

**‘2016 Examination Package’ -
Trial Examination 5 of 5**

STUDENT NUMBER

Figures

Words

Letter

--

FURTHER MATHEMATICS

Written examination 1

(TSSM’s 2015 trial exam updated for the current study design)

Reading time: 15 minutes

Writing time: 1 hour and 30 minutes

MULTIPLE-CHOICE QUESTION BOOK

Structure of book

Section	Number of questions	Number of questions to be answered	Number of modules	Number of modules to be answered	Number of marks
A	22	22			22
B	36	18	4	2	18
					Total 40

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, one bound reference, one approved graphic calculator or approved CAS calculator or CAS software and if desired, one scientific calculator
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.

Materials supplied

- Question book of 34 pages.

Instructions

- Print your **name** in the space provided on the top of this page.
- All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic communication devices into the examination room.

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SECTION A

Instructions for Section A

Answer **all** questions.

Choose the response that is correct for the question.

A correct answer scores 1, an incorrect answer scores 0.

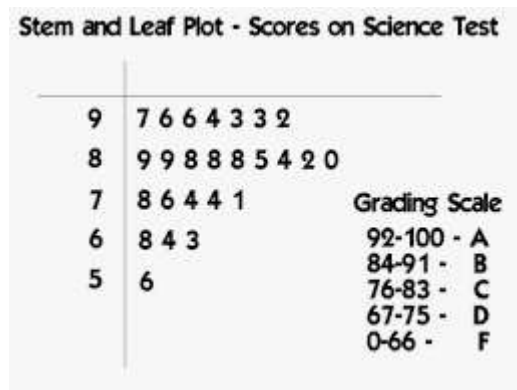
Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Core: Data analysis

The following information relates to Questions 1, 2 and 3

The following stem and leaf plot shows the percentage of marks obtained by 25 students in a Science test and the Grading scale. For example, if a student scored 89% mark he/she would be awarded Grade B.



Question 1

The percentage of students who scored Grade C on this particular test is:

- A. 16
- B. 4
- C. 15
- D. 85
- E. 76

**CORE - continued
TURN OVER**

FURMATH EXAM 1

Question 2

The median percentage of scores in this particular test is:

- A. 84.0
- B. 84.5
- C. 85.0
- D. 88.0
- E. 88.5

Question 3

Which of the following best describes the distribution of marks in this test?

- A. Approximately symmetric
- B. Bimodal
- C. Positively skewed
- D. Negatively skewed
- E. Bell-shaped distribution

Question 4

The reaction time to a certain psychological experiment is considered to be normally distributed with a mean of 20 seconds and a standard deviation of 4 seconds.

If the experiment is conducted on 410 people, the number of people with a reaction time between 12 seconds and 24 seconds is closest to:

- A. 82
- B. 334
- C. 399
- D. 279
- E. 280

CORE - continued

FURMATH EXAM 1

The following information relates to Questions 5 and 6

A taxi driver records the amount that he collects per hour in his first 21 trips.

17.27, 11.31, 15.72, 18.92, 9.55, 12.98, 19.12, 18.26, 22.79, 16.69, 11.68, 15.84, 12.81, 24.03, 15.03, 12.95, 12.25, 20.09, 18.64, 18.94, 13.92

Question 5

The mean amount per hour of his 21 trips is closest to:

- A. 15.03
- B. 16.13
- C. 15.84
- D. 17.51
- E. 15.67

Question 6

The amounts that the taxi driver received in his first 21 trips had a range of:

- A. 6.05
- B. 18.93
- C. 15.84
- D. 7.48
- E. 14.48

Question 7

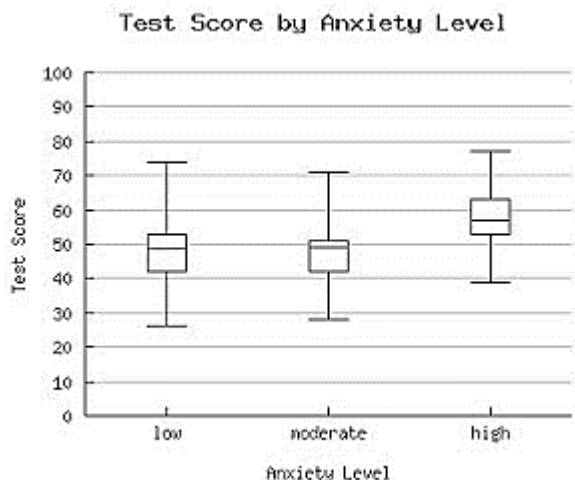
The annual salaries of employees in a large company are approximately normally distributed with a mean of \$50000 and a standard deviation of \$20000. If John's standardised salary is -0.6, his annual salary is:

- A. \$60000
- B. \$18000
- C. \$78000
- D. \$62000
- E. \$38000

**CORE - continued
TURN OVER**

Question 8

The following parallel box-plots show the tests scores in three levels of anxiety- low, medium and high.



Which of the following statements is not true?

- A. The range of the low anxiety level group is higher than the range of the moderate anxiety group.
- B. The median of the high anxiety level group is higher than the median of the other two groups.
- C. The highest test score is from the high anxiety level group.
- D. The lowest 25% of test scores is the largest in the low anxiety level group.
- E. The top 25% of test scores is the least in the moderate anxiety level group.

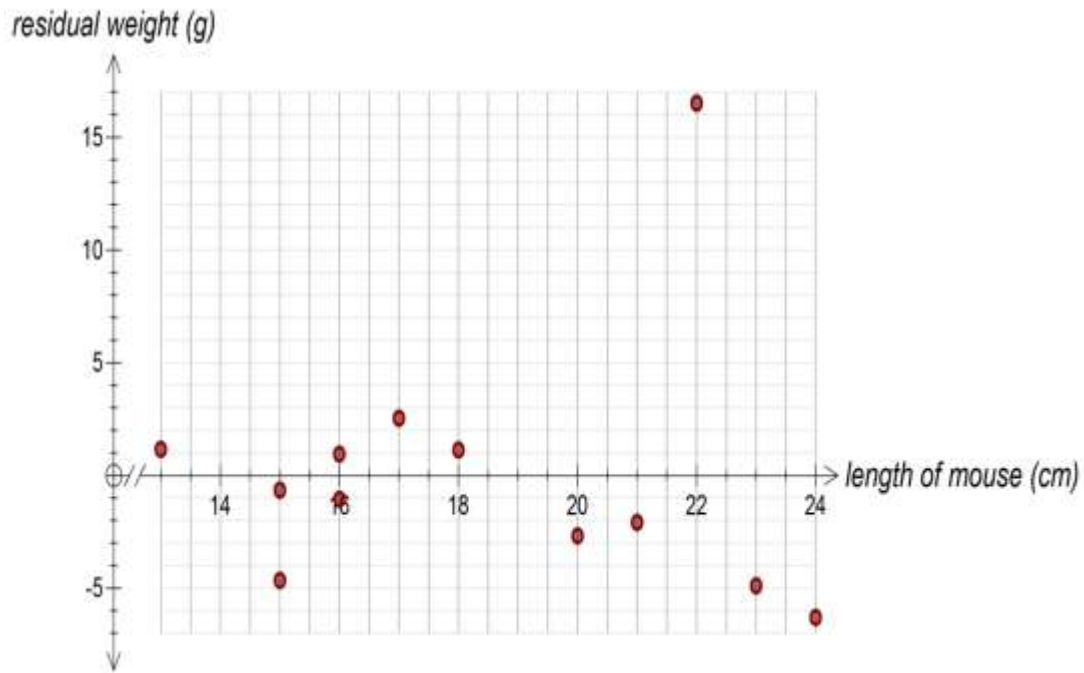
Question 9

The equation of a least-squares regression line is used to predict the amount of bacteria from the amount of Nitrogen present. It is predicted that there is 5.98g bacteria in 7g of Nitrogen and 3.6g of bacteria in 5g of Nitrogen. The slope of this least squares regression line is closes to:

- A. 1.09
- B. 1.19
- C. 0.84
- D. - 0.84
- E. -1.19

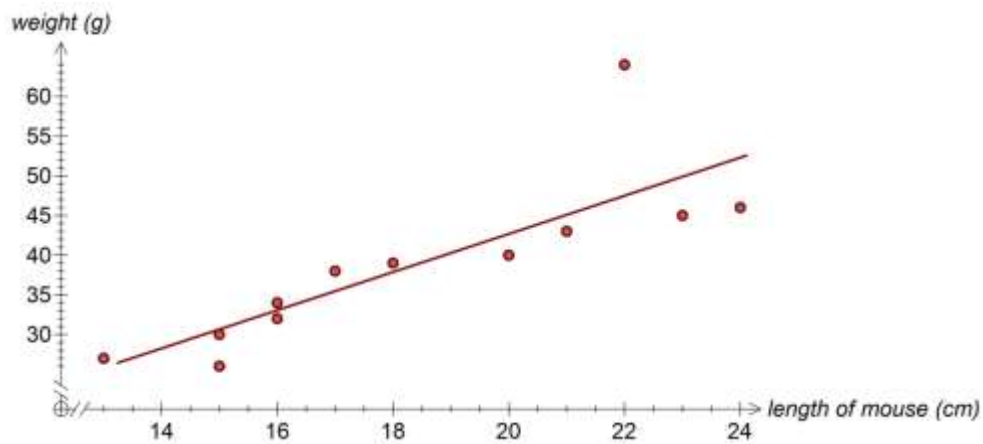
Question 10

The following residual plot shows the relationship between length of mouse and weight.



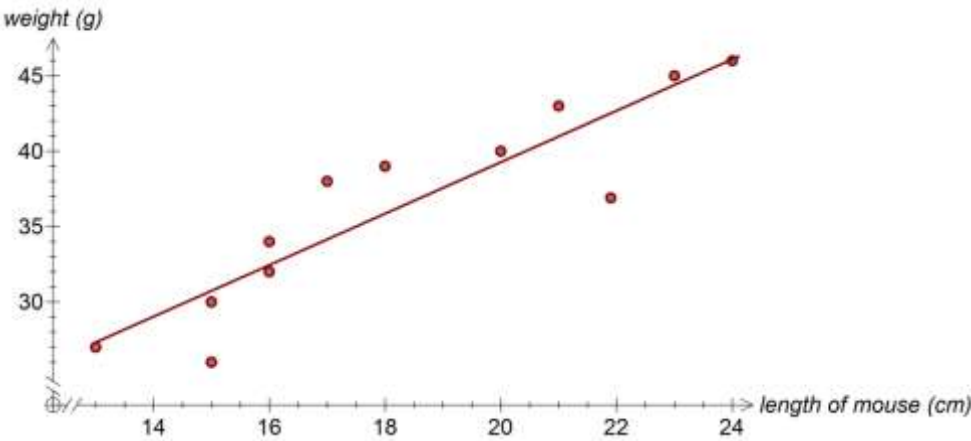
The scatterplot that describes the relationship between the length of mouse and their weight is:

A.

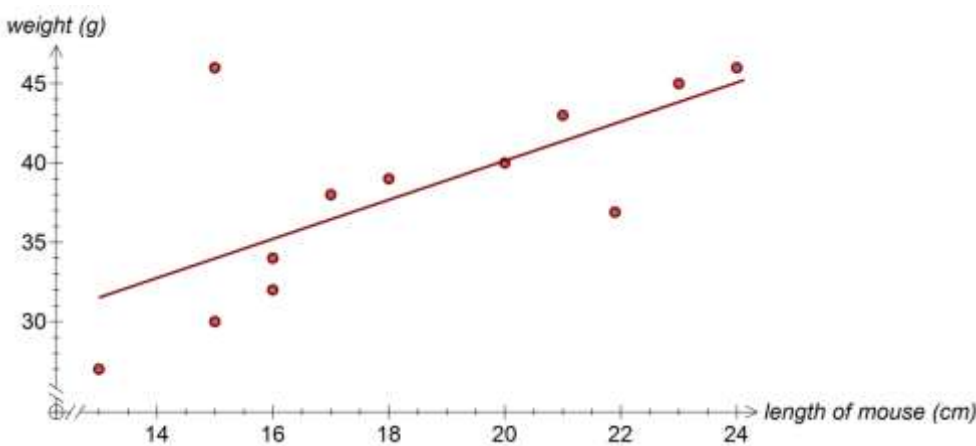


**CORE - continued
TURN OVER**

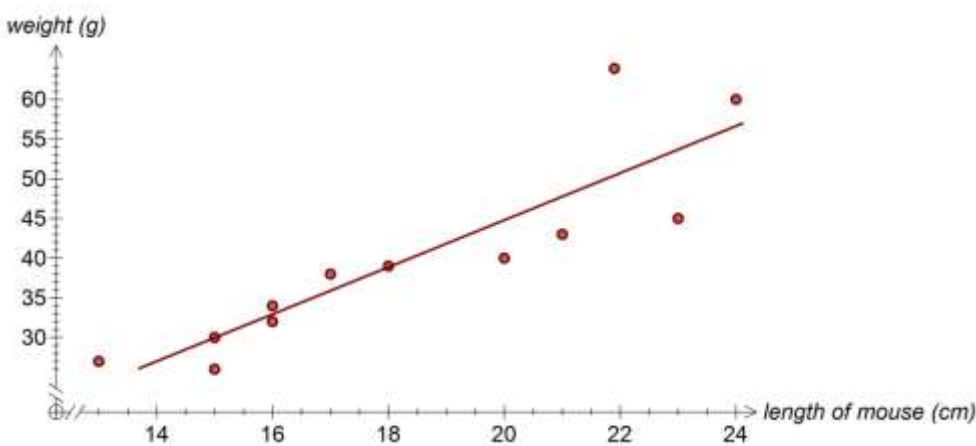
B.



C.

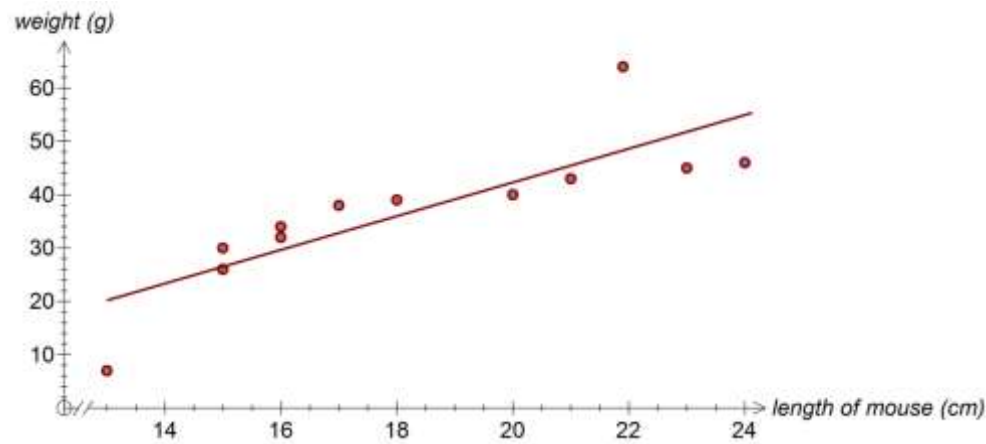


D.



FURMATH EXAM 1

E.



CORE - continued
TURN OVER

Question 11

The following data shows the relationship between height and arm span of 19 students.

<i>Arm Span (in cm)</i>	<i>Height (in cm)</i>
183	182
172	173
153	168
146	157
150	166
150	173
144	175
184	183
153	152
152	153
150	183
150	162
137	152
162	168
180	177
146	155
161	166
148	164
164	168

The least-squares regression line that predicts the height of the students from their arm span is:

- A. $Height(in\ cm) = 91.8204 - 0.4799 \times Arm\ span\ (in\ cm)$
- B. $Height(in\ cm) = 13.8686 + 0.8566 \times Arm\ span\ (in\ cm)$
- C. $Arm\ Span\ (in\ cm) = 91.8204 + 0.4799 \times Height\ (in\ cm).$
- D. $Arm\ Span(in\ cm) = 13.8686 + 0.8566 \times Height\ (in\ cm)$
- E. $Height(in\ cm) = 91.8204 + 0.4799 \times Arm\ span\ (in\ cm)$

Question 12

A company has computed a seasonal index for its monthly sales in a year. Which of the following statements about the index is not correct?

- A. The sum of the twelve seasonal index numbers should be 12.
- B. An index of 0.80 for July indicates that July sales are 20% lower than the average monthly sales.
- C. An index of 1.25 for January indicates that January sales are 25% above the average sales.
- D. The average index for all months in a year should equal 1.00.
- E. When an index equals 0.9, the deseasonalised sales will be lower than actual sales.

Question 13

The coefficient of determination measures:

- A. the cause and effect between two variables.
- B. the variation in the dependent variable "explained by" a variation in the independent variable.
- C. how much the independent variable causes of the dependent variable.
- D. the degree of causality.
- E. the degree of reliability of the relationship.

Core: Recursion and financial modelling

Question 14

Jeremy starts on a salary of \$32 000 in 2014 and gets a raise of 4% each year. His salary in 2019 will be closest to:

- A. \$38932.90
- B. \$40490.20
- C. \$37435.50
- D. \$172 104.00
- E. \$122 931.00

**CORE - continued
TURN OVER**

FURMATH EXAM 1

Question 15

An auditorium in a school has seats arranged in 10 rows. There are 36 seats in the last row and each subsequent row has 3 seats less than the previous row. A recurrence relation that can be used to find, t_n , the number of seats in the n^{th} row is:

- A. $t_n = t_{n-1} + 3, t_1 = 36$
- B. $t_n = 0.97t_{n-1}, t_1 = 36$
- C. $t_n = -3t_{n-1}, t_1 = 36$
- D. $t_n = t_{n-1} - 3, t_1 = 9$
- E. $t_n = t_{n-1} - 3, t_1 = 36$

Question 16

Kate decides to cycle 90 km in seven days. She increases her distance each day by two-fifths the following day. If she must cover the total distance of 90 km in seven days, the distance she travels on the first day is:

- A. 11.95 km
- B. 3.77 km
- C. 1.4 km
- D. 8.66 km
- E. 54.09 km

Question 17

The pattern 5, 2.5, 2.25, 2.225,..... follows the recurrence relation:

- A. $t_n = 0.1t_{n-1} + 2, t_1 = 5$
- B. $t_n = t_{n-1} + 2, t_1 = 0.25$
- C. $t_n = 0.2t_{n-1} + 1, t_1 = 5$
- D. $t_n = 0.1t_{n-1} - 2, t_1 = 5$
- E. $t_n = 0.1t_{n-1} - 0.25, t_1 = 5$

Question 18

Jim's nursery has 195 plants. He increases the number of plants by 20% each week and then sells 41 plants each week. The recurrence relation that describes this situation can be written as $t_0 = 195, t_n = 1.2t_{n-1} - 41$.

Which of the following statements is not true?

- A. Jim buys 39 more plants in the first week.
- B. Jim has 190 plants in his nursery at the end of the second week.
- C. Jim would have no plants in his nursery by the end of 17th week.
- D. Jim will have about 51 plants in his nursery by the end of 16th week.
- E. Jim sells 287 plants in the first 7 weeks.

CORE - continued

FURMATH EXAM 1

F.

Question 19

Leanne bought a plasma TV which was priced at \$3499. She paid \$1000 deposit and borrowed a loan for the balance which she paid off in 24 equal monthly instalments of \$135.36. The simple interest rate per annum, to the nearest percent, charged on her loan is:

- A. 11%
- B. 15%
- C. 20%
- D. 30%
- E. 46%

Question 20

The amount of time it will take for an investment to grow from \$250 000 to \$285 473 at the rate of 9.5% per annum compounded monthly is closest to:

- A. 50 months
- B. 1 year
- C. 1 year 5 months
- D. 6 years
- E. 9 years

Question 21

The monthly repayments on a loan of \$45 000 to be repaid in monthly instalments over 14 years at an interest rate of 12.5% pa. is:

- A. \$398.98
- B. \$736.61
- C. \$368.30
- D. \$568.43
- E. \$3683.04

**CORE - continued
TURN OVER**

FURMATH EXAM 1

Question 22

Riley invests \$8000 in a bank at 5.15% per annum with interest compounded quarterly. At the end of each quarter, he adds a sum of \$450 after interest is paid into his account. The amount in his account at the end of the third quarter, after he has added \$450, is:

- A. \$9230.45
- B. \$9680.45
- C. \$9663.00
- D. \$17113.10
- E. \$17680.50

END OF CORE

SECTION B

Instructions for Section B

Select **two** modules and answer **all** questions within the modules.

Choose the response that is **correct** or **best answers** the question and mark this response on the multiple-choice response sheet.

A correct answer scores 1, an incorrect answer scores 0.

No mark will be given if more than one answer is completed for any question.

Marks will not be deducted for incorrect answers.

Module	Page
Module 1: Matrices.....	16
Module 2: Networks and Decision Mathematics.....	22
Module 3: Geometry and measurement.....	27
Module 4: Graphs and relations.....	31

FURMATH EXAM 1

Module 1: Matrices

Question 1

$$\begin{bmatrix} 1 & 2 & 1 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix} \text{ equals:}$$

A. $\begin{bmatrix} 1 & 2 & 1 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 2 & 1 & 0 \\ 0 & 3 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

C. $\begin{bmatrix} 1 & 2 & 1 & 1 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 2 & 1 & 0 \\ 0 & 3 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$

E. $\begin{bmatrix} 1 & 2 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{bmatrix}$

MODULE 1 - continued

FURMATH EXAM 1

Question 2

If $A = \begin{bmatrix} 3 & -1 \\ x & 7 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 4 \\ -2 & -1 \end{bmatrix}$ and the product matrix $AB = \begin{bmatrix} 5 & 13 \\ -12 & 1 \end{bmatrix}$ then the value of x is:

- A. -2
- B. 2
- C. $\frac{1}{2}$
- D. 6
- E. -12

Question 3

$$y - 2z = 4$$

$$x = 3$$

$$y - x = 6$$

The system of three simultaneous linear equations above can be written in matrix form as:

A. $\begin{bmatrix} x \\ y \\ z \end{bmatrix} \begin{bmatrix} 0 & 1 & -2 \\ 1 & 0 & 0 \\ -1 & 1 & 0 \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \\ 6 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 1 & -2 \\ 1 & 1 & 1 \\ -1 & 1 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \\ 6 \end{bmatrix}$

C. $\begin{bmatrix} 1 & -2 & 0 \\ 1 & 0 & 0 \\ 1 & -1 & 0 \end{bmatrix} \begin{bmatrix} x \\ z \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \\ 6 \end{bmatrix}$

D. $\begin{bmatrix} 0 & 1 & -2 \\ 1 & 0 & 0 \\ -1 & 1 & 0 \end{bmatrix} \begin{bmatrix} x \\ z \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \\ 6 \end{bmatrix}$

E. $\begin{bmatrix} 0 & 1 & -2 \\ 1 & 0 & 0 \\ -1 & 1 & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 3 \\ 6 \end{bmatrix}$

MODULE 1 - continued

FURMATH EXAM 1

The following information relates to Questions 4 and 5

There are three grocery shops in a suburb and regular customers choose one of these three to buy their groceries. The following transition matrix shows the change in customers' choice from one week to another.

$$T = \begin{array}{c} \begin{array}{ccc} & \text{this week} & \\ & A & B & C \\ \begin{bmatrix} 0.70 & 0.30 & 0.05 \\ 0.10 & 0.50 & 0.35 \\ 0.20 & 0.20 & 0.60 \end{bmatrix} & \begin{array}{l} A \\ B \\ C \end{array} & \text{next week} \end{array} \end{array}$$

In a particular week, 300 customers shop from each of the three shops.

Question 4

In the long term, the number of customers who shop from shop C is closest to:

- A. 300
- B. 275
- C. 325
- D. 310
- E. 180

Question 5

The number of customers who are expected to buy their groceries from the three shops in the third week can be found by evaluating the matrix product:

A. $\begin{bmatrix} 0.70 & 0.30 & 0.05 \\ 0.10 & 0.50 & 0.35 \\ 0.20 & 0.20 & 0.60 \end{bmatrix}^3 \begin{bmatrix} 300 \\ 300 \\ 300 \end{bmatrix}$

D. $\begin{bmatrix} 0.70 & 0.30 & 0.05 \\ 0.10 & 0.50 & 0.35 \\ 0.20 & 0.20 & 0.60 \end{bmatrix} \begin{bmatrix} 300 \\ 300 \\ 300 \end{bmatrix}$

B. $\begin{bmatrix} 0.53 & 0.37 & 0.17 \\ 0.19 & 0.35 & 0.39 \\ 0.28 & 0.28 & 0.44 \end{bmatrix}^2 \begin{bmatrix} 300 \\ 300 \\ 300 \end{bmatrix}$

E. $\begin{bmatrix} 0.70 & 0.30 & 0.05 \\ 0.10 & 0.50 & 0.35 \\ 0.20 & 0.20 & 0.60 \end{bmatrix}^2$

C. $\begin{bmatrix} 0.53 & 0.37 & 0.17 \\ 0.19 & 0.35 & 0.39 \\ 0.28 & 0.28 & 0.44 \end{bmatrix}^2 \begin{bmatrix} 100 \\ 100 \\ 100 \end{bmatrix}$

MODULE 1 - continued

Question 6

Bianca is very fond of reading books on paper and online. The following table shows the number of books and types of books she read in June and July.

June			July		
	Paper	Online		Paper	Online
Fiction	2	4	Fiction	3	2
Non-Fiction	3	1	Non-Fiction	1	1
Magazines	4	5	Magazines	5	3

Which of the following matrix calculations will find the total number of Fiction, Non-fiction and Magazines she read in the two months?

A. $\begin{bmatrix} 2 & 4 \\ 3 & 1 \\ 4 & 5 \end{bmatrix} \begin{bmatrix} 3 & 2 \\ 1 & 1 \\ 5 & 3 \end{bmatrix}$

B. $\begin{bmatrix} 2 & 4 \\ 3 & 1 \\ 4 & 5 \end{bmatrix} - \begin{bmatrix} 3 & 2 \\ 1 & 1 \\ 5 & 3 \end{bmatrix}$

C. $\begin{bmatrix} 2 & 4 \\ 3 & 1 \\ 4 & 5 \end{bmatrix} \begin{bmatrix} 3 & 1 & 5 \\ 2 & 1 & 3 \end{bmatrix}$

D. $\begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix} + \begin{bmatrix} 4 \\ 1 \\ 5 \end{bmatrix} + \begin{bmatrix} 3 \\ 1 \\ 5 \end{bmatrix} + \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}$

E. $\begin{bmatrix} 2 & 3 & 4 \\ 4 & 1 & 5 \end{bmatrix} \begin{bmatrix} 3 & 2 \\ 1 & 1 \\ 5 & 3 \end{bmatrix}$

MODULE 1 - continued
TURN OVER

Question 7

The transition matrix and the third state matrix are defined as follows.

$$T = \begin{bmatrix} 0.75 & 0.35 \\ 0.25 & 0.65 \end{bmatrix}, \quad S_3 = \begin{bmatrix} 275 \\ 300 \end{bmatrix}$$

If $S_3 = T \times S_2$, the matrix S_2 is:

- A. $\begin{bmatrix} 311.25 \\ 263.75 \end{bmatrix}$
- B. $\begin{bmatrix} 184.375 \\ 390.625 \end{bmatrix}$
- C. $\begin{bmatrix} 325.75 \\ 249.25 \end{bmatrix}$
- D. $\begin{bmatrix} 275 \\ 300 \end{bmatrix}$
- E. $\begin{bmatrix} 246.875 \\ 328.125 \end{bmatrix}$

Question 8

If the matrix A has order 2×3 and matrix B is a non-singular matrix of order 2×2 , then which of the following statements is **not** true?

- A. $B^{-1}A$ is of order 2×3 .
- B. $(B^{-1} + A)$ is defined.
- C. AB^{-1} does not exist.
- D. A^{-1} does not exist.
- E. $B^{-1}B$ is an identity matrix of order 2 by 2.

Question 9

The matrix $A = \begin{bmatrix} 1 & x & 0 \\ 2 & 3 & 1 \\ -1 & 0 & 1 \end{bmatrix}$ is a singular matrix.

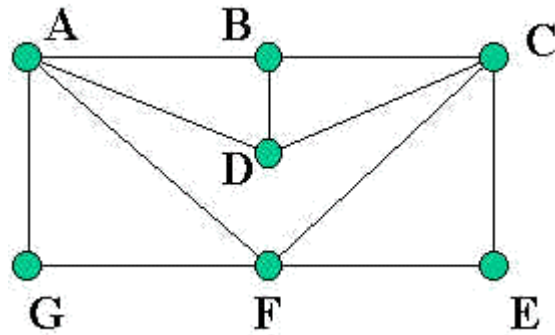
The value of x is:

- A.** 1
- B.** -3
- C.** 3
- D.** -1
- E.** $\frac{1}{3}$

**END OF MODULE 1
TURN OVER**

Module 2: Networks and decision mathematics

Question 1



Which of the following is **not** true for the above graph?

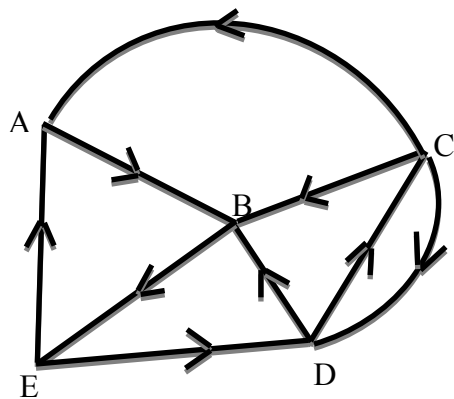
- A. There is an Euler trail for the graph above.
- B. The degree of vertex F is 4.
- C. The graph has 7 vertices.
- D. There is an Euler circuit in the graph above.
- E. There is a Hamiltonian circuit in the graph above.

Question 2

A simple graph has 5 vertices and 4 faces. The number of edges of this graph is:

- A. 0
- B. 1
- C. 7
- D. 8
- E. 11

Question 3



An adjacency matrix that could be used to represent the above graph is:

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

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

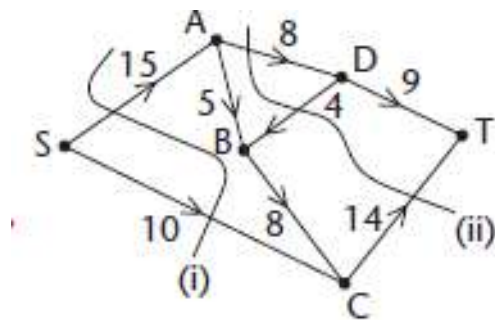
B.
$$\begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 1 \end{bmatrix}$$

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

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

MODULE 2 - continued
TURN OVER

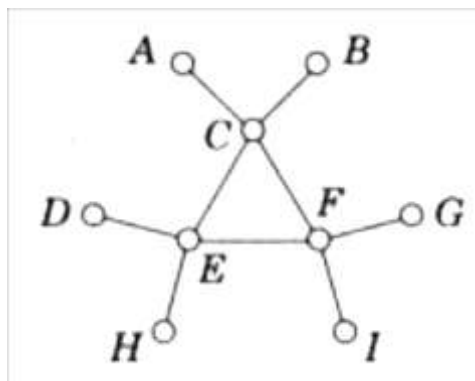
Question 4



The maximum flow from A to T in the above graph is:

- A. 13
- B. 18
- C. 22
- D. 25
- E. 28

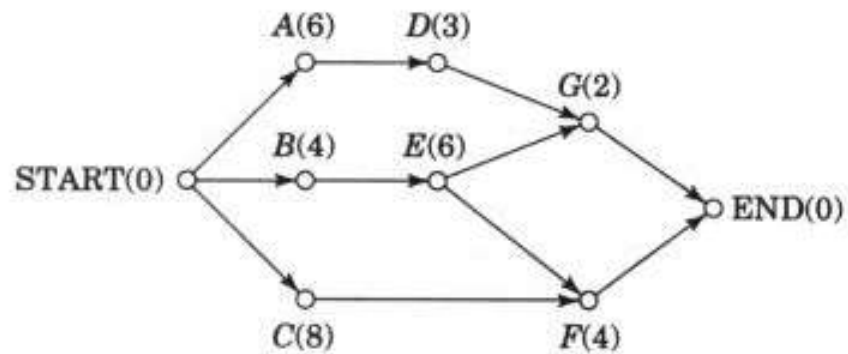
Question 5



The number of possible spanning trees for the above graph is/are:

- A. 1
- B. 2
- C. 3
- D. 4
- E. 5

The following graph relates to Questions 6 and 7



Question 6

The number of tasks in the above project is:

- A. 6
- B. 7
- C. 9
- D. 11
- E. 713

Question 7

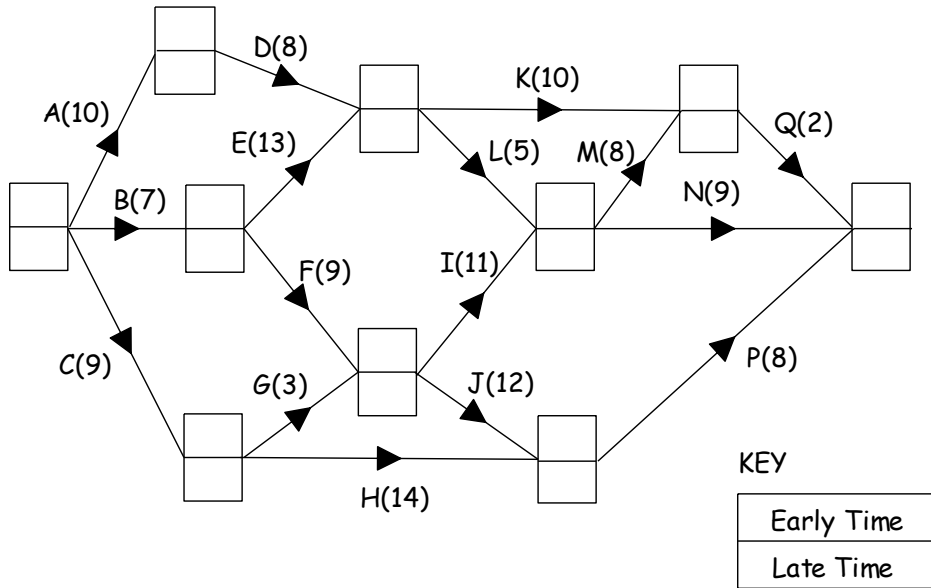
The length of the critical path of this project digraph is:

- A. 10
- B. 11
- C. 12
- D. 14
- E. 16

**MODULE 2 - continued
TURN OVER**

The following graph relates to Questions 8 and 9

The diagram below shows the activity network to model an automated welding process. The welding activities are represented by edges. The number in brackets on each edge represents the time, in minutes, to complete the activity.



Question 8

The float time on N is:

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

Question 9

The critical activities are:

- A. B, F, I, N Q.
- B. B, F, J, Q.
- C. B, F, I, J, Q.
- D. B, F, J, P.
- E. B, F, I, M, Q.

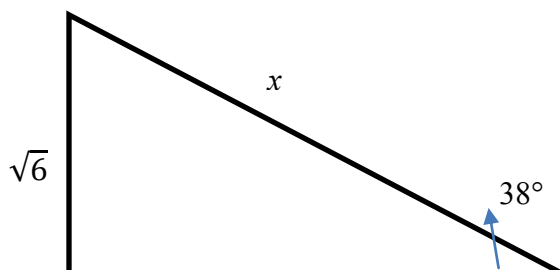
END OF MODULE 2

Module 3: Geometry and measurement

Question 1

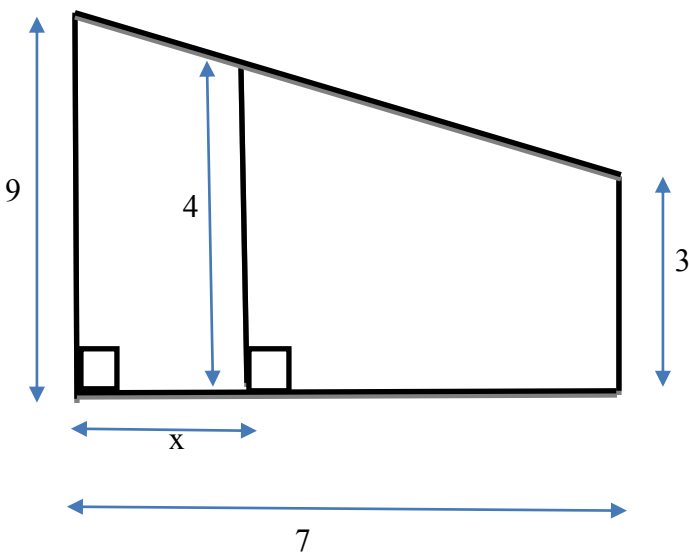
The value of x in the right angled triangle on the right can be calculated by using:

- A. $\frac{\sqrt{6}}{\cos(52^\circ)}$
- B. $\frac{\sqrt{6}}{\sin(52^\circ)}$
- C. $\sqrt{6} \cos(52^\circ)$
- D. $\sqrt{6} \sin(38^\circ)$
- E. $\sqrt{6} \tan(52^\circ)$



Question 2

The value of x in the following figure is:



- A. $\frac{35}{9}$
- B. $\frac{35}{6}$
- C. $\frac{7}{6}$
- D. $\frac{6}{7}$
- E. $\frac{14}{3}$

MODULE 3 - continued
TURN OVER

The following information relates to Questions 3 and 4

A boat left a point P and travelled for 65 km at a bearing of 325°T to a point R . Another boat left P and travelled a distance of 90 km at a bearing of 75°T to a point S .

Question 3

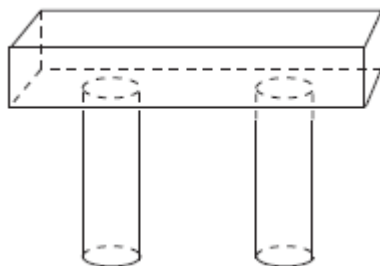
The measure of angle RPS is:

- A. 75°
- B. 105°
- C. 250°
- D. 110°
- E. 50°

Question 4

The distance between R and S can be calculated using:

- A. $\sqrt{65^2 + 90^2 + 2 \times 65 \times 90 \cos (110^\circ)}$
- B. $\sqrt{65^2 + 90^2 - 65 \times 90 \cos (110^\circ)}$
- C. $\sqrt{65^2 + 90^2 - 2 \times 65 \times 90 \cos (110^\circ)}$
- D. $\sin^{-1} \left(\frac{65}{90} \times \sin (110^\circ) \right)$
- E. $\sin^{-1} \left(\frac{90}{65} \times \sin (110^\circ) \right)$

Question 5

A concrete beam is to rest on two concrete pillars. The beam is a cuboid with sides of length 0.5 m, 3 m and 0.4 m. The pillars have diameter 0.4 m and height 2 m. The *total volume* of concrete needed to make the beam and the pillars is closest to:

- A. 1.1 m^3
- B. 0.85 m^3
- C. 2.6 m^3
- D. 1.6 m^3
- E. 0.78 m^3

Question 6

The coordinates of two points on the Earth's surface are given by the coordinates A(40°N , 120°W) and B(50°S , 120°W). The time taken for a ship to sail the shortest distance between these two points at an average speed of 45 knots is:

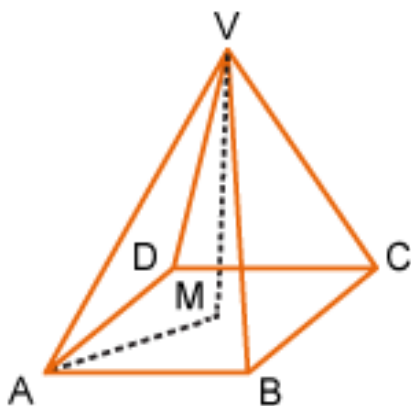
- A. 4 days
- B. 5 days
- C. 12 days
- D. 12 hours
- E. 5 hours

Question 7

The area of a triangle with side lengths 2 cm, 45 mm and 3.5 cm correct to two decimal places is:

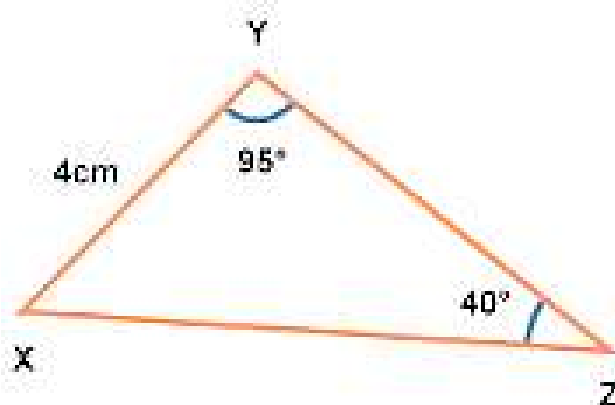
- A. 3.36 cm^2
- B. 3.35 mm^2
- C. 335.41 mm^2
- D. 33.5 mm^2
- E. 3.50 cm^2

MODULE 3 - continued
TURN OVER

Question 8

In the above square-based pyramid, VM is perpendicular to AC and AB = 6.5 cm. If the length of AV is 12.8 cm, the length VM is closest to:

- A. 12 cm
- B. 9 cm
- C. 16 cm
- D. 11 cm
- E. 10 cm

Question 9

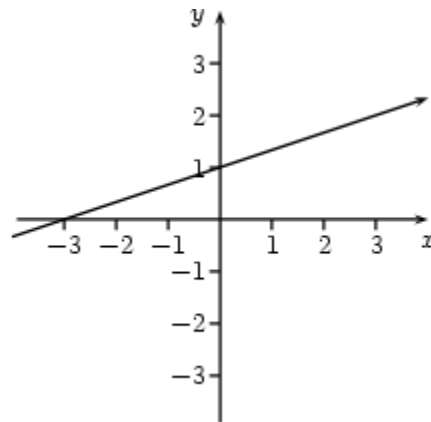
In the triangle above, the length of YZ can be calculated using:

- A. $\frac{4}{\sin(45^\circ)} \times \sin(40^\circ)$
- B. $\frac{4}{\sin(45^\circ)} \times \sin(95^\circ)$
- C. $\sin(40^\circ) \times \frac{\sin(45^\circ)}{4}$
- D. $\cos^{-1}\left(\frac{40^2 + 95^2 - 4^2}{2 \times 40 \times 95}\right)$
- E. $\frac{4}{\sin(40^\circ)} \times \sin(45^\circ)$

END OF MODULE 3

Module 4: Graphs and relations

Question 1



The equation of the above line is:

- A. $x - 3y - 3 = 0$
- B. $3x - y + 3 = 0$
- C. $3y - x = 3$
- D. $-3x + y = 0$
- E. $y = -3x$

Question 2

The point of intersection of the straight lines $x + 2y = 3$ and $3x - y = 5$ lies on the line:

- A. $x - y = 9$
- B. $y = \frac{4}{7}$
- C. $x = \frac{4}{7}$
- D. $y = \frac{13}{7}$
- E. $y = x + 9$

MODULE 4 - continued
TURN OVER

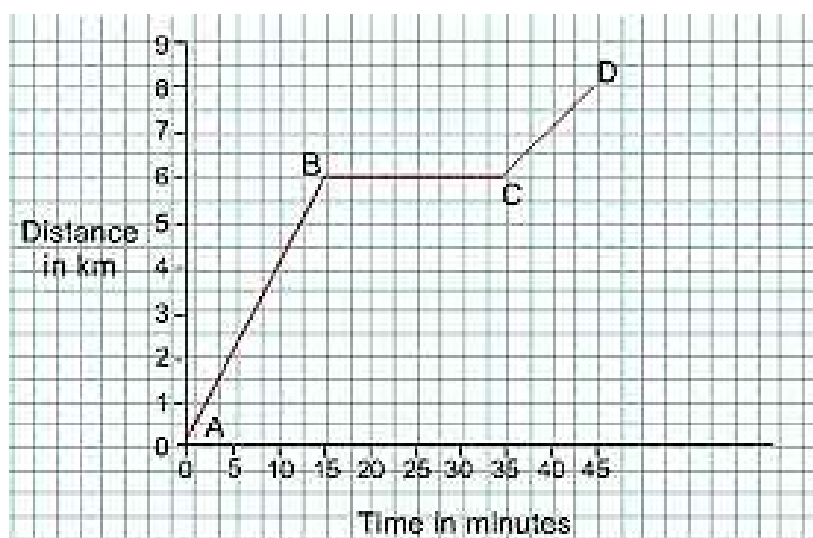
Question 3

The point (5, 10) lies on the graph of $y = \frac{k}{x}$. The value of k is:

- A. 5
- B. 10
- C. 15
- D. 50
- E. 100

Question 4

The following graph shows the distance (in km) covered by a car.



The average speed of the car, in km hr^{-1} , is:

- A. 32
- B. $\frac{32}{3}$
- C. 10
- D. $\frac{10}{3}$
- E. 45

Question 5

A plumber charges according to the following equation

$$C = a + b \times \text{hours}$$

He charges \$195 for two hours and \$330 for five hours.
The amount he will charge for three hours is:

- A. \$235
- B. \$262.50
- C. \$240
- D. \$525
- E. \$295

The following information relates to Questions 6 and 7

The constraints of a linear programming problem are defined as follows.

$$\begin{aligned}x + 2y &\leq 6 \\2x + y &\leq 10 \\x &\geq 0 \\y &\geq 0\end{aligned}$$

Question 6

The extreme points of the feasible region defined by the constraints above are:

- A. $(0, 0)$, $(0, 3)$, $(6, 0)$, $\left(\frac{14}{3}, \frac{2}{3}\right)$
- B. $(0, 3)$, $(5, 0)$, $\left(\frac{14}{3}, \frac{2}{3}\right)$
- C. $(0, 0)$, $(0, 3)$, $(5, 0)$, $\left(\frac{14}{3}, \frac{2}{3}\right)$
- D. $(0, 3)$, $(0, 10)$, $\left(\frac{14}{3}, \frac{2}{3}\right)$
- E. $(5, 0)$, $(6, 0)$, $\left(\frac{14}{3}, \frac{2}{3}\right)$

MODULE 4 - continued
TURN OVER

Question 7

The maximum value of $C(\$) = x - y$ in the feasible region defined by the constraints above is:

- A. \$4
- B. \$5
- C. \$6
- D. \$10
- E. \$3

The following information relates to Questions 8 and 9

A software company plans to sell two models of anti-virus software at costs of \$250 and \$400, respectively. The company makes a profit of \$45 on the \$250 model and makes \$50 on the \$400 model. The company estimates that the total monthly demand will not exceed 250 units. The company does not want to invest more than \$70,000 in the production of these software.

Question 8

The constraint on the amount that the company wants to spend on developing the software is:

- A. $5x + 8y \leq 1400$
- B. $5x + 8y \geq 1400$
- C. $x + y \leq 250$
- D. $9x + 10y \leq 1400$
- E. $9x + 10y \geq 50$

Question 9

The number of units of each model that should be stocked in order to maximize profit is:

- A. (250 , 0)
- B. (250 , 20)
- C. (175 , 250)
- D. (200, 250)
- E. (200 , 50)

END OF MULTIPLE-CHOICE QUESTION BOOK