

## 2011 Trial Examination

STUDENT NUMBER

Figures


Words

Letter

# FURTHER MATHEMATICS

## Written examination 1

Reading time: 15 minutes

Writing time: 1 hour and 30 minutes

### MULTIPLE-CHOICE QUESTION BOOK

#### Structure of book

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of modules</i>	<i>Number of modules to be answered</i>	<i>Number of marks</i>
A	13	13			13
B	54	27	6	3	27
					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 30 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**

**Question 1**

A student received a standardised mark on a maths test of  $z = -1.72$ . The actual mark he received was 56. If the standard deviation of the class was 9.3, what was the mean mark for the class closest to?

- A. 40
- B. 56
- C. 60
- D. 64
- E. 72

**Question 2**

Results in a Physics test gave a student a standardised  $z$ -score of  $z = -1.5$ . Assuming test scores are approximately normally distributed, then the student's Physics mark places him

- A. in the bottom 0.15% of marks in the class
- B. in the top 0.15% of marks in the class
- C. in the bottom 2.5% of marks in the class
- D. in the top 2.5% of marks in the class
- E. in the bottom 16% but not the bottom 2.5% of marks in the class

**Question 3**

Results in a Chemistry test are

20 43 52 52 63 70 71 72 89 94

The interquartile range is

- A. 72
- B. 66.5
- C. 62.6
- D. 52
- E. 20

**SECTION A – continued  
TURN OVER**

**Question 4**

The times (in seconds) for 8 athletes in a 200m running race at a local athletics meeting are  
19.3 20.2 23.5 19.7 22.0 21.5 25.1 22.3

The standard deviation of these times correct to one decimal place, is

- A. 1.8
- B. 1.9
- C. 2.0
- D. 19.3
- E. 21.7

*The following information relates to Questions 5 and 6*

**Question 5**

Bivariate data statistics indicate  $r = -0.7954$   $s_x = 8.23$   $s_y = 33.7$   $\bar{x} = 30.4$   $\bar{y} = 109.3$

The  $y$ -intercept of the least squares regression line is closest to

- A. - 3.3
- B. 10.3
- C. 109.3
- D. 150.3
- E. 208.3

**Question 6**

The coefficient of determination, written as a percentage is closest to

- A. 0.795%
- B. 0.633%
- C. -63.3%
- D. 63.3%
- E. 79.5%

*The following information relates to Questions 7 and 8*

The seasonal indices for Summer = 0.93      Autumn = 1.25      Winter = 1.05

**Question 7**

The seasonal index for Spring is

- A. 0.23
- B. 0.63
- C. 0.77
- D. 0.83
- E. 3.23

**SECTION A – continued**

**Question 8**

A trend line used to forecast deseasonalised quarterly sales for a retail store is

$$\text{Deseasonalised sales} = 12000 + 12300 \times \text{Quarter number}$$

Where Quarter 1 is Summer 2010, Quarter 2 is Autumn 2010 etc

The **seasonalised** sales for Summer 2011 are forecast to be closest to

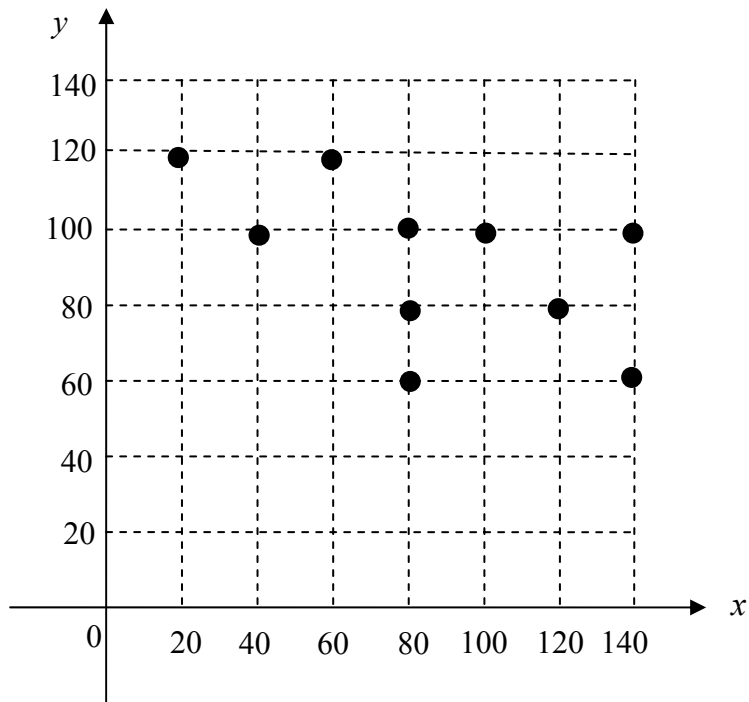
- A. \$73500
- B. \$68355
- C. \$79033
- D. \$69195
- E. \$121500

**Question 9**

The distribution of scores obtained by a History class is normally distributed with a mean of 56 and a standard deviation of 9. The percentage of students who received marks greater than 74 is closest to

- A. 0.15%
- B. 2.5%
- C. 5%
- D. 16%
- E. 47.5%

**SECTION A – continued**  
**TURN OVER**



**Question 10**

By fitting a 3-median regression line to the graph above, the slope is

- A.  $\frac{2}{5}$
- B.  $\frac{-5}{2}$
- C.  $\frac{-4}{7}$
- D.  $\frac{-7}{4}$
- E.  $\frac{-2}{5}$

SECTION A – continued

**Question 11**

A least squares regression line used to predict the fuel used by a car (in kms/litre) in terms of the mass (in kgs) of the car is given by

$$\text{fuel consumption} = 16.1 - 0.006 \times \text{mass}$$

Cars that are predicted to use 8.9km/l have a mass of

- A. 1100kgs
- B. 1200kgs
- C. 1300kgs
- D. 1400kgs
- E. 1500kgs

*The following information relates to Questions 12 and 13*

The data below shows the number of goals kicked by a team over a 10 week period season.

Week	Goal
1	15
2	13
3	10
4	14
5	7
6	20
7	11
8	15
9	18
10	14

**Question 12**

Using a **four-point** moving mean with centring, the smoothed value of the number of goals scored in Week 4 correct to one decimal place is

- A. 5.9
- B. 7.9
- C. 9.9
- D. 11.9
- E. 13.9

**SECTION A – continued**  
**TURN OVER**

**Question 13**

If this information is used to determine the seasonal index for each week, the seasonal index for **Week 6** will be closest to

- A. 0.555
- B. 0.803
- C. 1.370
- D. 1.460
- E. 1.640

**END OF SECTION A**



**SECTION B**

**Instructions for Section B**

Select **three** 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.

<b>Module</b>	<b>Page</b>
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**SECTION B – continued**  
**TURN OVER**

**Module 1: Number patterns**

**Question 1**

The first five terms of the Fibonacci type sequence below are  
12, 15, 27, 42, 69....

The next term in this sequence is

- A. 72
- B. 80
- C. 86
- D. 96
- E. 111

**Question 2**

Which of the following sequences is not an arithmetic sequence?

- A. -2, 3, 8, 13, ...
- B. 200, 150, 100, 50 ...
- C. 1.2, 2.7, 4.2, 5.7, ...
- D. 10, 15, 20, 25,, ...
- E. 2, 4, 8, 16, ...

**Question 3**

The first three terms of a geometric sequence are 36, 24, 16, ....

The sum of the first 8 terms is closest to

- A. 103.8
- B. 156.0
- C. 230.9
- D. 615.1
- E. 1773.3

**Question 4**

A difference equation is defined by  $t_n = 1.4t_{n-1} - 50$  where  $t_1 = 100$

The fifth term of the sequence is closest to

- A. 334.2
- B. 56.4
- C. 29
- D. -9.5
- E. -113.1

**SECTION B – Module 1: Number patterns - continued**

**Question 5**

If  $t_1 = 4$  and  $t_2 = 11$  and  $t_3 = 25$  then the first order difference equation that fits this sequence is

- A.  $t_{n+1} = t_n + 7$
- B.  $t_{n+1} = t_n + 14$
- C.  $t_{n+1} = 2t_n + 3$
- D.  $t_{n+1} = 3t_n + 2$
- E.  $t_{n+1} = 3t_n - 1$

*The following information relates to Questions 6 and 7*

A farmer has 5000 sheep at the start of Year 1. The number of sheep on the farm increases by 4% each year, however 100 sheep are sold.

**Question 6**

If this pattern continues then the number of sheep on the farm at the end of Year 3 is

- A. 5100
- B. 5204
- C. 5304
- D. 5312
- E. 5425

**Question 7**

If  $S_n$  is the number of sheep on the farm at the start of Year  $n$ , then the difference equation for the number of sheep on this farm is

- A.  $S_{n+1} = 1.4 \times S_n + 5000$  where  $S_1 = 5000$
- B.  $S_{n+1} = 1.04 \times S_n + 100$  where  $S_1 = 5000$
- C.  $S_{n+1} = 1.04 \times S_n - 100$  where  $S_1 = 5000$
- D.  $S_{n+1} = 1.4 \times S_n + 100$  where  $S_1 = 5000$
- E.  $S_{n+1} = 1.04 \times S_n$  where  $S_1 = 5000$

**SECTION B – Module 1: Number patterns - continued**  
**TURN OVER**

**Question 8**

The difference equation  $t_{n+1} = 3t_n - 9$  generates a sequence.

If  $t_2 = 3$ , then  $t_1$  is equal to

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

**Question 9**

A school has a population of 540 students and there are 340 females.

The ratio of males to females at the school is

- A. 27:17
- B. 17:27
- C. 17:10
- D. 10:17
- E. 2:3

**SECTION B – continued**

**Module 2: Geometry and trigonometry**

**Question 1**

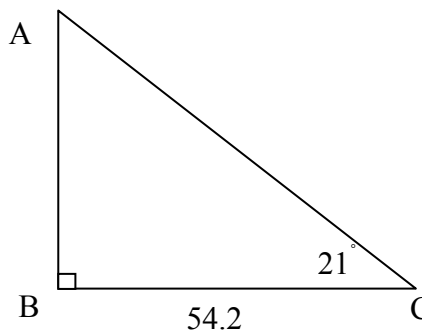
The area of a circle is  $87\text{cm}^2$ . The diameter of the circle, correct to one decimal place is

- A. 5.3 cm
- B. 10.5cm
- C. 27.7 cm
- D. 55.4 cm
- E. 60.7 cm

**Question 2**

For the right angled triangle below, the length of AC in cm is closest to

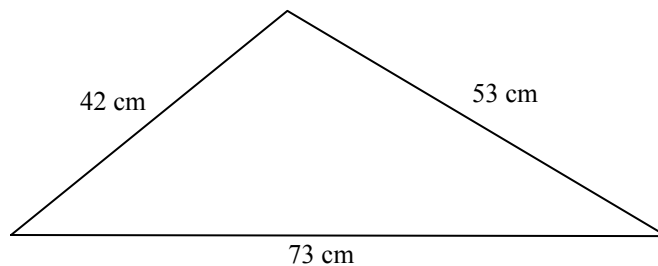
- A. 19.4
- B. 58.1
- C. 58.6
- D. 141.2
- E. 151.2



**Question 3**

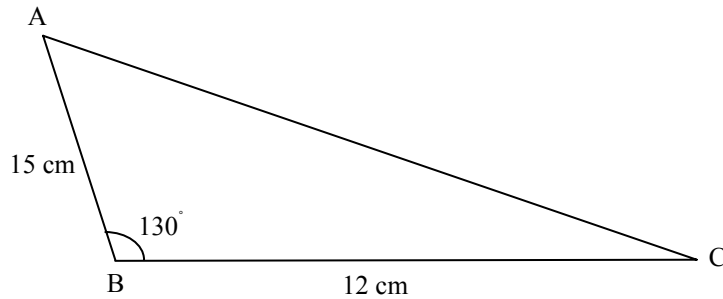
The area of the triangle below in  $\text{cm}^2$  is closest to

- A. 168
- B. 1079
- C. 1097
- D. 1113
- E. 1311



**SECTION B – Module 2: Geometry and trigonometry - continued**  
**TURN OVER**

The following information relates to Questions 4 and 5



**Question 4**

The length of AC, correct to one decimal place is

- A. 9.7 cm
- B. 11.7 cm
- C. 24.5 cm
- D. 137.6 cm
- E. 600.4 cm

**Question 5**

The bearing of A from C is

- A. 022°T
- B. 028°T
- C. 130°T
- D. 292°T
- E. 298°T

**Question 6**

The scale on a map is 1:500.

A distance of 10 cm on this map would correspond to an actual distance of

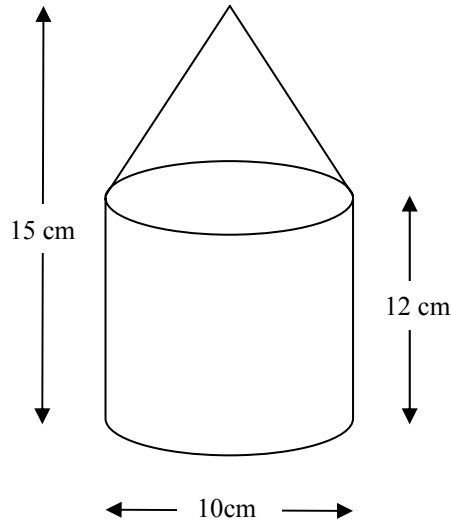
- A. 5m
- B. 50m
- C. 500m
- D. 5000m
- E. 50000m

**Question 7**

The plan for a wheat silo is drawn to a scale of 1:200. On the plan drawn, the volume of the wheat silo is  $360 \text{ cm}^3$ . The volume of the actual wheat silo to be built is

- A.  $2880 \text{ m}^3$
- B.  $14400 \text{ m}^3$
- C.  $72000 \text{ m}^2$
- D.  $72000 \text{ m}^3$
- E.  $2880000 \text{ m}^3$

**Question 8**



The volume of the above shape, in  $\text{cm}^3$ , is closest to

- A.  $1300\pi$
- B.  $750\pi$
- C.  $650\pi$
- D.  $360\pi$
- E.  $325\pi$

**Question 9**

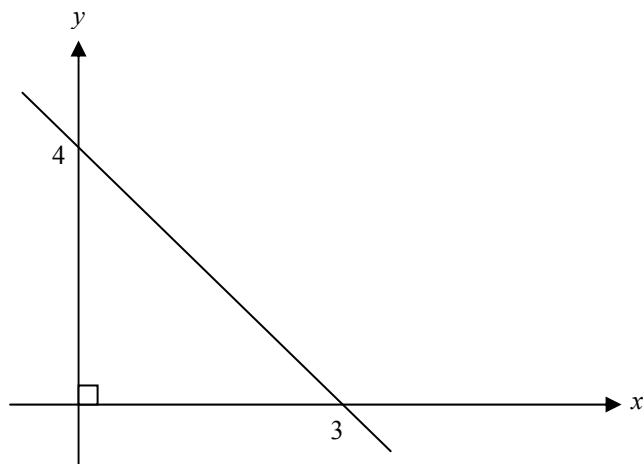
A triangle has side lengths of 12 cm, 14 cm and 18 cm respectively. A second triangle which is similar to the first triangle has a longest side length of 27 cm. The perimeter of the second triangle is

- A. 44 cm
- B. 66 cm
- C. 88 cm
- D. 105 cm
- E. 120 cm

**SECTION B – continued**  
**TURN OVER**

**Module 3: Graphs and relations**

*The following information relates to Questions 1 and 2*

**Question 1**

The gradient of the line above is

- A.  $\frac{4}{3}$
- B.  $\frac{3}{4}$
- C.  $\frac{-3}{4}$
- D.  $\frac{-4}{3}$
- E. -12

**Question 2**

The equation of the line is

- A.  $4y + 3x = 4$
- B.  $4y + 3x = 12$
- C.  $3y + 4x = 4$
- D.  $4y - 3x = 12$
- E.  $3y + 4x = 12$

**SECTION B – Module 3: Graphs and relations - continued**



**Question 3**

An equation for the straight line that passes through the points (3, 8) and (5,-2) is

- A.  $y = -5x + 23$
- B.  $y = 5x + 23$
- C.  $y = -5x - 23$
- D.  $y = 23x + 5$
- E.  $y = 23x - 5$

**Question 4**

The solution to the simultaneous equations  $3x + 4y = 23$  and  $-2x + 7y = 4$  is

- A. (-2,5)
- B. (2,5)
- C. (5,-2)
- D. (5,2)
- E. (-2,-5)

**Question 5**

Taking a taxi involves a flag call of \$3.20 and a cost of \$2.50 per kilometre. How far could you travel if you had \$50 only?

- A. 14 kms
- B. 15 kms
- C. 17kms
- D. 18kms
- E. 19kms

**Question 6**

Twins Stephen and Julianna are given the same amount of money for their birthday and decide to shout their friends at Jack's hamburger shop. A hamburger costs \$4.50 and drinks \$1.50.

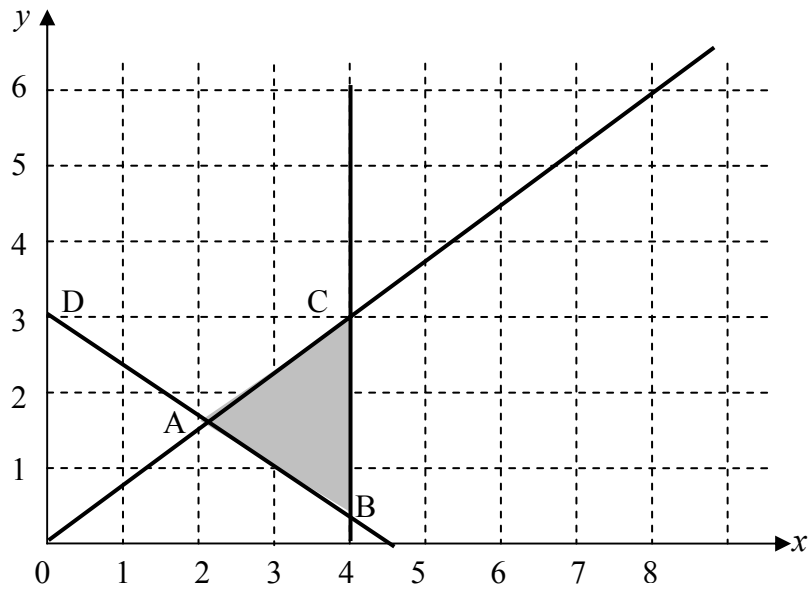
Julianna buys 14 hamburgers and 16 drinks whereas Stephen buys 12 hamburgers and a certain number of drinks. How many drinks did Stephen buy?

- A. 6
- B. 11
- C. 15
- D. 22
- E. 24

**SECTION B – Module 3: Graphs and relations - continued**  
**TURN OVER**

The following information relates to Questions 7 and 8

The shaded region on the graph illustrates the feasible region defined by numerous constraints.



**Question 7**

Which of the following is a constraint bordering the feasible region?

- A.  $4y + 3x = 12$
- B.  $y = 4$
- C.  $y = 5x$
- D.  $x = 4$
- E.  $4y - 3x = 12$

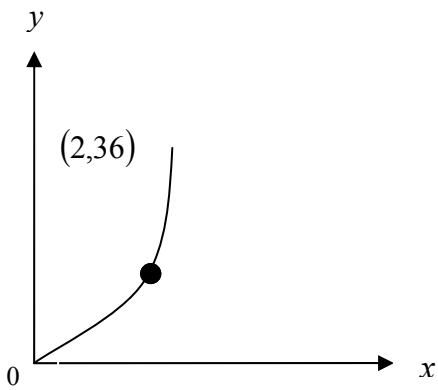
**Question 8**

On the feasible region shown, the **maximum** solution of  $P = 2x + 4y$  occurs at the boundary point

- A. Coordinate A
- B. Coordinate B
- C. Coordinate C
- D. Coordinate D
- E. the origin (0,0)

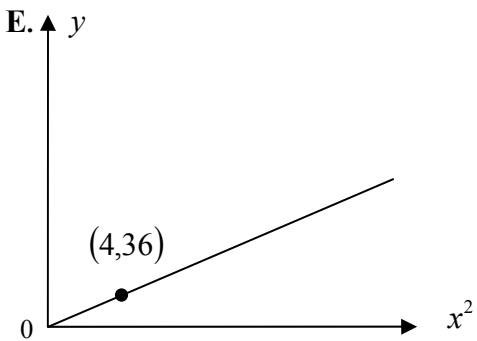
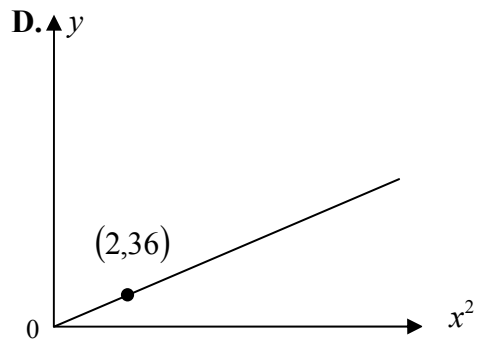
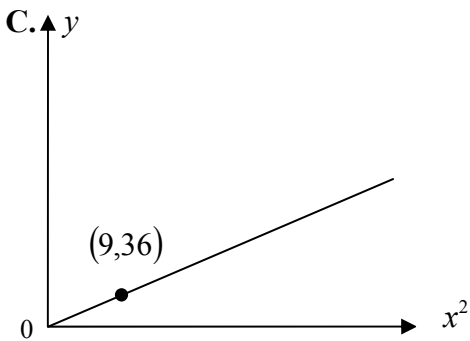
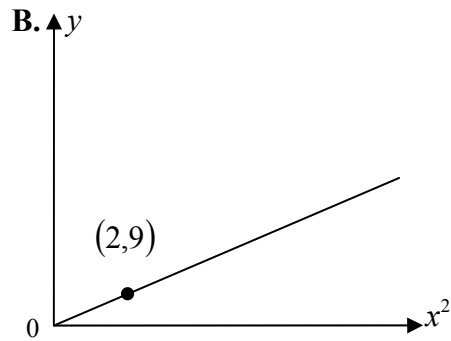
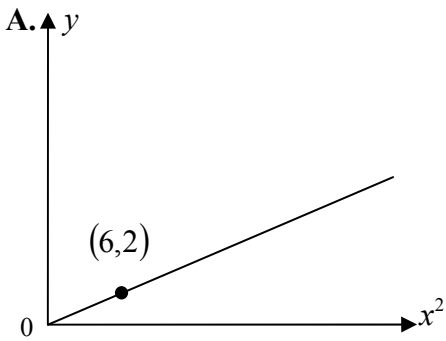
**SECTION B – Module 3: Graphs and relations – continued**  
**TURN OVER**

The graph shown below shows the relationship  $y = kx^2$



**Question 9**

Which of the following graphs, in which  $y$  is plotted against  $x^2$ , also shows the same relationship?



**SECTION B – continued**

**Module 4: Business-related mathematics**

**Question 1**

A calculator retails at \$187 including a GST of 10%. The amount of GST is

- A. \$17.00
- B. \$17.80
- C. \$18.00
- D. \$18.70
- E. \$19.00

**Question 2**

Tom invests \$5000 at 8% pa simple interest for 4 years as he hopes to go on a holiday. The amount he will have available to spend after the investment period is

- A. \$1600
- B. \$3400
- C. \$4400
- D. \$5400
- E. \$6600

**Question 3**

I invest \$2000 for 5 years and earn \$700 in interest in that time. What simple interest rate did I earn per year to one decimal place?

- A. 7.0%
- B. 7.1%
- C. 7.2%
- D. 7.3%
- E. 7.4%

**Question 4**

If Aileen invested \$900 each month into a superannuation investment account returning an interest rate of 5.75% pa compounding monthly, how much would she have to retire on after 25 years?

- A. \$52315.38
- B. \$270000.00
- C. \$287791.20
- D. \$600241.15
- E. \$604017.31

**SECTION B – Module 4: Business-related mathematics – continued**  
**TURN OVER**

**Question 5**

Eva has \$2000 to invest immediately and \$100 to invest weekly. How much will she have after 5 years if she invests the money at 2.55% pa compounded weekly?

- A. \$25421.57
- B. \$25434.88
- C. \$29954.03
- D. \$29967.34
- E. \$32269.68

**Question 6**

Michael wishes to purchase a home worth \$540000. What is the repayment amount per month if he takes out a reducing balance loan at 6.57% for 30 years?

- A. \$1500.00
- B. \$3419.34
- C. \$3438.06
- D. \$6117.35
- E. \$6150.84

**Question 7**

Siobhan takes out an interest only loan of \$300000. If she is able to repay \$1575 per month, what interest rate has she been charged per annum?

- A. 6.0%
- B. 6.1%
- C. 6.2%
- D. 6.3%
- E. 6.4%

**Question 8**

A \$3000 computer depreciates in value by 15% each year. By how much has the computer depreciated after 4 years to the nearest dollar?

- A. \$1200
- B. \$1433
- C. \$1434
- D. \$1566
- E. \$1567

**Question 9**

If \$10000 is invested at 7% per annum compounded quarterly. How much interest is made in the third year?

- A. \$88.49
- B. \$825.57
- C. \$884.90
- D. \$1488.82
- E. \$2314.39

**SECTION B – continued**  
**TURN OVER**

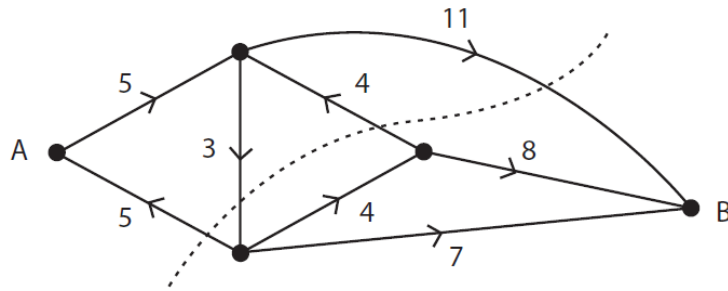
**Module 5: Networks and decision mathematics**

**Question 1**

A connected planar graph has 8 vertices and 13 edges. The number of faces is

- A. 3
- B. 4
- C. 5
- D. 6
- E. 7

**Question 2**

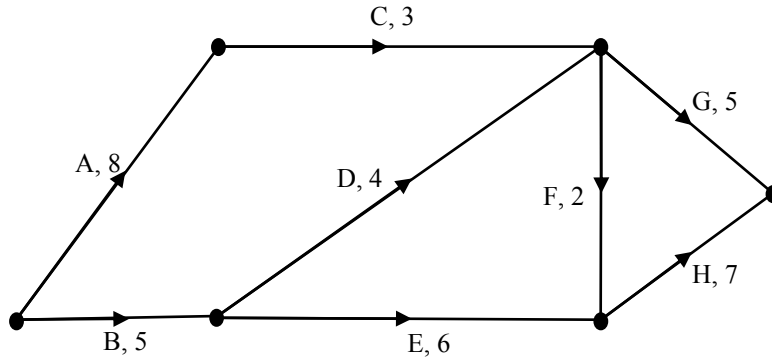


Considering the flow from A to B, the capacity of the cut shown in the network is

- A. 7
- B. 9
- C. 14
- D. 16
- E. 23

The following information relates to Questions 3, 4 and 5

The diagram below shows the activities needed to complete a project and the times for each activity in hours.



**Question 3**

The shortest time to complete the project, in hours, is

- A. 14
- B. 16
- C. 18
- D. 19
- E. 20

**Question 4**

The latest start time for activity B in hours is

- A. 0
- B. 2
- C. 5
- D. 7
- E. 8

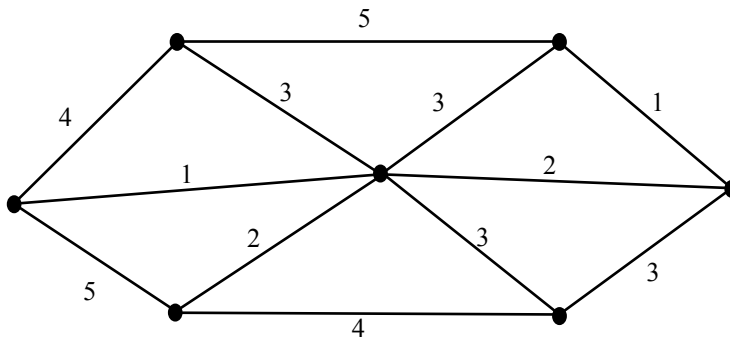
**Question 5**

Which activity has the longest slack (float) time?

- A. activity B
- B. activity C
- C. activity D
- D. activity G
- E. activity H



**Question 6**



In the network above, the length of the minimum spanning tree is

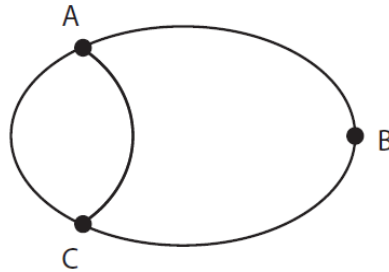
- A. 8
- B. 9
- C. 10
- D. 11
- E. 12

**Question 7**

A night-watchman at a zoo needs to check all paths at the zoo, starting and returning to the main office. He wishes to do this without retracing his steps. The path he should take is

- A. an Euler path
- B. a minimum spanning tree
- C. a Hamilton path
- D. an Euler circuit
- E. a Hamilton circuit

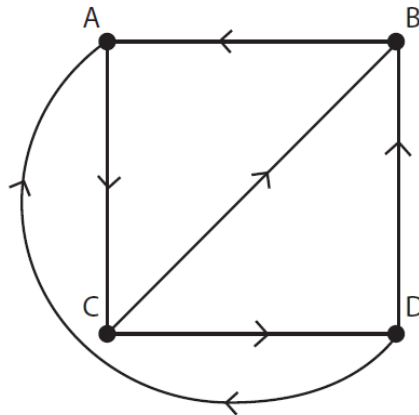
**Question 8**



Which statement is **incorrect** regarding the graph above?

- A. The graph above is a connected planar graph
- B. ABCA is a Hamilton circuit
- C. An Euler circuit can be formed by adding another edge between B and C
- D. An Euler circuit can be formed by adding another edge between A and C
- E. The sum of the degrees of the vertices is 8

**Question 9**



A round robin table tennis tournament results in the one step dominance network graph above. The most dominant Team taking into account one and two step dominance is

- A. Team A
- B. Team B
- C. Team C
- D. Team D
- E. Team C and Team D

**SECTION B – continued**

**Module 6: Matrices****Question 1**

The order of matrix  $\begin{bmatrix} 2 & -1 & 0 \\ 3 & 4 & 2 \end{bmatrix}$  is

- A.  $3 \times 1$
- B.  $6 \times 2$
- C.  $3 \times 2$
- D.  $2 \times 3$
- E. 6

**Question 2**

If matrix  $A = \begin{bmatrix} 5 & 4 \\ 2 & 1 \end{bmatrix}$  and matrix  $B = \begin{bmatrix} 3 & 0 \\ -1 & 2 \end{bmatrix}$ , then  $3A + 2B =$

- A.  $\begin{bmatrix} 8 & 4 \\ 1 & 3 \end{bmatrix}$
- B.  $\begin{bmatrix} 13 & 9 \\ 3 & 7 \end{bmatrix}$
- C.  $\begin{bmatrix} 5 & 4 \\ 2 & 1 \end{bmatrix}$
- D.  $\begin{bmatrix} 21 & 12 \\ 4 & 7 \end{bmatrix}$
- E.  $\begin{bmatrix} 19 & 8 \\ 1 & 8 \end{bmatrix}$

**Question 3**

If matrix  $A = \begin{bmatrix} 5 & -1 & 0 \\ 3 & 4 & 2 \end{bmatrix}$ , then the element that corresponds to  $A_{12}$  is

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

**SECTION B – Module 6: Matrices – continued**  
**TURN OVER**

**Question 4**

The matrix  $\begin{bmatrix} 0 & 40 \\ 24 & -16 \end{bmatrix}$  is equal to

A.  $8 \begin{bmatrix} 0 & 40 \\ 24 & -16 \end{bmatrix}$

B.  $8 \begin{bmatrix} 0 & 4 \\ 24 & -2 \end{bmatrix}$

C.  $8 \begin{bmatrix} -16 & 24 \\ 40 & 0 \end{bmatrix}$

D.  $-8 \begin{bmatrix} 0 & 5 \\ 3 & 2 \end{bmatrix}$

E.  $8 \begin{bmatrix} 0 & 5 \\ 3 & -2 \end{bmatrix}$

**Question 5**

If  $A = \begin{bmatrix} 5 & x \\ y & 7 \end{bmatrix}$  is a **singular** matrix then the product  $xy$  is equal to

A. 0

B. 5

C. 7

D. 12

E. 35

**Question 6**

The inverse of matrix  $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$  is

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

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

C.  $\begin{bmatrix} -2 & -4 \\ -6 & -8 \end{bmatrix}$

D.  $\begin{bmatrix} 2 & -1 \\ -1.5 & 0.5 \end{bmatrix}$

E.  $\begin{bmatrix} -2 & 1 \\ 1.5 & -0.5 \end{bmatrix}$

*The following information relates to Questions 7 and 8*

If it rains on any one day, the probability it rains on the next day is 0.8, however if it is fine on any one day, the probability it is fine on the next day is 0.9.

**Question 7**

The transition matrix for these events is

A.  $\begin{bmatrix} 0.8 & 0.1 \\ 0.9 & 0.2 \end{bmatrix}$

B.  $\begin{bmatrix} 0.8 & 0.9 \\ 0.1 & 0.2 \end{bmatrix}$

C.  $\begin{bmatrix} 0.8 & 0.2 \\ 0.9 & 0.1 \end{bmatrix}$

D.  $\begin{bmatrix} 0.8 & 0.9 \\ 0.2 & 0.1 \end{bmatrix}$

E.  $\begin{bmatrix} 0.8 & 0.1 \\ 0.2 & 0.9 \end{bmatrix}$

**SECTION B – Module 6: Matrices – continued**  
**TURN OVER**

**Question 8**

If there is a 70% chance it is fine on the Monday, what is the chance it will rain on the following Friday, giving your answer as a percentage closest to one decimal place.

- A. 32.5%
- B. 32.8%
- C. 42.1%
- D. 67.2%
- E. 67.5%

**Question 9**

Matrix  $A$  is a  $2 \times 3$  matrix. Matrix  $B$  has 3 columns.

$C$  is another matrix.

If the matrix product  $ABC$  has order  $2 \times 5$

Then the order of matrix  $C$  is

- A.  $2 \times 3$
- B.  $2 \times 5$
- C.  $3 \times 2$
- D.  $5 \times 2$
- E.  $3 \times 5$

**END OF MULTIPLE-CHOICE QUESTION BOOK**