Insight Publications

INSIGHT

Trial Exam Paper

2007

FURTHER MATHEMATICS

Written examination 1

MULTIPLE-CHOICE QUESTION BOOK

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

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 the following items into the examination: pens, pencils, highlighters, erasers, sharpeners, rulers, one bound reference that may be annotated (can be typed, handwritten or a textbook), one approved graphics calculator (memory DOES NOT have to be cleared) and, if desired, one scientific calculator.
- Students are NOT permitted to bring blank sheets of paper or white out liquid/tape into the examination.

Materials provided
- The question and answer book of 33 pages, with an answer sheet for the multiple-choice questions.
- A separate sheet with miscellaneous formulas.
- Working space is provided throughout the question book.

Instructions
- Write your **name** in the box provided on the multiple-choice answer sheet.
- Remove the formula sheet during reading time.
- Unless otherwise indicated, 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 or any other electronic devices into the examination.

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Working space

SECTION A

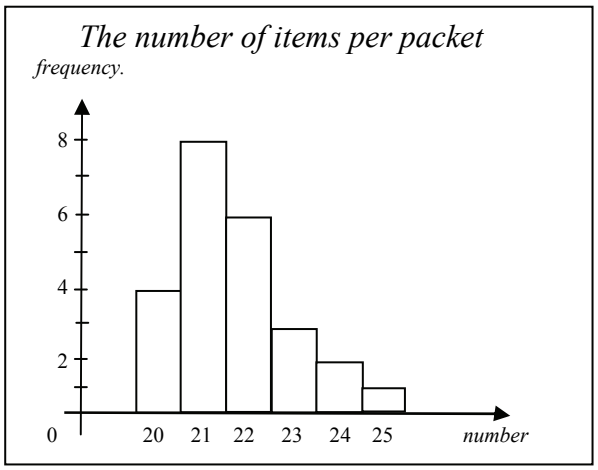
Instructions for Section A

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.
Choose the response that is **correct** for the question.
One mark will be awarded for a correct answer; no marks will be awarded for an incorrect answer.
Marks **are not** deducted for incorrect answers.
No marks will be awarded if more than one answer is completed for any question.

Core – Data Analysis

Question 1

At a school carnival, lucky-dips were sold in packets containing a number of items per packet. The distribution is shown in the frequency table below.



The percentage of packets that contained more than 23 items is

A. 3%
B. 6.25%
C. 24%
D. 12.5%
E. 25%

Question 2

Data collected from a test is displayed in a stemplot as shown below.

STEM	LEAF
0	5 6 8 8
1	0 3 3 5
1	5 6 8 8 9 9
2	1 4 4
2	5

The inter-quartile range for this data is

A. 2
B. 5
C. 9
D. 15.5
E. 20

Question 3

Data was collected from a fishing competition on the size of fish caught that day. It was noticed that the data had a bell shaped distribution with a mean of 22.5cm and standard deviation of 2.5cm.

Approximately what percentage of fish were less than 25cm?

A. 16%
B. 95%
C. 50%
D. 68%
E. 84%

Question 4

A student wrote the following numbers to calculate the mean and median.

10, 12, 14, 14, 18, 19, 19

After her calculations, she was informed that her last number 19 was incorrect and in fact was a number **less than** 10.

Compared to her original answers, which of the following is **true**?

A. The actual result had a lower mean and median.
B. The actual result had a lower mean but the same median.
C. The actual result had a lower mean but a higher median.
D. The actual result had the same mean but a lower median.
E. The results remained unchanged.

Question 5

Jon's exam grades for three subjects are shown below. The class average and standard deviation are also shown for each subject.

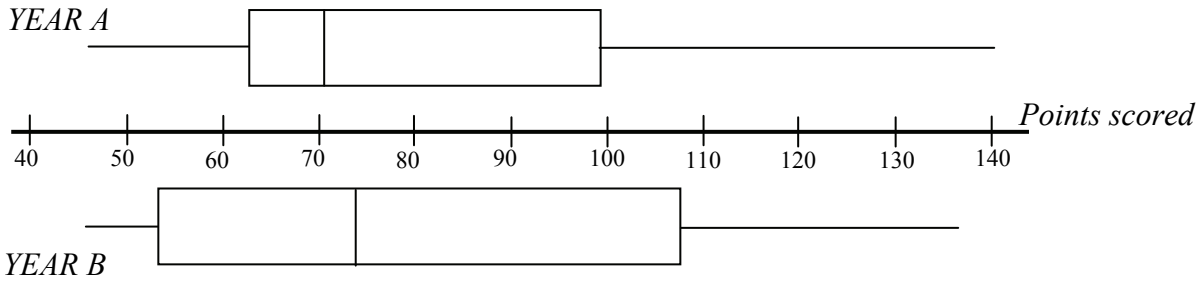
Subject	*Jon's Mark*	*Class Mean*	*Class Standard deviation*
History	65	70	10
Science	75	75	10
Art	85	90	5

Jon's best performance in relation to the class results was

A. History
B. Science
C. Art
D. Art and History were equal
E. Art and Science were equal

Questions 6 and 7 refer to the following information

A junior football team compares the number of points it has scored over the last two years (*A* and *B*) by using the box plots as displayed below.



Question 6

From this box-plot summary, which of the following observations is true?

A. Year A scores were generally higher than Year B
B. 50% of Year A scores were less than 70 points compared to only 25% for Year B
C. If the box-plots were standardised, Year A would have an outlier
D. Both box-plots have a positive skew
E. 25% of Year A scores are more than Year B

Question 7

The variables:

Year (A or B) and **Points scored** are

A. both categorical variables.
B. both numerical variables.
C. categorical and numerical variables respectively.
D. numerical and categorical variables respectively.
E. neither categorical and numerical variables

Question 8

A survey of seven trees noting the age and height of an exotic species gave the following results:

Age (years)	1	4	7	11	12	14	20
Height (metres)	1.8	3.4	5.0	6.2	7.0	6.8	7.4

Further analysis using a least squares regression association would have the **independent variable** and **correlation coefficient** for this data as

A. *Age*, 0.933
B. *Age*, 0.871
C. *Height*, 0.933
D. *Height*, 0.871
E. *Age*, 0.305

Questions 9 and 10 refer to the following information

The population of Victoria from 1990 to 2004 is shown in the table below.

Years from 1990	0	1	3	4	5	7	10	11	13	14
Population in millions	4.40	4.44	4.48	4.50	4.54	4.62	4.77	4.83	4.94	4.99

Table 1

Question 9

Using least squares regression analysis it was found that a linear model to fit this data in **table 1** was

$$\text{Population in millions} = 4.36 + 0.043 \times \text{Years from 1990}$$

Using this model, the **residual** for the population in millions for the year 2000 was

A. 4.79
B. 85.59
C. 0.02
D. –0.02
E. Impossible to calculate because of missing data

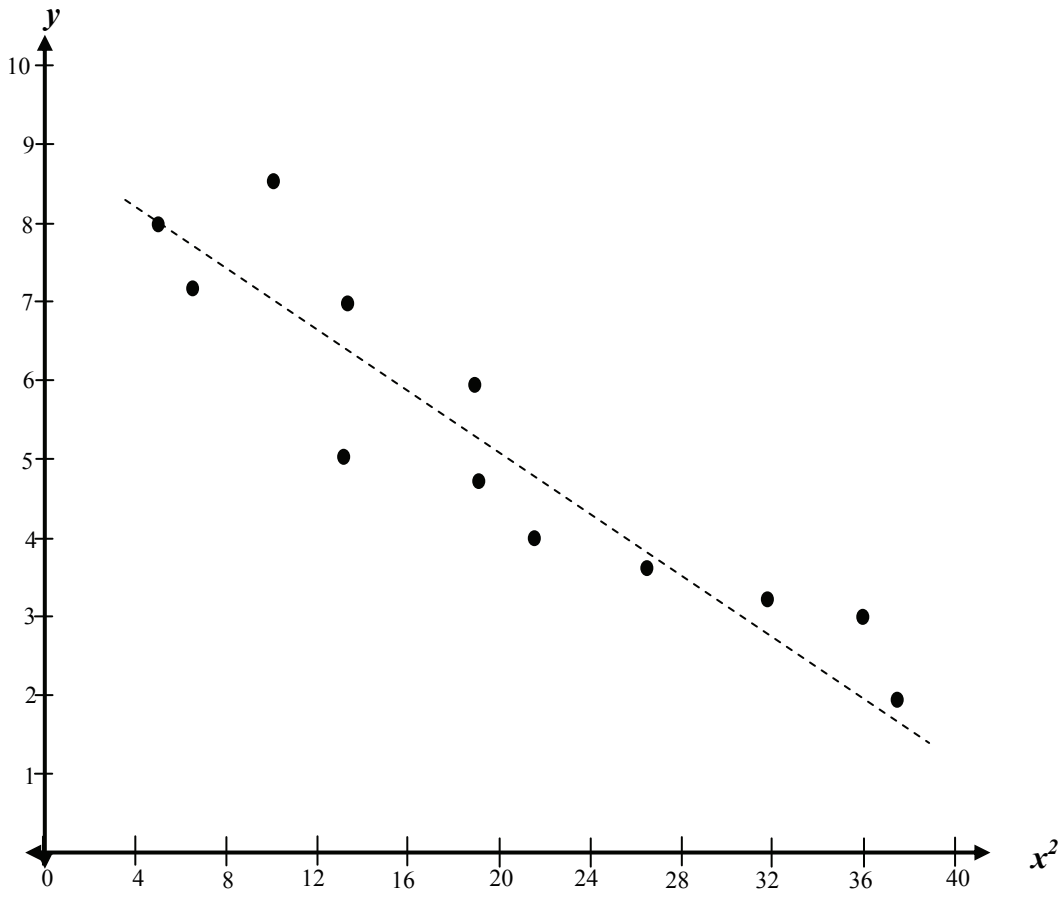
Question 10

When interpreting this linear regression model, which of the following is **true**?

A. The population is increasing at 0.043 million people per year
B. The gradient of 0.043 shows there is are no correlation to predict population
C. The initial population in 1990 is predicted as 0.043 million people
D. The population is decreasing as time increases
E. The population remains steady

Question 11

Data collected has been transformed giving the following resulting graph.



The line of best fit (as indicated by the dash line in the figure) is closest to

A. $y = 8.8 + 0.2x$
B. $y = 8.8 - 0.2x$
C. $y = 0.2 + 8.8x^2$
D. $y = 8.8 - 0.2x^2$
E. $y = 0.2 + 8.8x$

Questions 12 and 13 refer to the following information

The table below shows the seasonal indices of swimwear sales for a particular firm.

Quarter	Summer	Autumn	Winter	Spring
Seasonal Index	1.10	0.95	0.82	

Question 12

The seasonal index for Spring is missing. Once calculated this value shows that sales for spring are

A. typically 3% above average
B. typically 3% below average
C. typically 113% above average
D. typically 13% below average
E. typically 13% above average

Question 13

The deseasonalised figure for swimwear sales in Winter is 88. The **actual** sales for Winter is closest to

A. 107
B. 72
C. 82
D. 99
E. 0

END OF SECTION A
TURN OVER

SECTION B

Instructions for Section B

Select **three** modules and answer **all** questions within the modules selected on the answer sheet provided.
Indicate 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.
One mark will be awarded for a correct answer; no marks will be awarded for an incorrect answer.
Marks **are not** deducted for incorrect answers.
No marks will be awarded if more than one answer is completed for any question.

Module 1: Number Patterns

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

Question 1

Which of the following sequences is **not** a geometric sequence?

A. 2, 6, 18, 54, 162 …
B. 2, –6, 18, –54, 162 …
C. 100, 50, 25, 12.5, 6.25 …
D. 1, 3, 6, 12, 36 …
E. 0.1, 1, 10, 100, 1000 …

Question 2

The first four terms of an arithmetic are { –2, 1, 4, 7 … }.

The 25^{th} term for this sequence is

A. 76
B. 73
C. 70
D. 850
E. 45

The following information relates to questions 3 and 4

A large cattle station has a herd of 160 000 cattle at the start of the first year. The cattle population increases by 2% each year. At the end of each year, 4 000 cattle are sold.

Applying this process, at the start of the second year there are now 159 200 cattle.

Question 3

Continuing this process, the number of cattle at the **start** of the third year is

A. 158 384
B. 158 400
C. 155 200
D. 161 552
E. 162 384

Question 4

If A_n is the number of cattle at the start of each year, n, a difference equation that can be used to model the population of the herd over time is

A. $A_{n+1} = 160\,000 - 0.98A_n$ where $A_1 = 4\,000$
B. $A_{n+1} = 160\,000 - 1.02A_n$ where $A_1 = 160\,000$
C. $A_{n+1} = 0.98A_n - 4\,000$ where $A_1 = 159\,200$
D. $A_{n+1} = 1.02A_n - 4\,000$ where $A_1 = 160\,000$
E. $A_{n+1} = 160\,000 - 0.98A_n$ where $A_1 = 160\,000$

Question 5

A stationary car is leaking oil. When first observed the area of the oil patch is 80cm^2. In the first minute it increases by $\frac{1}{10}$ of its area. In the second and subsequent minutes it increases by $\frac{1}{10}$ of its **growth** in the previous minute.

The largest possible size the oil slick will grow to is closest to

A. 100cm^2
B. 90cm^2
C. 89cm^2
D. 88cm^2
E. No answer; it will keep on increasing to a very large area

Question 6

For an **arithmetic** sequence, the first term, t_1 is 4 and the sum of twenty terms, S_{20} is 650

For this to be true, the common difference, d and the twentieth term, t_{20} are respectively

A. 3 and 61
B. 4 and 61
C. 3 and 32.5
D. 4 and 64
E. 3 and 64

Question 7

The values of the first four terms are shown in the table below.

Term number	Value of term
1	2
2	5
3	14
4	41

The first order difference equation that best describes this sequence is

A. $t_{n+1} = t_n + 3$
B. $t_{n+1} = (t_n)^2 + 1$
C. $t_{n+1} = 2t_n + 1$
D. $t_{n+1} = t_n + (t_n)^2 - 1$
E. $t_{n+1} = 3t_n - 1$

Question 8

A difference equation is defined by

$$t_{n+1} = -2t_n \quad \text{where} \quad t_1 = -1.$$

The nth term, t_n, is given by

A. $1 - 2n$
B. $-(-2)^{n-1}$
C. $(-2)^{n-1}$
D. $(-2)^n$
E. $-1 - 2n$

Question 9

A difference equation is defined by

$$t_n = 2t_{n-1} + t_{n-2} \quad \text{where} \quad t_1 = -1 \quad \text{and} \quad t_2 = 1.$$

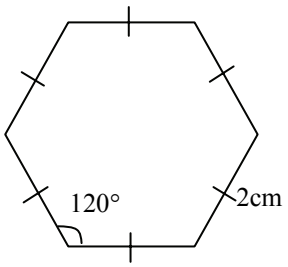
The sixth term of this sequence is

A. –7
B. 9
C. 14
D. 17
E. 41

Module 2: Geometry and trigonometry

Before you answer these questions you must **shade** the Geometry and trigonometry box on the answer sheet for multiple-choice questions.

Question 1

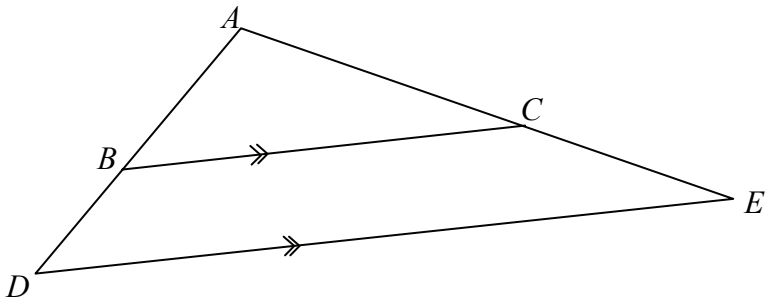


The regular hexagon above of sides 2cm has a total area of approximately

A. 1.73cm^2
B. 3.66cm^2
C. 10.39cm^2
D. 6cm^2
E. 16cm^2

Question 2

The triangles *ABC* and *ADE* are similar figures where $\overline{BC}$ is parallel to $\overline{DE}$.



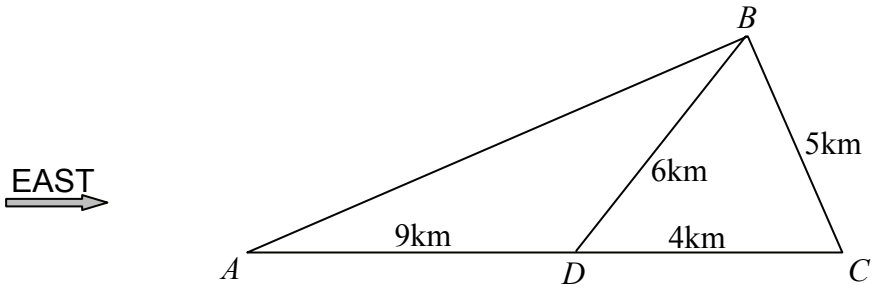
Given that the ratio of *AB*:*AD* is 3:5 and the area of triangle *ADE* is 600cm^2, then the area of triangle *ABC* is

A. 216cm^2
B. 360cm^2
C. 600cm^2
D. $1\,000\text{cm}^2$
E. $1\,667\text{cm}^2$

Questions 3 & 4 refer to the following diagram.

Four towns *A*, *B*, *C*, and *D* are connected by a network of straight roads as shown on the map below. Towns *C* and *D* are both due east of town *A*. The distances shown on the map are **horizontal distances**.

(not drawn to scale)



Question 3

The area of the land in triangle *CBD* in square kilometres is closest to

A. 15.0km^2
B. 12.0km^2
C. 11.0km^2
D. 10.0km^2
E. 9.9km^2

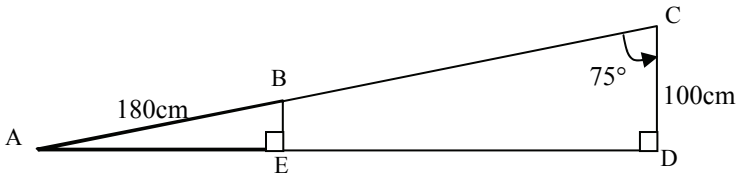
Question 4

The bearing of *B* **from** *D* is approximately

A. 070°T
B. 056°T
C. 048°T
D. 042°T
E. 034°T

Question 5

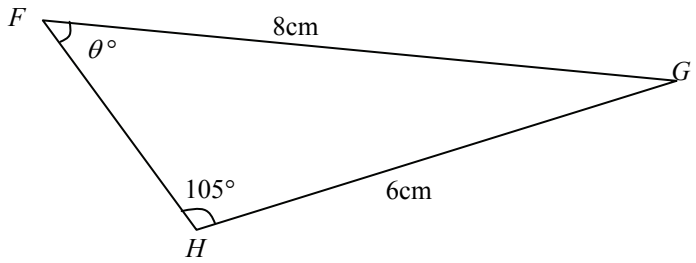
A roofing beam *AC* is supported by two vertical struts *BE* and *CD*.



The $\angle ACD$ is 75° and the lengths of *AB* and *CD* are 180cm and 100cm respectively. The length of *BC* to two decimal places is

A. 26.79cm
B. 103.53cm
C. 180.02cm
D. 206.37cm
E. 386.37cm

Question 6



Using the sine rule, an appropriate form to find θ is

A. $\sin\theta = \dfrac{\sin(105)}{6} \times 8$

B. $\sin\theta = \dfrac{\sin(105)}{8} \times 6$

C. $\sin\theta = \dfrac{6}{\sin(105)} \times 8$

D. $\sin\theta = \dfrac{8}{\sin(105)} \times 6$

E. $\sin^{-1}\theta = \dfrac{\sin(105)}{6} \times 8$

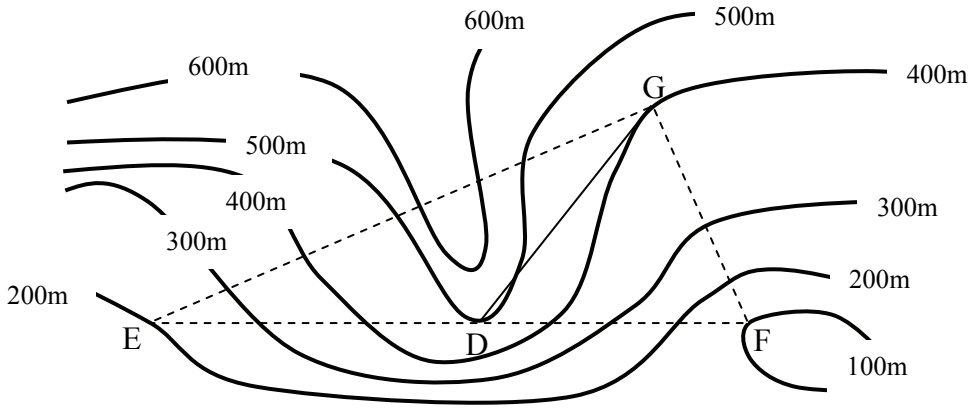
Question 7

The diameter of Rover's bowl is 20cm. The shape of the dog's bowl is **cylindrical** and it can hold 2200cm^3. The height of the bowl must be at least

A. 5cm
B. 6cm
C. 7cm
D. 8cm
E. 1.8cm

Questions 8 & 9 refer to the following diagram.

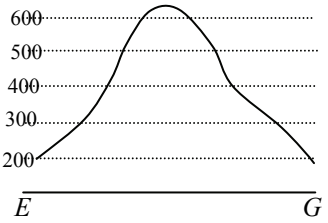
Below is a contour map of roads between four sites *D*, *E*, *F* and *G*.



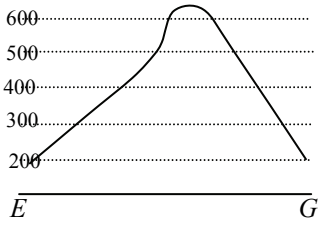
Question 8

The cross-section profile that best describes the contours along the road *EG* is

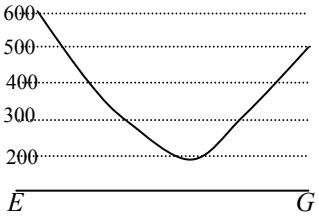
A.



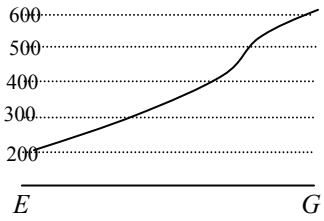
B.



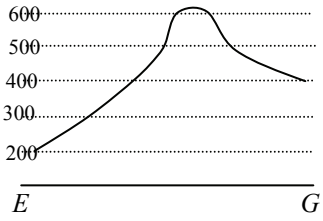
C.



D.



E.



Question 9

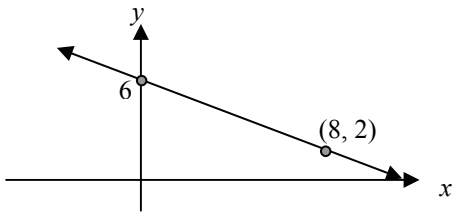
Given that the horizontal distance between *F* and *G* is 2km, the average gradient **from *G* to *F*** is approximately

A. 6.67
B. 0.15
C. 0.20
D. –0.15
E. –6.67

Module 3: Graphs and relations

Before you answer these questions you must **shade** the Graphs and relations box on the answer sheet for multiple-choice questions.

Question 1



The equation of the line above is

A. $y + 2x = 6$

B. $y - 2x = 12$

C. $2y + x = 12$

D. $2y - x = 6$

E. $y - x = 6$

Question 2

For the equation

$ay - bx = c$, where a, b and c are constants;

the gradient and y-intercept are respectively

A. $-b$ and c

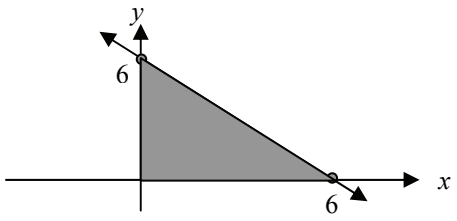
B. b and c/a

C. $-b$ and c/a

D. b/a and c

E. b/a and c/a

Question 3



The feasible region is **shaded** above for an unknown set of constraints.

Which of the following does **not** support this result?

A. $x \geq 0$

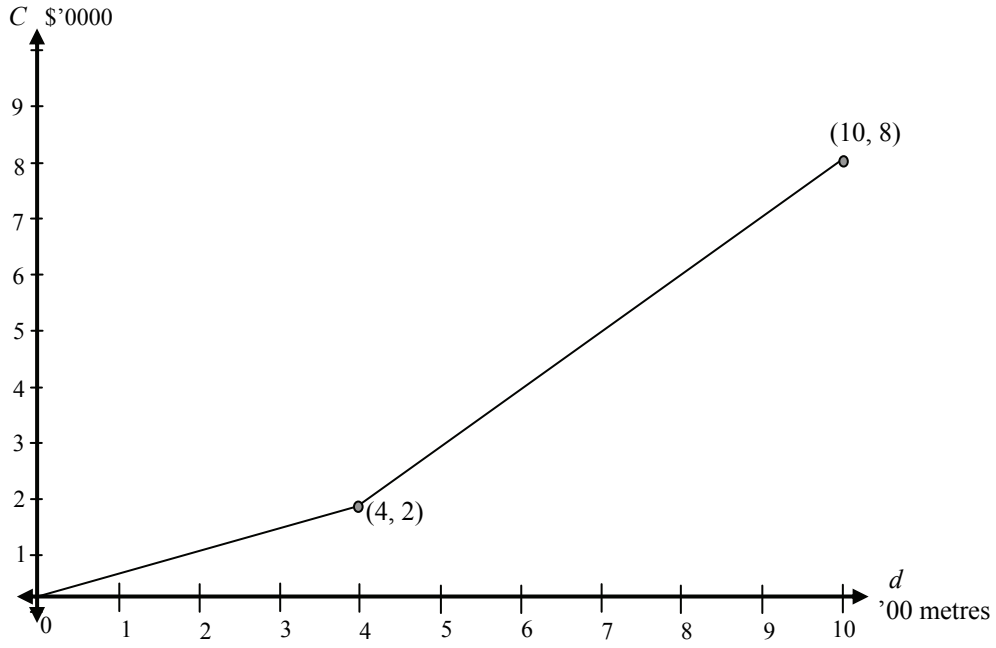
B. $y \geq 0$

C. the point (6, 6) satisfies all constraints

D. $x + y \leq 6$

E. the maximum value of $2x + y$ is at the point (6, 0)

The following graph relates to Questions 4 and 5



The cost, C, in \$'0 000, of laying a pipeline depends on the type of terrain being excavated.

The graph above shows how the cost changes with the distance, d, (in '00 metres). The graph also indicates that at a distance of 400 metres (i.e. $d = 4$), the cost suddenly changes due to the change in terrain being excavated for the pipe-line.

Question 4

Which of the following statements is true?

A. The laying of the pipeline is much quicker after 400 metres.

B. In the first 400 metres, the cost of pipe-line is \$50 per metre.

C. After the first 400 metres, the cost of pipe-line is \$1 per metre.

D. The total cost for 1 kilometre of pipe-line was \$8 000.

E. The change after 400 metres was due to easier excavation.

Question 5

Which of the following rules best describes the graph above?

A. $C = \begin{cases} 0.5d & \text{for } 0 \le d \le 4 \\ d - 2 & \text{for } 4 < d \le 10 \end{cases}$

B. $C = \begin{cases} 0.5d & \text{for } 0 \le d \le 2 \\ d + 2 & \text{for } 2 < d \le 8 \end{cases}$

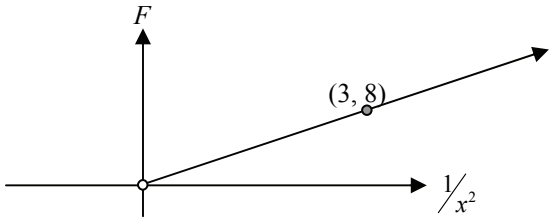
C. $C = \begin{cases} 2d & \text{for } 0 \le d \le 4 \\ d + 2 & \text{for } 4 < d \le 10 \end{cases}$

D. $C = \begin{cases} 0.5d & \text{for } 0 \le d \le 4 \\ 2d - 2 & \text{for } 4 < d \le 10 \end{cases}$

E. $C = \begin{cases} 2d & \text{for } 0 \le d \le 4 \\ d - 2 & \text{for } 4 < d \le 10 \end{cases}$

Question 6

The force of attraction, F, between two bodies decreases the further the distance, x, the bodies are apart. When graphing the force, F, against $1/x^2$, a linear model is obtained as follows.



The rule connecting F and x is

A. $F = 8/3x^2$

B. $F = 3/8x^2$

C. $F = 64/9x^2$

D. $F = 8/3x$

E. $F = 3/8x$

Question 7

The simultaneous equations $2y - 3x = 6$ and $y = x + 2$ have a unique solution of

A. (1, 3)

B. (3, 0)

C. (3, 1)

D. (–2, 0)

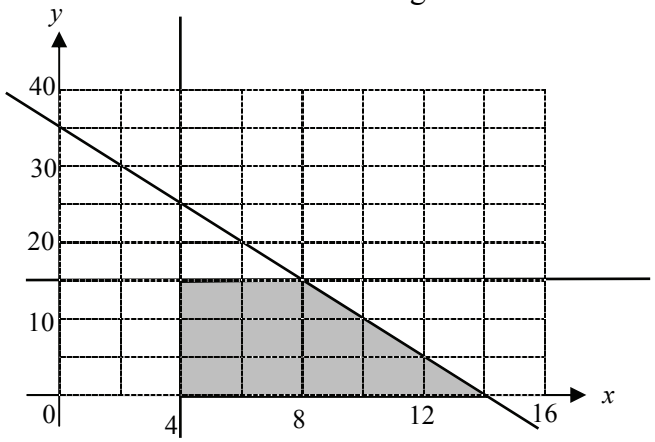
E. (0, –2)

The following graph relates to Questions 8 and 9

In a linear programming problem involving the number of items a firm can produce in one day subject to a variety of constraints.

- x represents number of item F that can be produced in one day.
- y represents number of item G that can be produced in one day.

The shaded area below shows the feasible region.



Question 8

The Profit, z, in dollars, for this firm for one day is given by the equation

$$z = 0.5x + 2y$$

Using the feasible region above the maximum profit is

A. \$7.00
B. \$23.50
C. \$28.00
D. \$34.00
E. \$77.00

Question 9

One of the constraints defining the feasible region indicates that

A. A maximum of 14 items of product F can be made.
B. A minimum of 15 items of product G can be made.
C. The total number of items F and G that can be made is 49.
D. The point (12, 8) satisfies all constraints.
E. There must be at least 4 products of item F produced.

Module 4: Business-related mathematics

Before you answer these questions you must **shade** the Business-related mathematics box on the answer sheet for multiple-choice questions.

Question 1

The selling price of a DVD is $45 after it was discounted by 20%.

The original marked price was

A. $56.25
B. $54.00
C. $225.00
D. $36.00
E. $60.00

Question 2

In April, Molly received the following statement from her bank showing all the transactions from her savings for the month of March.

Date	Transaction	Debit	Credit	Balance
1 Mar	Balance forward			2 945.18
6 Mar	Withdrawal	234.00		2 711.18
17 Mar	Deposit		400.00	3 111.18
28 Mar	Deposit		255.00	3 366.18

Interest is calculated on the minimum monthly balance. If the rate is 2.4% p.a., the amount of interest Molly will receive for March will be

A. $0.54
B. $65.07
C. $6.73
D. $5.16
E. $5.42

Question 3

Nic wants to buy car at $22 000. On a hire purchase plan, he can purchase the car with a 10% deposit plus repayments of $320 per month for six years.

The total amount of **interest** paid for this car on the hire-purchase plan is

A. $3 040
B. $3 240
C. $5 040
D. $5 240
E. $23 240

Question 4

Nic invests $3 500 in an account that is advertised at 6.2%p.a. with interest compounded quarterly.

The total amount he will have in 4 years is

A. $3 729.43
B. $4 368.00
C. $4 452.11
D. $4 476.59
E. $9 163.48

Question 5

Marion has bought a photocopier for $84 000. For tax purposes she uses reducing balance depreciation. The table below shows the book value of the photocopier after one year.

	Reducing balance Depreciation
Initial	$84 000
At the end of 1 year	$76 440

The book value of the photocopier after the second year is approximately

A. $63 300
B. $68 880
C. $69 560
D. $70 220
E. $71 560

Question 6

A company purchases a delivery van for $29 000. It depreciates at a rate of 25 cents for every kilometre. The van has a scrap value of $5 000.

The Book Value after travelling 20 000 km is

A. $0
B. $5 000
C. $19 000
D. $21 000
E. $24 000

Question 7

Stamp Duty is payable to the state government on a property transaction according to the following rate schedule.

Transfer of Real Property rates	
Range	**Rate**
\$0 - \$20 000	1.4 per cent of the dutiable value of the property
\$20 001 - \$115 000	\$280 plus 2.4 per cent of the dutiable value in excess of \$20 000
\$115 001 - \$870 000	\$2 560 plus 6 per cent of the dutiable value in excess of \$115 000
More than \$870 000	5.5 per cent of the dutiable value

The stamp duty payable on a property worth \$320 000 using the schedule above is

A. \$2 560
B. \$12 300
C. \$14 860
D. \$19 200
E. \$33 000

Question 8

Joan borrows \$120 000 and makes monthly repayments of \$1 400.

She uses the annuities formula to calculate how much she owes after X years at a rate of Y% per annum, calculated monthly on the reducing balance.

$$A = 120000(1.0075)^{240} - \frac{1400(1.0075^{240} - 1)}{0.0075}$$

Observing her formula the number of years, X and the rate, Y are

A. 10 years, 7.5%
B. 20 years, 7.5%
C. 20 years, 6.25%
D. 10 years, 9%
E. 20 years, 9%

Question 9

Jordan originally had a home loan of $128 000. The interest rate is 7.2%p.a. compounded monthly and her monthly repayments were $845.

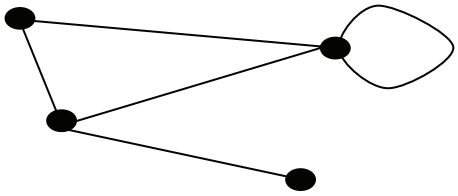
After 5 years she decided to increase her repayments. If the new repayments are $1 000, the **total** still owing after seven years from the original loan (i.e. two years of the new repayment) is

A. $75 300
B. $102 757
C. $115 634
D. $119 622
E. $158 863

Module 5: Networks and decision mathematics

Before you answer these questions you must **shade** the Networks and decisions mathematics box on the answer sheet for multiple-choice questions.

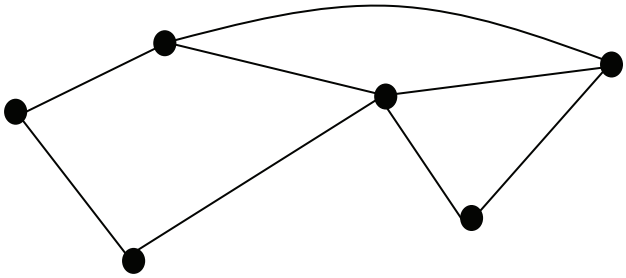
Question 1



For the network above, the sum of degrees is:

A. 5
B. 12
C. 10
D. 8
E. 9

Question 2



Which of the following statements is **false** regarding the network above?

A. Euler's formula for planar graphs applies to the network
B. The sum of degrees is double the number of edges
C. It contains an Euler circuit and Hamiltonian path
D. Many circuits exist
E. It contains an Euler path and Hamiltonian circuit

Question 3

Three students A, B and C are sharing out tasks W, X and Y.

The number of hours to complete each task is shown.

	A	B	C
W	8	9	7
X	13	15	12
Y	15	18	17

If each student must do one task only, how should tasks be allocated to achieve minimum completion time?

A. W → A, X → B, Y → C

B. W → C, X → B, Y → A

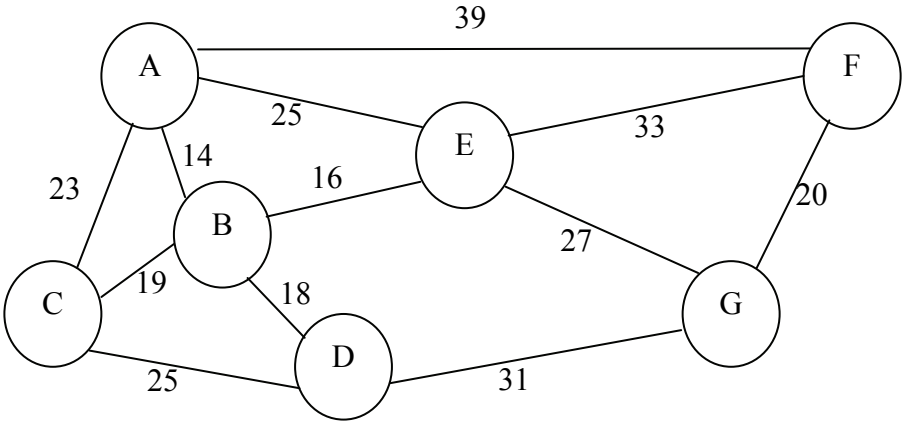
C. W → B, X → A, Y → C

D. W → B, X → C, Y → A

E. W → A, X → C, Y → B

Questions 4 and 5 refer to the following network.

For a shire, the graph below shows the major towns A, B …G connected by the main roads, all distances are in kilometres.



Question 4

The minimum spanning tree for this network is

A. 119 km

B. 114 km

C. 127 km

D. 105 km

E. 96 km

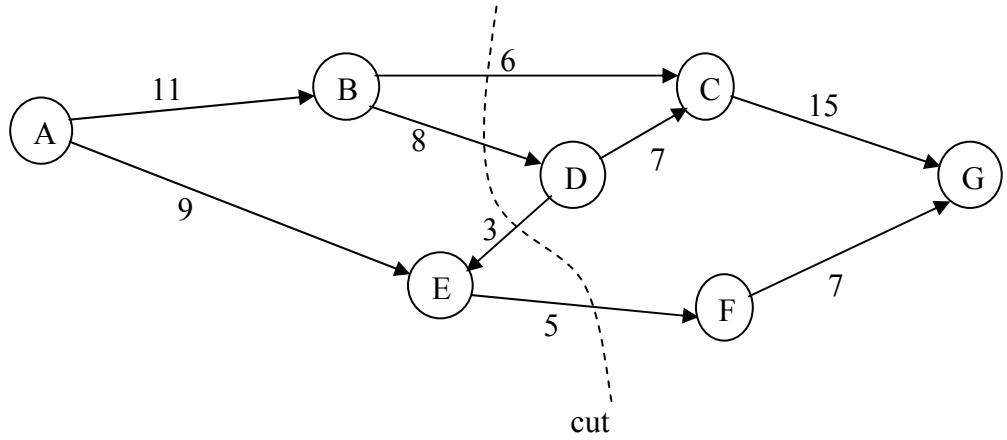
Question 5

A salesperson from town A needs to make deliveries to all towns and return home. If this is done without visiting any other town twice, it would be an example of a

A. Hamiltonian Circuit
B. Complete Graph
C. Euler Circuit
D. Tree
E. Reachability matrix

Question 6

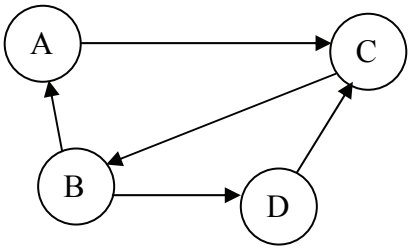
The following directed graph shows the potential water flow of ’000 litres per hour in an irrigation system.



The capacity of the cut in the above network, in ‘000 litres per hour, is:

A. 19
B. 22
C. 25
D. 17
E. 18

Question 7



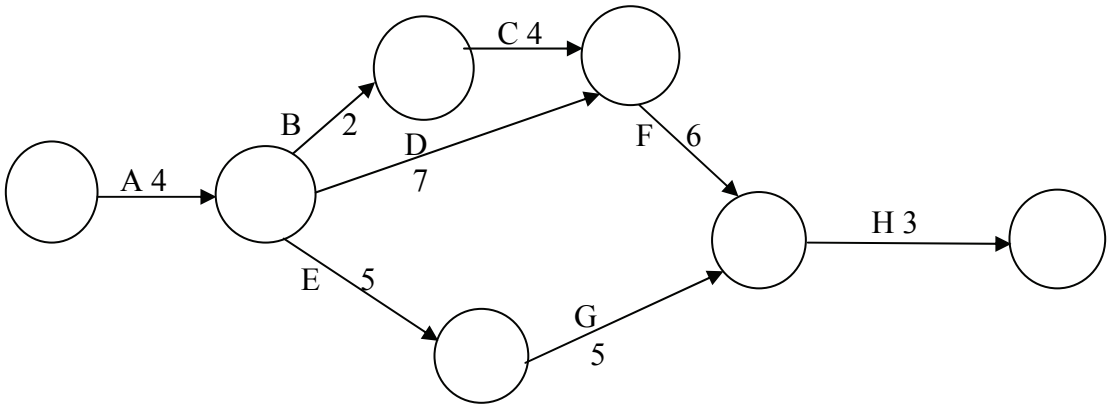
A 2-step reachability matrix for this network is:

A. $\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 2 & 1 \\ 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$ **B.** $\begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \end{bmatrix}$ **C.** $\begin{bmatrix} 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$

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

Questions 8 and 9 refer to the following critical path.

For a particular project there are eight activities to be completed and the time taken to complete each activity is shown in hours.



Question 8

The critical path and completion time for this project is

A. AEGH, 17 hours
B. AEFH, 18 hours
C. ADFH, 20 hours
D. ABCDFH, 20 hours
E. ADCFH, 26 hours

Question 9

Assume that any activity can be **reduced to one** hour by providing extra equipment or labour.

If the project is to be crashed by reducing the completion time of ONE activity only, then this will reduce the completion time of the project by a maximum of

A. 1 hour
B. 2 hours
C. 3 hours
D. 4 hours
E. 5 hours

Module 6: Matrices

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

Question 1

Let $A = \begin{bmatrix} 3 \\ -1 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 2 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 0 \\ 2 & -1 \end{bmatrix}$

Which of the following operations **can** be performed?

A. $C - B + A$
B. $C - A + B$
C. $AB + C$
D. $BA + C$
E. CBA

Question 2

Let $M = \begin{bmatrix} 2 & 1 \\ 2 & -1 \end{bmatrix}$ and $N = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Then M^2N^4 equals

A. $\begin{bmatrix} 8 & 1 \\ 4 & 5 \end{bmatrix}$ **B.** $\begin{bmatrix} 6 & 1 \\ 2 & 3 \end{bmatrix}$

C. $\begin{bmatrix} 6 & 1 \\ 2 & -1 \end{bmatrix}$ **D.** $\begin{bmatrix} 5 & 1 \\ 4 & 2 \end{bmatrix}$

E. Impossible, no solutions

Question 3

Let $R = \begin{bmatrix} 1 & 0 \\ 0 & 3 \end{bmatrix}$ and $T = \begin{bmatrix} 1 & 4 \\ 3 & -3 \end{bmatrix}$

The matrix X such that $RX = T$ will be:

A. $\begin{bmatrix} 1 & 13 \\ 3 & -1 \end{bmatrix}$ **B.** $\begin{bmatrix} 1 & 4 \\ 1 & -1 \end{bmatrix}$ **C.** $\begin{bmatrix} 1 & 12 \\ 3 & -9 \end{bmatrix}$

D. $\begin{bmatrix} 0 & 4 \\ 3 & -6 \end{bmatrix}$ **E.** $\begin{bmatrix} 1 & 4 \\ 9 & -9 \end{bmatrix}$

Question 4

Two rival companies, KFB (K) and Jocks (J) sell French fries in three sizes: small (*S*), medium (*M*) and large (*L*).

The price of each size of fries, in cents, is listed in a price matrix P, where

$$P = \begin{matrix} \\ K \\ J \end{matrix} \begin{matrix} \begin{matrix} S & M & L \end{matrix} \\ \begin{bmatrix} 120 & 180 & 220 \\ 130 & 170 & 210 \end{bmatrix} \end{matrix}$$

Due to competition, KFB reduces the price of all sizes by 10% and Jocks reduces their prices by 8%.

The new price matrix showing the decreased prices can be generated by performing which matrix product?

A. $\begin{bmatrix} 120 & 180 & 220 \\ 130 & 170 & 210 \end{bmatrix} \begin{bmatrix} 0.1 & 0 \\ 0 & 0.08 \end{bmatrix}$

B. $\begin{bmatrix} 120 & 180 & 220 \\ 130 & 170 & 210 \end{bmatrix} \begin{bmatrix} 0.9 & 0 \\ 0 & 0.92 \end{bmatrix}$

C. $\begin{bmatrix} 0.1 & 0 \\ 0 & 0.08 \end{bmatrix} \begin{bmatrix} 120 & 180 & 220 \\ 130 & 170 & 210 \end{bmatrix}$

D. $\begin{bmatrix} 0.9 & 0 \\ 0 & 0.92 \end{bmatrix} \begin{bmatrix} 120 & 180 & 220 \\ 130 & 170 & 210 \end{bmatrix}$

E. $\begin{bmatrix} 0.9 & 0.1 \\ 0.08 & 0.92 \end{bmatrix} \begin{bmatrix} 120 & 180 & 220 \\ 130 & 170 & 210 \end{bmatrix}$

Question 5

How many of the following four sets of simultaneous linear equations have a **unique** solution?

$2x - y = 3$ $x + y = 1$	$4x = 12$ $2x - y = 4$	$x - 2y = 0$ $-2x + 4y = 10$	$3x - y = 5$ $3x - y = 10$

A. 0
B. 1
C. 2
D. 3
E. 4

Question 6

The order of matrix A is (3×1) and the order of the matrix product AX is (3×4), then the order of matrix X must be

A. (1×4)
B. (3×4)
C. (4×1)
D. (4×3)
E. (3×1)

Question 7

The following system of the linear equations

$$x - 3z = 4$$
$$x + 2y - z = 3$$
$$3y + 2z = 0$$

when written in matrix form is

A. $\begin{bmatrix} 1 & -3 & 0 \\ 1 & 2 & -1 \\ 3 & 2 & 0 \end{bmatrix} \begin{bmatrix} x & y & z \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \\ 0 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 0 & -3 \\ 1 & 2 & -1 \\ 0 & 3 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \\ 0 \end{bmatrix}$

C. $\begin{bmatrix} 1 & -3 & 0 \\ 1 & 2 & -1 \\ 0 & 3 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \\ 0 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 0 & -3 \\ 1 & 2 & -1 \\ 3 & 2 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \\ 0 \end{bmatrix}$

E. $\begin{bmatrix} 1 & -3 & 0 \\ 1 & 2 & -1 \\ 0 & 3 & 2 \end{bmatrix} + \begin{bmatrix} x & y & z \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \\ 0 \end{bmatrix}$

Question 8

The solution of the matrix equation

$$\begin{bmatrix} 1 & -2 \\ 4 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 6 \\ 14 \end{bmatrix}$$

is

A. $\begin{bmatrix} 4 \\ -1 \end{bmatrix}$ **B.** $\begin{bmatrix} 2 \\ 10 \end{bmatrix}$ **C.** $\begin{bmatrix} -4 \\ 1 \end{bmatrix}$

D. $\begin{bmatrix} 3 \\ 1 \end{bmatrix}$ **E.** $\begin{bmatrix} 1 \\ -2 \end{bmatrix}$

Question 9

Two locations *A* and *B* are regular popular holiday spots for a large number of people. It is noticed that the 90% of the people that go to location *A* return again the following year and the rest go to location *B*.

Location *B* retains 85% of people each year and the other 15% go to location *A*.

Assuming this pattern of movement is maintained and given that 100 people originally go to location A and 200 go to location *B*, the number that will holiday at each location in the **long term** is

A. 300 holiday at location *A*; 0 at location *B*

B. 200 holiday at location *A*; 100 at location *B*

C. 120 holiday at location *A*; 180 at location *B*

D. 175 holiday at location *A*; 125 at location *B*

E. 180 holiday at location *A*; 120 at location *B*

END OF MULTIPLE-CHOICE QUESTION BOOK