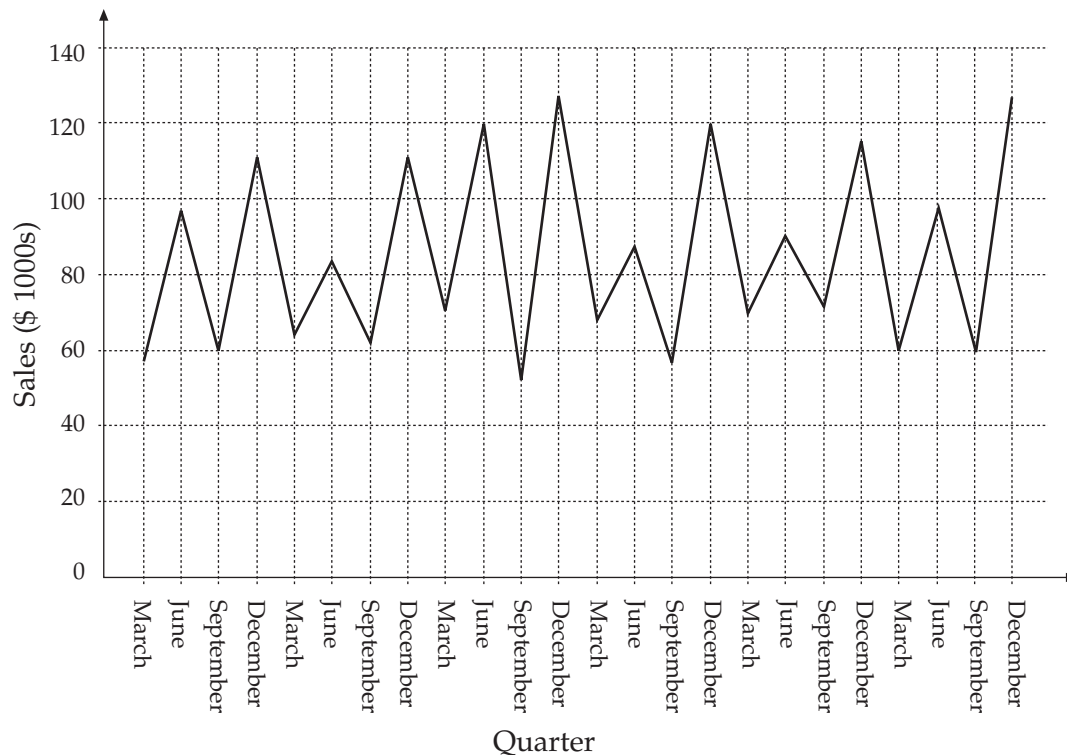 C $y = 107 - 0.38x$

 D $y = 71 - 0.38x$

 E $y = 184 - 2.6x$

Question 11

For the data points $(40, 72)$ and $(63, 30)$ the residuals, respectively, are closest to

 A 4 and − 4

 B − 8 and 10

 C 8 and 10

 D 8 and −10

 E − 4 and 5

The information below relates to Questions 12 and 13

The quarterly sales figures of a clothing store, for the six years that the store has been in operation, are graphed below.

Question 12

The pattern revealed in the variation of these sales figures can best be described as

  A essentially random.

  B seasonal with decreasing trend.

  C increasing trend.

  D seasonal.

  E seasonal with increasing trend.

Question 13

If the data for each year is deseasonalised then the two seasons that have seasonal indices with the largest values would be

  A March and June.

  B March and September.

  C June and December.

  D September and December.

  E June and September.

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

The ratio scale on a map is 1 : 15 000. Two suburban shopping malls are shown 30 cm apart on a map. The actual straightline distance on the ground between the two shopping malls is

- **A**   450 m
- **B**   500 m
- **C**   2.0 km
- **D**   4.5 km
- **E**   5.0 km

Question 2

A triathlon has three sections: swim, cycle and run. A recent event had the distance of each section given respectively by the ratio 1 : 12 : 7. The percentage of the distance of the run section is

- **A**   5%
- **B**   20%
- **C**   35%
- **D**   45%
- **E**   60%

Question 3

A photographer takes a picture of a person with a height of 175 cm. If the height of the person in the print is 25 cm, what is the ratio of the original person to the reproduction?

    A   7 : 1

    B   6 : 1

    C   5 : 1

    D   8 : 10

    E   1 : 7

Question 4

An arithmetic sequence has a common difference of 3 and a first term of -9. The sum of the first ten terms is

    A   21

    B   45

    C   18

    D   27

    E   –12

Question 5

A geometric sequence whose 8th term is 256 and whose 5th term is 4 has a common ratio of

    A   4

    B   2

    C -4

    D   0.5

    E   0.25

Question 6

The following is an infinite geometric sequence

32, 8, 2, 0.5, ……

The sum of an infinite number of terms of this sequence is

    A   128

    B   64

    C   42

    D $42\frac{1}{2}$

    E $42\frac{2}{3}$

Question 7

Which of the sequences below is generated by the difference equation

$$t_{n+1} = t_n - 2, \ t_1 = 6 \ ?$$

    A   6, 12, 24, 48, 96, …

    B   6, 8, 10, 12, 14, …

    C   6, $-$ 3, 1.5, $-$ 0.75, 0.375, …

    D $-$ 6, 12, $-$ 24, 48, $-$ 96, …

    E   6, 4, 2, 0, $-$ 2, …

Question 8

The solution to the difference equation

$$t_{n+1} = 2t_n + 8, \ t_1 = -6$$

is given by

    A $t_n = 2^{n-1} - 5$

    B $t_n = (2)^n - 8$

    C $t_n = 2(2)^{n-1} + 4$

    D $t_n = 8(2)^{n-1} - 6$
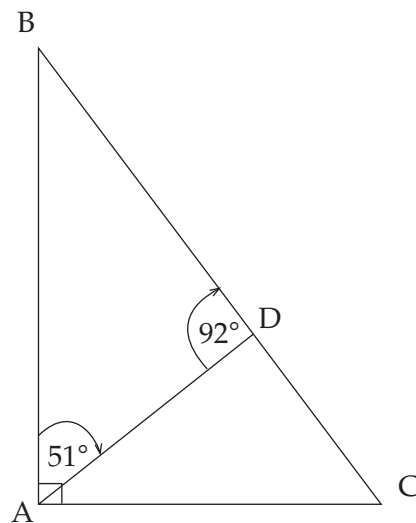
    E $t_n = 8(2)^{n-1} + 2$

Question 9

The first five terms of a sequence are plotted on the graph below.
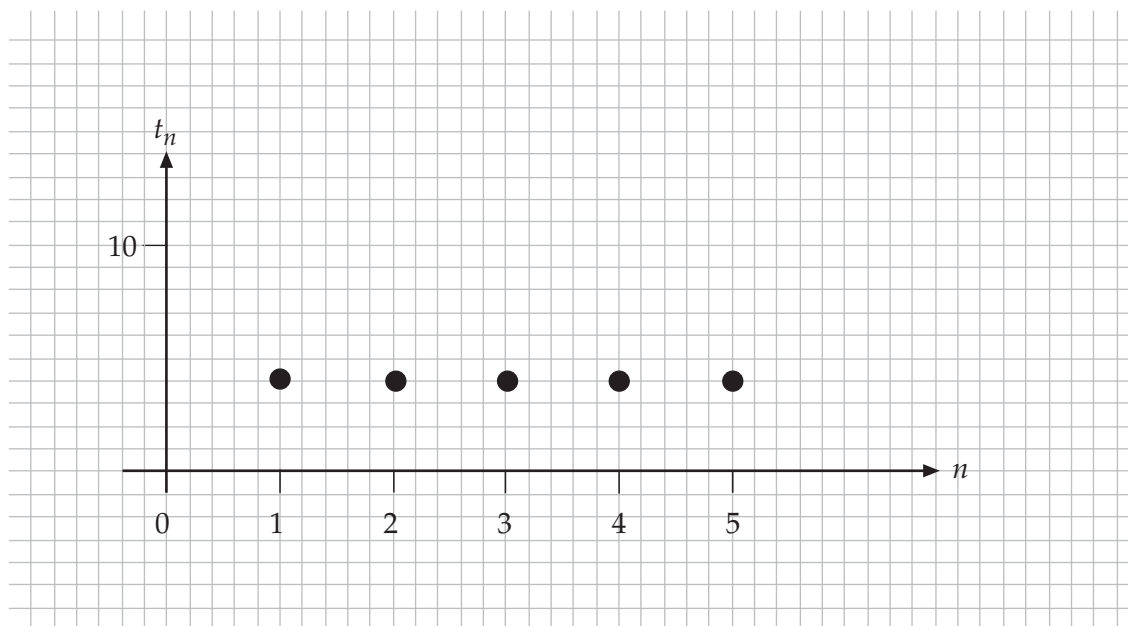
Which of the following could match the sequence in the graph?

- **A** $t_{n+1} = t_n + 4$, $\quad t_1 = 3$
- **B** $t_{n+1} = 2t_n - 1$, $\quad t_1 = 3$
- **C** $t_{n+1} = 0.5t_n + 2$, $t_1 = 4$
- **D** $t_{n+1} = 2t_n + 4$, $\quad t_1 = 4$
- **E** $t_{n+1} = 3t_n$, $\qquad t_1 = 4$

Module 2 : Geometry and trigonometry
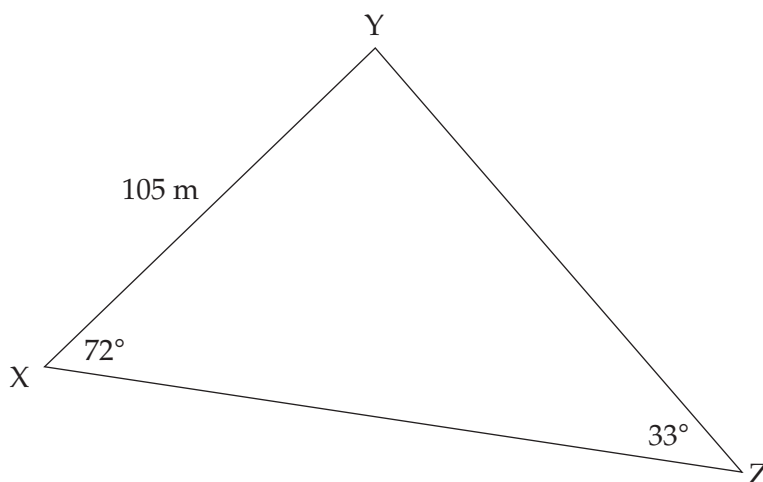
Question 1

In the triangle ABC, ∠ BAC is a right angle.
In triangle BAD, ∠ ADB = 92° and ∠ BAD = 51°.
The magnitude of ∠ BCA is

     A   39°

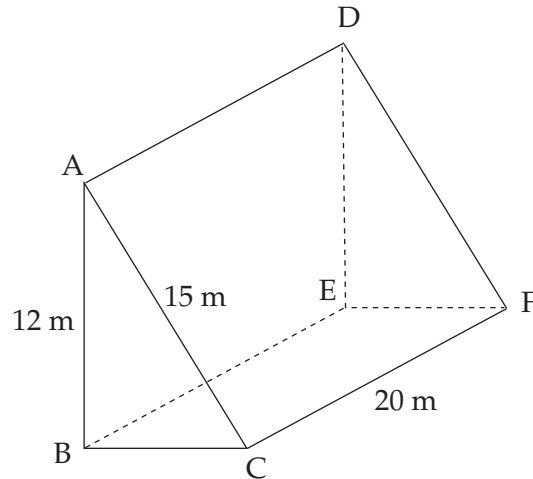   **B**   51°

     C   53°

     D   88°

     E   92°

Question 2

In the triangle XYZ, drawn below, XY = 105 metres, ∠XZY = 33° and ∠YXZ = 72°.

In triangle XYZ, the length of the side YZ, in metres correct to one decimal place, is

    A   38.7

    B   60.1

    C   77.8

    D   183.4

    E   186.2

The following information relates to Questions 3 and 4

The triangular faces ABC and DEF of this triangular prism have right-angles at vertices B and E respectively.

The edges AB = DE = 12 metres. AC = DF = 15 metres. CF = BE = AD = 20 metres.

Question 3

The angle that the edge AC makes with the edge BC, in degrees correct to one decimal place, is closest to
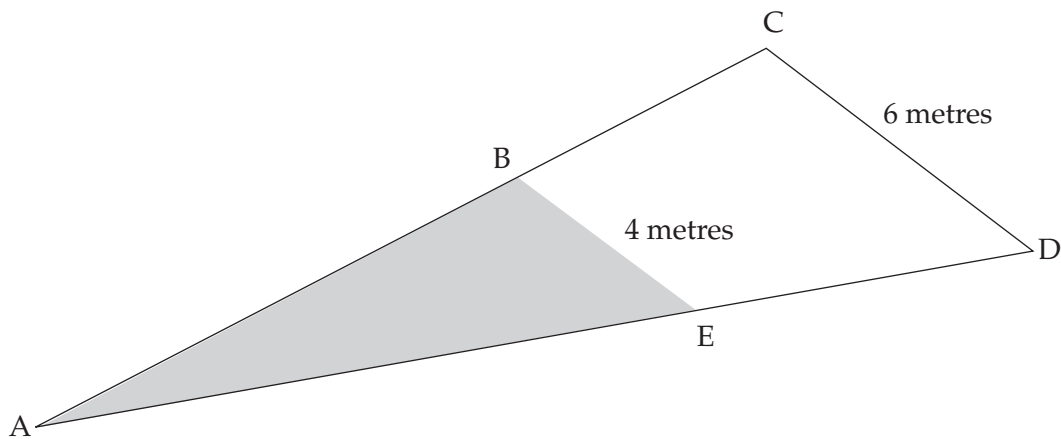
  A   36.9

  B   38.7

  C   45.0

  D   51.3

  E   53.1

Question 4

The volume of this prism, correct to the nearest cubic metre, is

  A   1800

  B   2305

  C   1080

  D   2160

  E   1350

Question 5

In the diagram above BE is parallel to CD.

BE = 4 metres and CD = 6 metres.

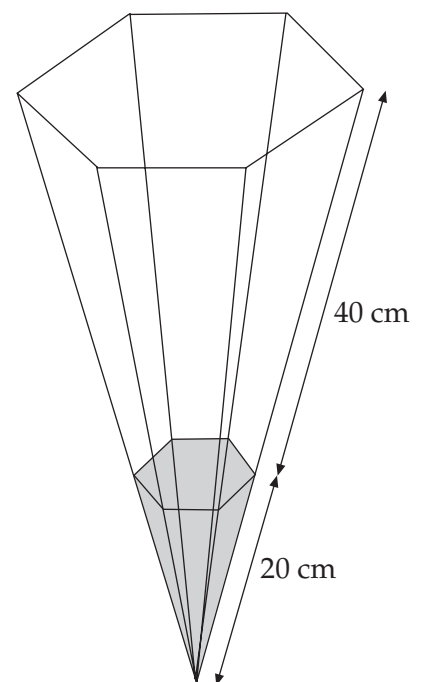The ratio of shaded area to unshaded area is

     A   2 : 3

     B   4 : 9

     C   8 : 27

     D   4 : 5

     E   9 : 4

Question 6

When the container in the diagram is full it contains twenty litres of liquid.
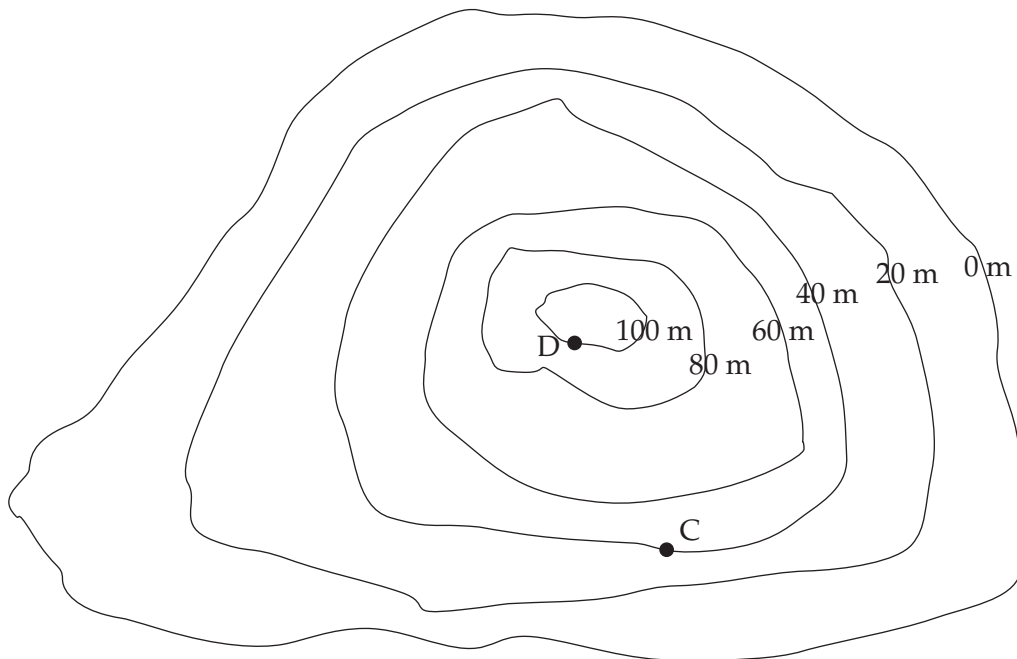
The volume of liquid (shaded) in the container, in litres correct to 2 decimal places, is closest to

     A   0.74

     B   2.22

     C   2.50

     D   5.00

     E   6.67

Question 7

A contour map of a land feature has been drawn below. The contour interval is 20 metres and the scale of the map is 1 : 10 000


If the distance from C to D measures 4 centimetres on the map, then the average slope when going from C to D is closest to

    A   0.15

    B   1.5

    C   6.67

    D   60

    E   8.53

The following information relates to Questions 8 and 9

A traverse survey has been carried out on an irregularly shaped block of land and a field sketch of this survey is shown in the diagram below. The traverse line, **AB,** is on a bearing of **345° T** and all distances are in metres.
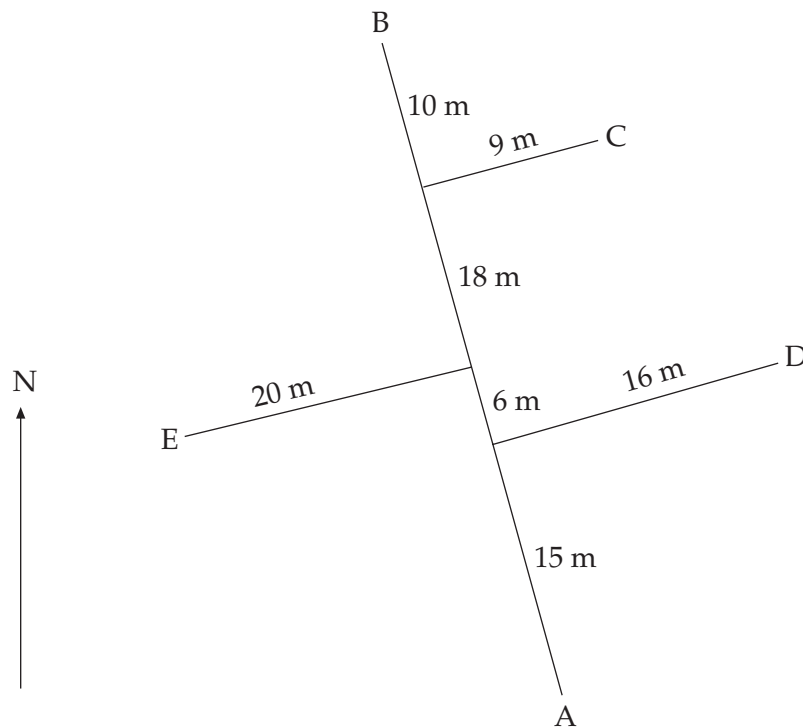
Question 8

The straight-line distance between points **E** and **C**, in metres correct to one decimal place, is

    A   34.7

    B   34.1

    C   29.0

    D   40.1

    E   35.9

Question 9

The bearing of point **D** from point **A**, in degrees correct to one decimal place, is

    A   31.8

    B   45.0

    C   46.8

    D   61.8

    E   211.8

Module 3 : Graphs and relations

Question 1

In the equation $y = 5 - 3x$, when $y = 11$ the value of x is

    A   –2

    B   2

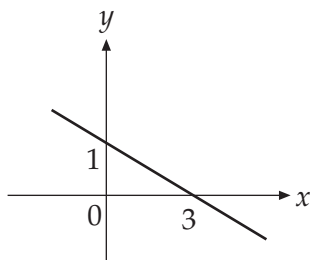   **C**   –7

    D   7

    E   –27

Question 2

A computer repairman charges $25 call out fee plus $36 for each 30 minutes or part thereof. On a particular visit he charged the householder $133. It was noted he arrived at 1:15 pm. The repairman's departure time could be

    A   1:45 pm

    B   2:10 pm

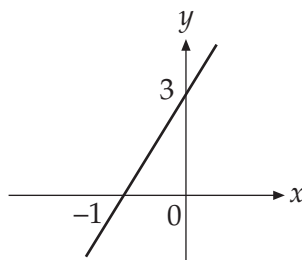   **C**   2:45 pm

    D   3:15 pm

    E   3:45 pm

Question 3

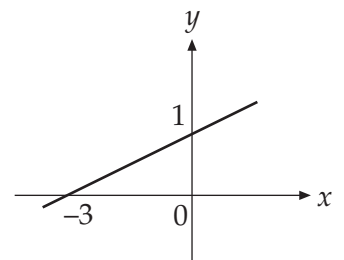Which is the graph of the equation $x + 3y - 3 = 0$?

A

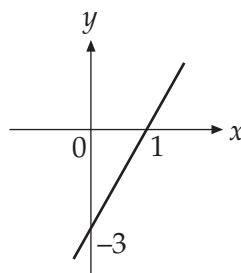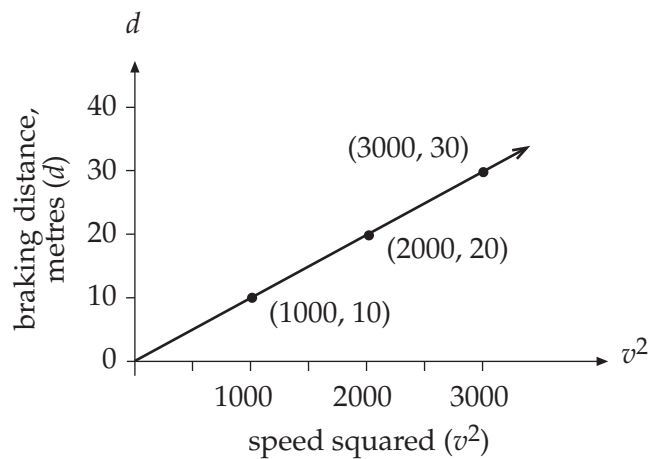**B**

C

D
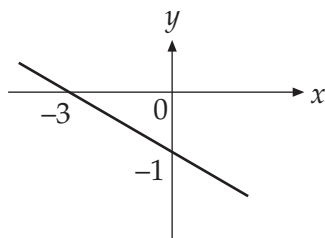
E

Question 4

The straight line $y = kx - 7$ passes through the point (–5, 3). The value of k must be

    A   –5

    B   3

    C   –2

    D   1

    E   0

Question 5

The ABC motor company tested the braking distance (d) metres of their latest car and its relationship to the speed (v) km/h of the car. The graph of d versus v^2 is shown below.

The relationship between d and v is

    A $d = \dfrac{v^2}{10}$

    B $d = \dfrac{v^2}{100}$

    C $d = \dfrac{v^2}{1000}$

    D $d = 10v^2$

    E $d = 100v^2$

Question 6

The intensity of sound decreases as you move away from a sound source. This relationship can be written in the form $I = \dfrac{k}{r^2}$. When $I = 0.04$ and $r = 5$ the value of k is

    A   0.01

    B   0.1

    C   1.0

    D   10

    E   100

Question 7

If an objective function is $\qquad\qquad Z = 3x + 4y,$

then the maximum value of Z would be given by the vertex with the co-ordinates of

    A   (0, 10)

    B   (15, 10)

    C   (10, 10)

    D   (0, 20)

    E   (5, 15)

Question 8
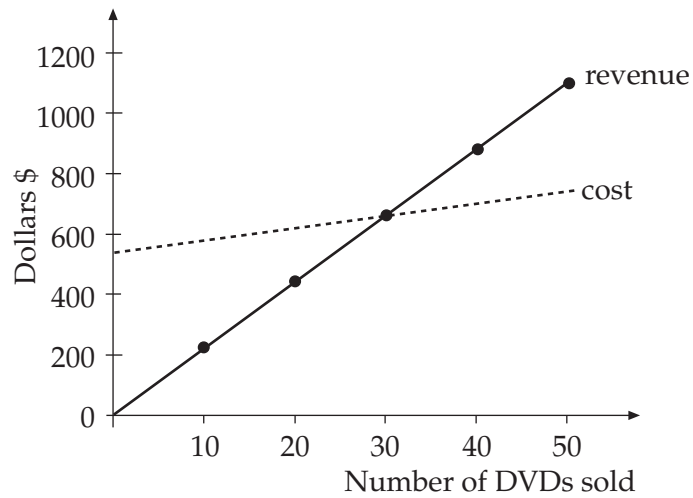
The intersection point of the boundaries of the linear inequations

$$x + 3y \le 30 \qquad \text{and}$$
$$5x + 15y \ge 300 \qquad \text{is}$$

    A   (0, 10)

    B   (0, 20)

    C   (100, 0)

    D   (10, 20)

    E   The lines do not intersect

Question 9

This graph shows the relationships between revenue and cost, and the number of DVDs sold at a music shop.

The money that needs to be outlayed in cost for manufacturing of DVDs to break even is closest to

    A $0

    B $30

    C $600

    D $660

    E $1100

Module 4 : Business related mathematics

Question 1

Peter invests $4000 at 3% per annum simple interest. He will maintain this investment until he has earned $600 in interest. The length of Peter's investment will be

    A   6 months

    B   3 years

    C   5 years

    D   6 years

    E   7 years

Question 2

Marcos purchased two shirts, each at a discounted price. After 5% discount had been deducted from the first shirt he paid $38 and after 10% had been deducted from the second shirt he paid $72. If Marcos had bought these two shirts at their original prices then he would have paid a total of

    A $121

    B $120

    C $116

    D $110

    E $100.90

Question 3

Brenton invests $10 000 at 5% interest per annum, compounding annually. The value of Brenton's investment after 4 years is

    A $10 167.71

    B $10 509.45

    C $12 000.00

    D $12 155.06

    E $12 166.53

The following information relates to Questions 4 and 5

Barb decides to depreciate her computer, originally costing $4 000, each year under the reducing balance method. After 3 years the value of the computer is $1 300.
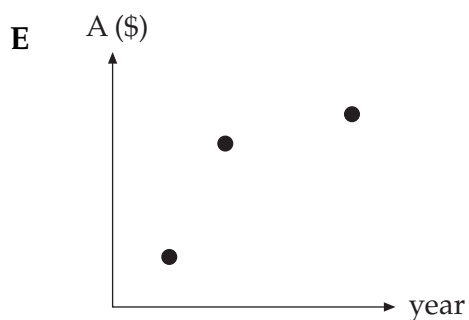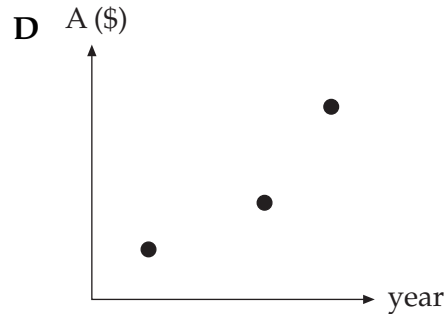
Question 4

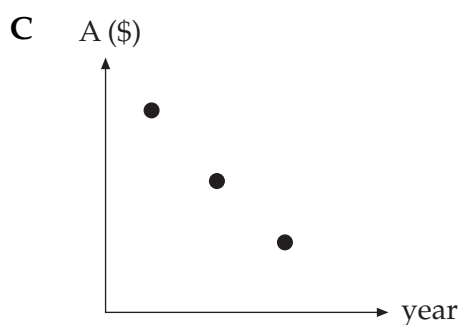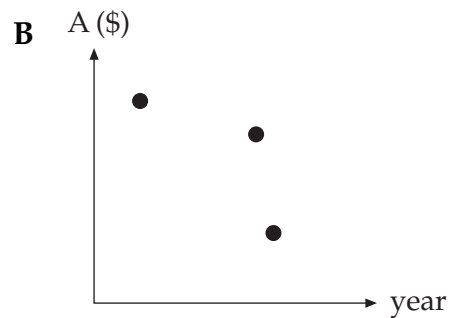The depreciation rate is closest to

    A   37%

    B   31%

    C   29%

    D   26%

    E   23%

Question 5

Which of the following graphs best represents the amount, A ($), that Barb reduced the value by each year?
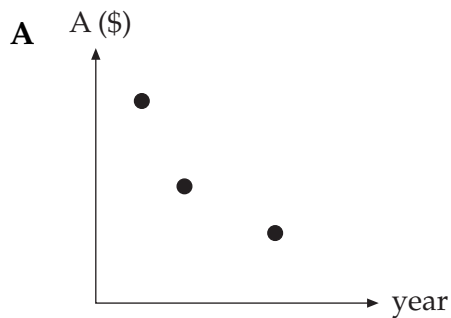
Question 6

Theo used the annuities formula $A = PR^n - \dfrac{Q(R^n - 1)}{R - 1}$ to assist him in determining the length of time it would take him to pay back a loan. The value of R was correctly calculated by Theo to be 1.02. The terms of Theo's loan could be

    A   2% per annum interest, compounding quarterly with quarterly repayments.

    B   2% per annum interest, compounding quarterly with annual repayments.

    C   24% per annum interest, compounding quarterly with monthly repayments.

    D   8% per annum interest, compounding annually with annual repayments.

    E   8% per annum interest, compounding quarterly with quarterly repayments.

The following information relates to Questions 7 and 8

Morag purchases a used car for $3000 under a hire purchase agreement. She pays a deposit of $500 and agrees to pay the balance in equal monthly payments over 1 year. Interest is to be charged at a flat rate of 11% per annum.

Question 7

The effective annual rate of interest paid by Morag will be closest to

    A   0.09%

    B   1.1%

    C   11%

    D   20.31%

    E   22%

Question 8

The effective interest rate paid by Morag could best be described as

    A   the interest paid as a percentage of the original principal owing.

    B   the interest paid as a percentage of the final principal owing.

    C   the interest paid as a percentage of the average principal owing.

    D   being equivalent to the flat interest rate.

   **E**   being twice the flat interest rate.

Question 9

Fofi takes out a loan of $120 000 at 6% per annum interest, compounding quarterly. She will repay the loan quarterly over 20 years. Exactly halfway through the term of the loan, the amount still owed by Fofi will be closest to

      A $43 000

      B $60 000

      C $64 000

      D $73 000

      E $77 000

Module 5 : Networks and decision mathematics

Question 1

The **sum** of the degrees on the vertices of the graph below is
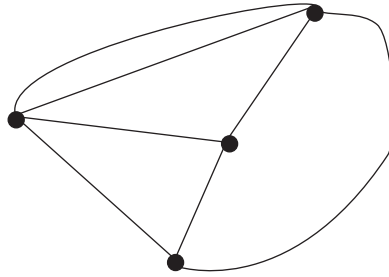
    A   4

    B   12

    C   13

    D   14

    E   15

Question 2

Consider the following four networks.
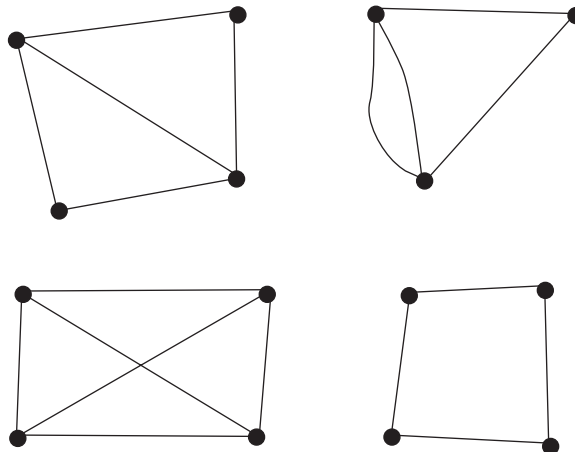
The number of these networks that contain an Euler circuit is

    A   0

    B   1

    C   2

    D   3

    E   4

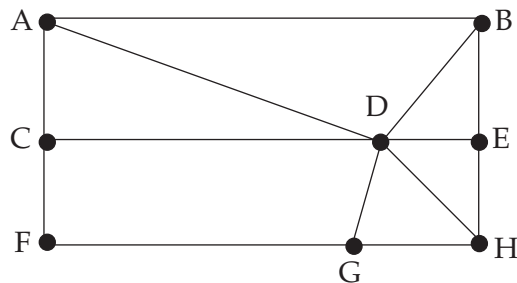## Question 3

A connected planar graph has 14 edges and 10 vertices. The number of **finite** regions that this network has is

    A   4

    B   5

    C   6

    D   24

    E   26

Question 4

Mike sets out on a run which can be represented by the following network. Beginning at D he runs to each vertex exactly once, eventually finishing at C.

Mike's journey could be described as

    A   an Euler path.

    B   an Euler circuit.

    C   a Hamiltonian path.

    D   a Hamiltonian circuit.

    E   none of the above.

Question 5

Katrina's netball team is part of a league of 6 teams. In a season each team plays every other team once. To determine how many matches in total would be played throughout the season, Katrina drew a graph that illustrated each team playing each other. The type of graph that Katrina drew is described as

    A   bipartite.

    B   planar.

    C   connected.

    D   complete.

    E   simple.

Question 6

A particular design project has six activities, these being A, B, C, D, E and F. The latest starting time for activity D is day 4. If it is known that activity D lies on the critical path for this project, then the earliest starting time for this activity is

A Day 1

B Day 2

C Day 4

D Day 5

E Not able to be determined

Question 7

At Yallambie College, students in the Further Maths class undertake the Core and Modules 1, 2 and 3. Four of the students have rated their strength in each area on a score from 1 to 10 and this is recorded in the following table (10 is the highest strength score).

	Core	Module 1	Module 2	Module 3
Freddie	5	9	7	3
Joan	7	4	6	5
Matt	6	5	4	4
Anna	8	3	5	8

One of the weaker students in the class, Emidio, has decided to seek assistance from these four students in order to improve his prospects. If each one of the four helps with one section of the work, which arrangement would be most beneficial to Emidio?

A Core – Matt   Module 1 – Freddie   Module 2 – Joan   Module 3 – Anna

B Core – Joan   Module 1 – Freddie   Module 2 – Matt   Module 3 – Anna

C Core – Anna   Module 1 – Freddie   Module 2 – Joan   Module 3 – Matt

D Core – Anna   Module 1 – Freddie   Module 2 – Matt   Module 3 – Joan

E Core – Joan   Module 1 – Matt   Module 2 – Freddie   Module 3 – Anna

Question 8

The capacity of the cut on the digraph shown is equal to 15.
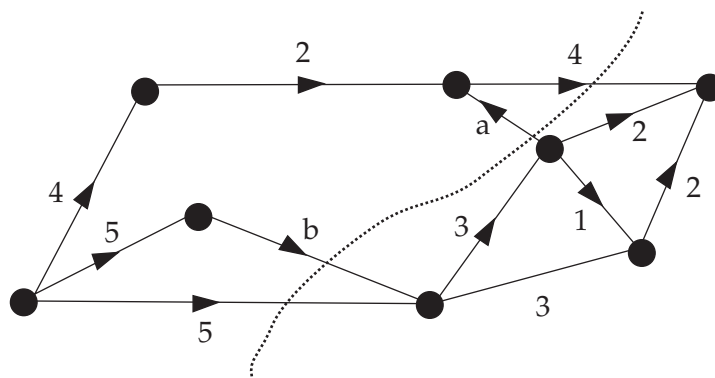
Which one of the following is a true statement?

A $a + b = 6$

B $a - b = 6$

C $b - a = 6$

D $a = 6$

E $b = 6$

Question 9

Five friends have decided to form a band where each one will fill a different position. The following bipartite graph shows which individuals are capable of filling the various positions.

Adam

Billy

Craig

Dinh

Ethan

Lead guitar

Bass guitar

Keyboards

Drums

Vocals
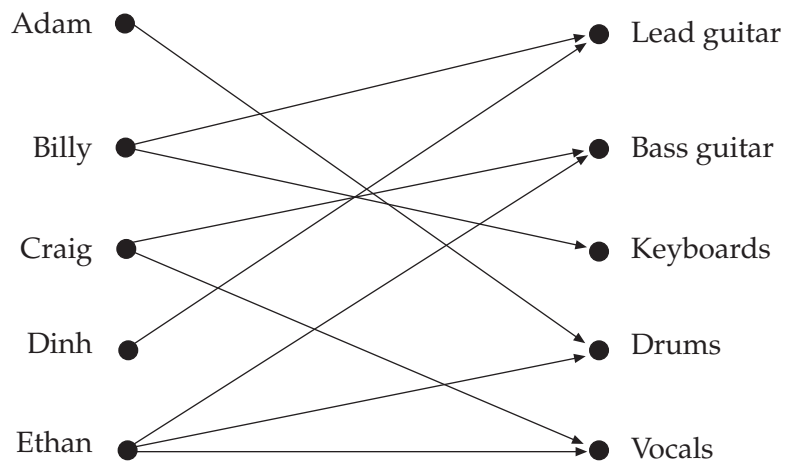
If all 5 positions are filled by different individuals, which one of the following statements is true?

A   Billy must take the lead guitar position.

B   Craig must take the bass guitar position.

C   Craig and Ethan are the only two who have choice of positions.

D   Billy and Ethan are the only two who have a choice of positions.

E   Ethan may choose from three different positions.