

# 2017 VCE Further Mathematics Trial Examination 1



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# VICTORIAN CERTIFICATE OF EDUCATION 2017

## FURTHER MATHEMATICS

### Trial Written Examination 1

Reading time: 15 minutes  
Total writing time: 1 hour 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 - Core	24	24			24
B - Modules	32	16	4	2	16
					Total 40

- Students are permitted to bring into the exam room: pens, pencils, highlighters, erasers, sharpeners, rulers, one bound reference, one approved technology (calculator or software) and, if desired, one scientific calculator. Calculator memory DOES NOT need to be cleared. For approved computer - based CAS, full functionality may be used.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

##### Materials supplied

- Question book of 44 pages.
- Formula sheet
- Answer sheet for multiple-choice questions.
- Working space is provided throughout the book.

##### Instructions

- Check that your **name and student number** as printed on your answer sheet for multiple-choice questions are correct, **and** sign your name in the space provided to verify this.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

##### At the end of the examination

- You may keep this question book and formula sheet.

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

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**SECTION A - Core****Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

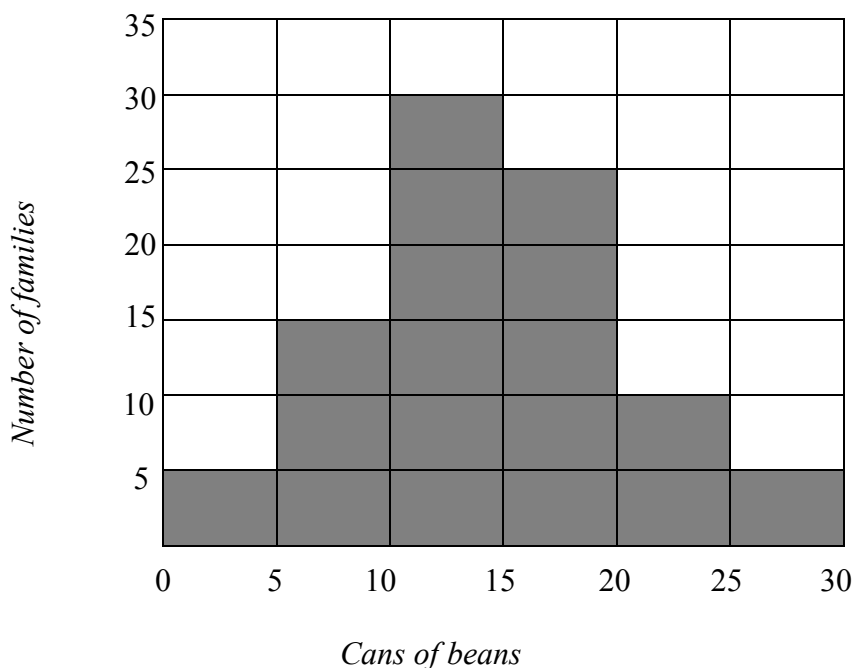
Choose the response that is **correct** for the question.

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.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

**Data analysis****Question 1**

A number of families were surveyed to see how many cans of beans they consumed in a three-month period. The results are shown in the above histogram.

The percentage of these families who consumed more than 15 cans of beans in the three months is closest to

- A. 15%
- B. 40%
- C. 44%
- D. 56%
- E. 77%

**Question 2**

People were given a political statement to read and asked to give their level of agreement to the statement. They were then asked to indicate their political orientation.

The variables, *level of agreement* (high, medium, low) and *political orientation*, (where 1 = Labor, 2 = Liberal, 3 = Greens and 4 = Other) are

- A. both ordinal variables.
- B. both nominal variables.
- C. a nominal variable and an ordinal variable respectively.
- D. an ordinal variable and a nominal variable respectively.
- E. a nominal variable and a numerical variable respectively.

**Question 3**

1	9							
2	1	3	3	5	5	5		
3	2	2	3	4	6	7	8	
4	3	5	8					
5	7	8						
6								
7								
8	1							

Key 1/9 = 19

The stem and leaf plot above shows the ages of people in a Tai Chi class.

The median age is

- A. 25
- B. 32
- C. 33.5
- D. 34
- E. 38

*Use the following information to answer Questions 4 and 5*

Elasticity		
Material	Mean	Standard Deviation
A	20 GPa	5 GPa
B	30 GPa	10 GPa
C	40 GPa	$x$ GPa

The mean and standard deviation of the elasticity of three materials A, B and C are listed in the above table. The unit of measurement is the Gigapascal. The elasticity of each of these materials is normally distributed.

#### Question 4

A piece of material A is randomly selected. What is the probability that it will have an elasticity at least as great as the mean of material B?

- A. 0.025
- B. 0.15
- C. 0.25
- D. 0.5
- E. 0.975

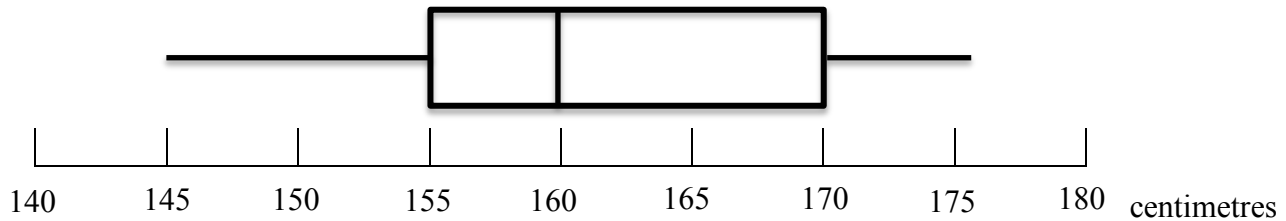
#### Question 5

Which one of the following statements is **NOT** true?

- A. A randomly chosen piece of material A with an elasticity of 15 would have a value of -1 on a normal standard curve.
- B. A randomly chosen piece of material B with an elasticity of 2 on a normal standard curve would have an actual elasticity of 50.
- C. If a randomly chosen piece of material C has an 84% chance of having an elasticity greater than 37, then the value of  $x$  is 3.
- D. The elasticity of material B has a larger spread than that for material A.
- E. The total area under the standard normal curve for the elasticity of material B is larger than the total area under the standard normal curve for that of material A.

**Question 6**

Heights of females



400 females were measured for height and the results shown in the above box plot. How many of these females had a height greater than 170 cm?

- A. 4
- B. 40
- C. 50
- D. 100
- E. 120

**Question 7**

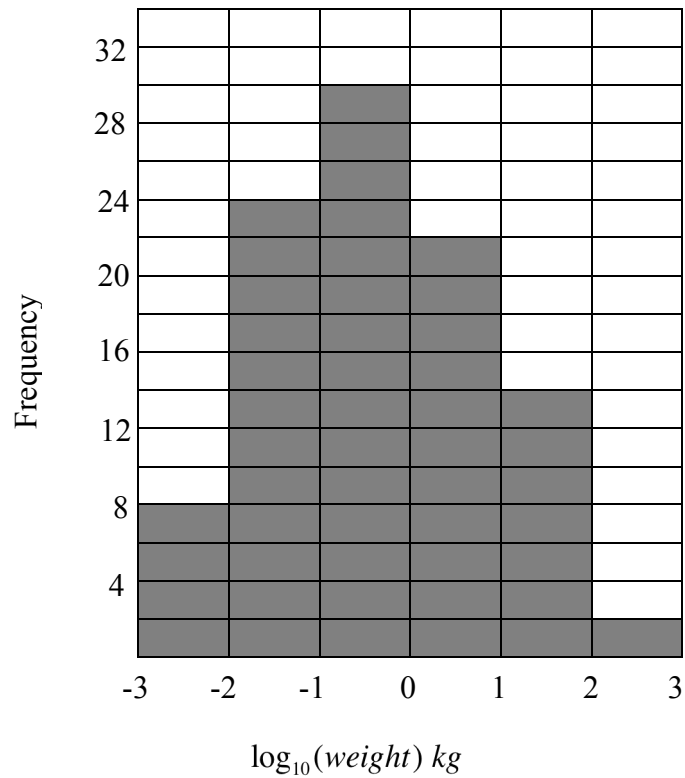
Ken wants to display the results of the number of goals kicked in the last season by three teams, the Mutants, the Phantoms and the Dodgers.

What is the best display for him to use ?

- A. A back-to-back stem and leaf.
- B. A scatter plot.
- C. A dot plot.
- D. A time series.
- E. Parallel box plots.

**Question 8**

The distribution of weights of 100 animals is shown in the histogram below.



Based on the histogram, the percentage of animals with a weight greater than 0.1 kg is closest to

- A. 8%
- B. 16%
- C. 38%
- D. 68%
- E. 92%



*Use the following information to answer Questions 9 and 10*

The table below shows the marks 20 students achieved on a test and the number of hours they spent watching TV in the week prior to the test.

Marks on test	Hours spent watching TV
16	8
11	15
17	8
17	7
18	6
19	6.5
11	16
8	15
11	14
18	5.5
18	8
18	7
14	11
14	10
16	9
13	11
13	13
14	12
16	7
12	10

**Question 9**

Which one of the following statements is **FALSE**?

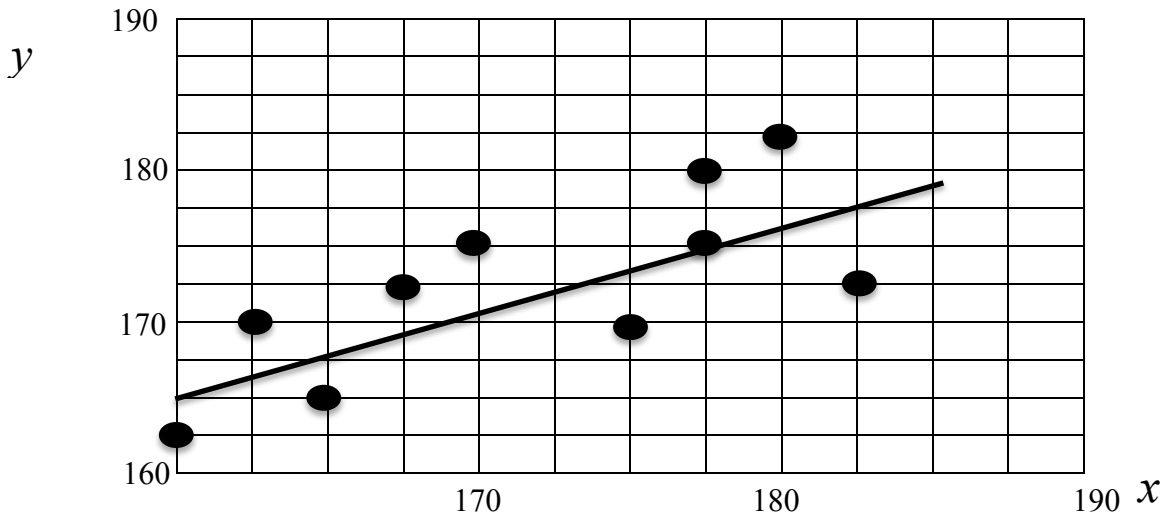
- A. Hour spent watching TV is the explanatory variable.
- B. The gradient of the regression line is approximately 23.3.
- C. Approximately 15% of the variation in the mark on the test can be attributed to factors other than the number of hours spent watching TV in the week prior to the test.
- D. There is a strong negative correlation between hours spent watching TV and marks achieved on the test.
- E. The coefficient of determination is approximately 0.85.

**Question 10**

It can be concluded from the given information that for this test

- A.** There is approximately a 1.72 decrease in test scores for every extra hour spent watching TV in the week prior to the test.
- B.** There is approximately a 0.86 decrease in test scores for every extra hour spent watching TV in the week prior to the test.
- C.** There is approximately a 1.72 decrease in the time spent watching TV in the week prior to the test for every extra mark obtained on the test.
- D.** There is approximately a 0.86 decrease in the time spent watching TV in the week prior to the test for every extra mark obtained on the test.
- E.** There is approximately a 0.86 decrease in test scores for every hour decrease in the time spent watching TV in the week prior to the test.

**Question 11**



The least squares regression line has been fitted to the above data. Which one of the following is closest to the residual plot for this data?

- A.
- B.
- C.
- D.
- E.

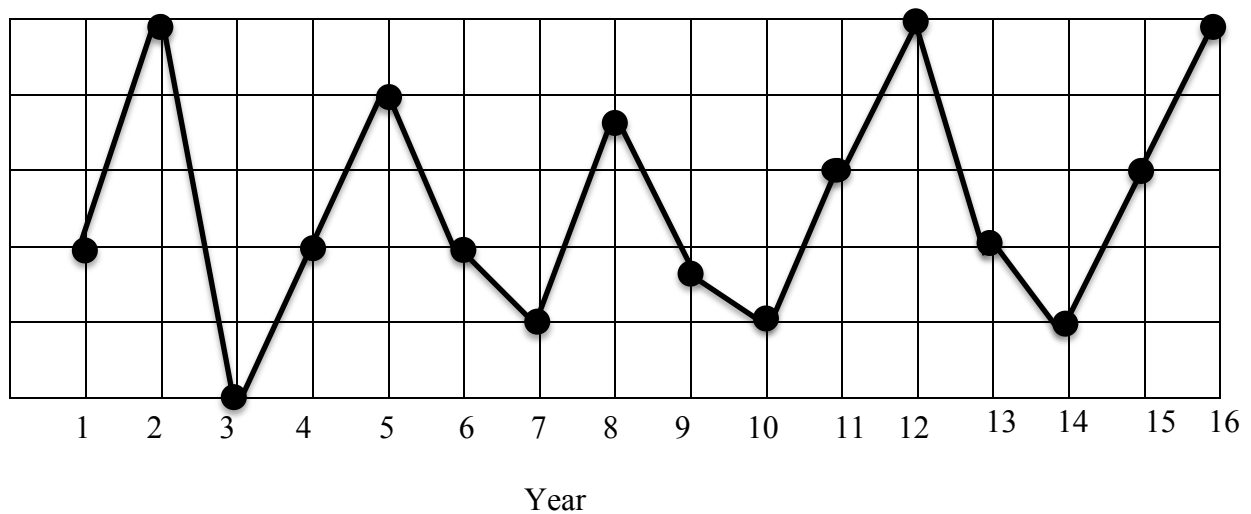
**Question 12**

A log transformation is used to linearise a scatter plot showing the charge,  $Q$  units, on a plate of a condenser  $t$  seconds after it starts to discharge.

The equation of this linearized data is  $\log_{10} Q = 3.5 - 0.9t$

The charge on the plate 0.3 seconds after it starts to discharge is closest to

- A. 0.5 units.
- B. 6.4 units.
- C. 1698 units.
- D. 2972 units.
- E. 3154 units.

**Question 13**

The pattern in the time series plot above is best described as having

- A. Irregular fluctuations.
- B. Seasonality with an increasing trend.
- C. Seasonality
- D. Cyclic with an increasing trend.
- E. Cyclic.

**Question 14**

2015				2016			
Spring	Summer	Autumn	Winter	Spring	Summer	Autumn	Winter
\$1100	\$1250	\$1200	\$990	\$1320	\$1430	\$1380	\$1000

The above table shows the profits for a fruit shop for each season in 2015 and 2016.

What is the two point moving average for spring in 2016?

- A. \$1155
- B. \$1265
- C. \$1312.50
- D. \$1375
- E. \$1470

*Use the following information to answer Questions 15 and 16*

The table below gives the seasonal index for ice cream sales in one outlet over the four seasons in 2016.

Season	Spring	Summer	Autumn	Winter
Seasonal Index	0.8	1.4	1.2	0.6

### Question 15

The actual number of ice creams sold in autumn at this outlet was 4728.

The deseasonalised number was closest to

- A. 2645
- B. 3782
- C. 3895
- D. 3940
- E. 5674

### Question 16

To correct for seasonality, the number of ice cream sales for winter should be

- A. Increased by  $66\frac{2}{3}\%$
- B. Decreased by 60%
- C. Increased by 60%
- D. Decreased by 40%
- E. Increased by 40%

**Recursion and financial modelling****Question 17**

Consider the recurrence relation  $V_0 = 4$ ,  $V_{n+1} = -2V_n + 7$

The value of  $V_5$  is

- A. 9
- B. 11
- C. 29
- D. -29
- E. -51

**Question 18**

Simon invested \$5000 at 4% interest compounding annually.  
Each year the bank deducts \$20 in charges.

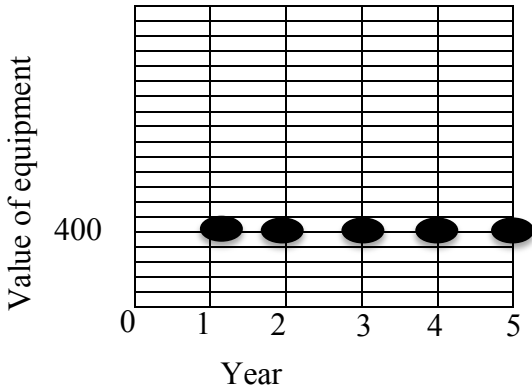
Which one of the following recurrence relations could Simon use to find the value of his investment after a certain number of years?

- A.  $V_{n+1} = 0.04V_n - 20$ ,  $V_0 = 5000$
- B.  $V_{n+1} = 1.04V_n - 20$ ,  $V_0 = 5000$
- C.  $V_{n+1} = 0.96V_n - 20$ ,  $V_0 = 5000$
- D.  $V_{n+1} = 1.02V_n - 4$ ,  $V_0 = 5000$
- E.  $V_{n+1} = 1.0033V_n - 20$ ,  $V_0 = 5000$

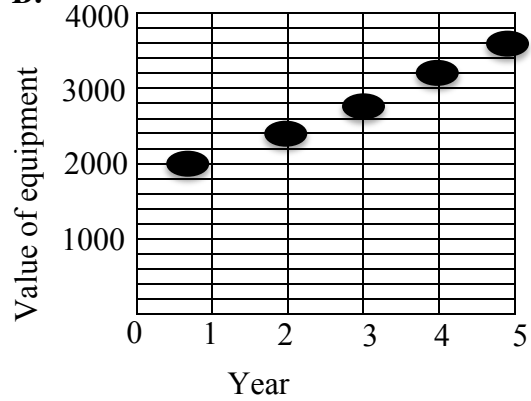
**Question 19**

Office equipment that cost \$4000 is depreciated using a flat rate depreciation of 10% per annum. Which one of the following graphs could represent this situation?

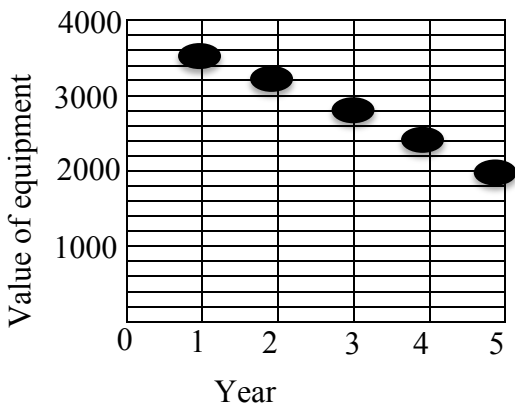
**A.**



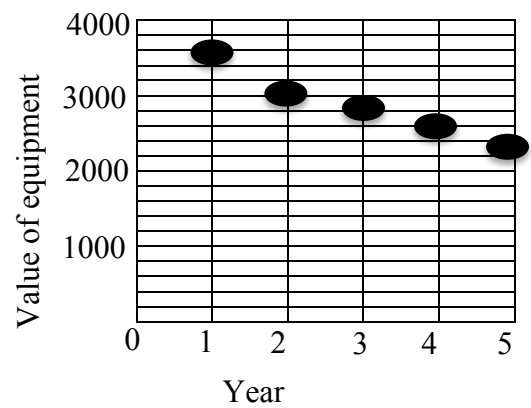
**B.**



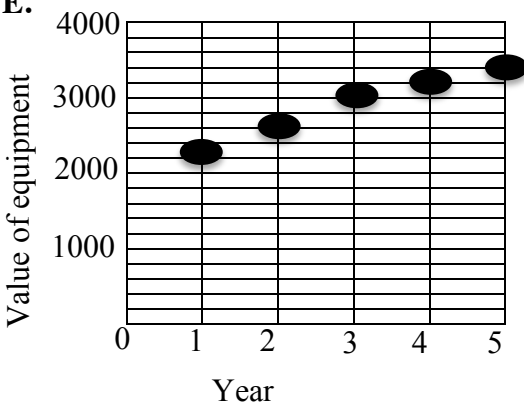
**C.**



**D.**



**E.**





**Question 20**

The recurrence relation  $A_{n+1} = 1.0043A_n - 240$  is used to calculate the value of the balance of Sue's reducing loan with monthly repayments.

Which one of the following is closest to the annual interest rate of the loan?

- A. 0.43%
- B. 1.2%
- C. 2%
- D. 2.9%
- E. 5.2%

**Question 21**

Jason borrows \$25000 at a rate of 8% per annum to buy a car. The loan is to be repaid by making quarterly repayments of \$3760. What is the amount by which the principal is reduced at the first repayment?

- A. \$500
- B. \$1760
- C. \$2000
- D. \$3260
- E. \$21740

**Question 22**

Lily has a \$250000 home loan with an interest rate of 4% per annum compounding monthly. The number of years it will take Lily to pay off this loan if her monthly repayments are \$2000 is closest to

- A. 14 years
- B. 16 years
- C. 25 years
- D. 28 years
- E. 61 years

**Question 23**

Farah borrowed \$24000 at a rate of 6% per annum compounding monthly to buy furniture. Farah repays \$200 per month for four years and then decides to repay the balance of the loan fully with equal monthly repayments over the next three years.

The amount that Farah will have to repay each month for the last three years is closest to

- A. \$400
- B. \$500
- C. \$600
- D. \$700
- E. \$800

**Question 24**

Magda purchased a car for \$42000 and its scrap value after 12 years was \$5976. Magda averaged 15000 kilometres per year in the car over the 12 years she drove it. If the depreciation was calculated using the unit cost method then the value of the depreciation per kilometre was closest to

- A. 10 cents.
- B. 20 cents.
- C. 30 cents.
- D. 40 cents.
- E. 50 cents.

**END OF SECTION A**

**SECTION B - Module****Instructions for Section B**

Select **two** modules and answer **all** questions within the modules selected in pencil on the answer sheet provided for multiple-choice questions.

Show the modules you are answering by shading the matching boxes on your multiple-choice answer sheet **and** writing the name of the module in the box provided.

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.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

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**Module 1: Matrices**

Before answering these questions you must **shade** the 'Matrices' box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

**Question 1**

$$A = \begin{bmatrix} 3 & -2 & 1 \\ 2 & -3 & 4 \\ -1 & 5 & 0 \end{bmatrix}$$

$2a_{23} - 3a_{12}$  equals

- A. -6
- B. -4
- C. 2
- D. 5
- E. 14

**Question 2**

$$X = \begin{bmatrix} 2 & 1 & 3 \\ -3 & 4 & -1 \\ 5 & 0 & -2 \end{bmatrix}$$

$X^T$  is the transpose of  $X$

$(X^T)^T$  equals

**A.**

$$\begin{bmatrix} 2 & -3 & 5 \\ 1 & 4 & 0 \\ 3 & -1 & -2 \end{bmatrix}$$

**B.**

$$\begin{bmatrix} 1 & 4 & 0 \\ 3 & -1 & -2 \\ 2 & -3 & 5 \end{bmatrix}$$

**C.**

$$\begin{bmatrix} 2 & 1 & 3 \\ -3 & 4 & -1 \\ 5 & 0 & -2 \end{bmatrix}$$

**D.**

$$\begin{bmatrix} -3 & 5 & 2 \\ 4 & 0 & 1 \\ -1 & -2 & 3 \end{bmatrix}$$

**E.**

$$\begin{bmatrix} 5 & 2 & -3 \\ 0 & 1 & 4 \\ -2 & 3 & -1 \end{bmatrix}$$

**Question 3**

$$\text{If } 4X - 2 \begin{bmatrix} -1 & 0 & 3 \\ 4 & 2 & 1 \end{bmatrix} = \begin{bmatrix} 4 & 4 & 2 \\ 8 & 6 & 2 \end{bmatrix}$$

Then  $X$  equals

**A.**  $\begin{bmatrix} 0.5 & 1 & 2 \\ 4 & 2.5 & 1 \end{bmatrix}$

**B.**  $\begin{bmatrix} 1.5 & 1 & 2 \\ 4 & 2.5 & 1 \end{bmatrix}$

**C.**  $\begin{bmatrix} 1.5 & 1 & 1.25 \\ 3 & 2 & 0.75 \end{bmatrix}$

**D.**  $\begin{bmatrix} 0.5 & 1 & 1.25 \\ 3 & 2 & 0.75 \end{bmatrix}$

**E.**  $\begin{bmatrix} 1.5 & 1 & 2 \\ 4 & 2 & 1 \end{bmatrix}$

**Question 4**

$$\text{If } P = \begin{bmatrix} 4 & 7 \\ 2 & 3 \end{bmatrix} \quad R = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \quad \text{and } PQ = R$$

Then  $Q$  equals

**A.**

$$-\frac{1}{2} \begin{bmatrix} 3a-7b & 3c-7d \\ 4b-2a & 4d-2c \end{bmatrix}$$

**B.**

$$\frac{1}{2} \begin{bmatrix} 3a-7c & 3b-7d \\ 4c-2a & 4a-2b \end{bmatrix}$$

**C.**

$$\begin{bmatrix} 3a-7c & 3b-7d \\ 4c-2a & 4a-2b \end{bmatrix}$$

**D.**

$$\frac{1}{2} \begin{bmatrix} 7c-3a & 7d-3b \\ 2a-4c & 2b-4d \end{bmatrix}$$

**E.**

$$-\frac{1}{2} \begin{bmatrix} 7c-3a & 7d-3b \\ 2a-4c & 2b-4d \end{bmatrix}$$



**Question 5**

Table 1 shows the number of apples, oranges and mangoes sold on a certain day by three different stores.

Table 1

Store	Apple	Orange	Mango
A	250	125	80
B	180	200	100
C	250	280	120

Table 2 shows the value in dollars of the each piece of fruit in each of the stores.

Table 2

Store	Apple	Orange	Mango
A	0.50	1.00	5.00
B	0.65	0.40	4.00
C	0.70	0.80	2.00

The matrix product that gives the total value of all the fruit sold at store B on that day is

A. 
$$\begin{bmatrix} 180 \\ 200 \\ 100 \end{bmatrix} \begin{bmatrix} 0.65 & 0.40 & 4.00 \end{bmatrix}$$

B. 
$$\begin{bmatrix} 180 & 200 & 100 \end{bmatrix} \begin{bmatrix} 0.65 & 0.40 & 4.00 \end{bmatrix}$$

C. 
$$\begin{bmatrix} 180 \\ 200 \\ 100 \end{bmatrix} \begin{bmatrix} 0.65 \\ 0.40 \\ 4.00 \end{bmatrix}$$

D. 
$$\begin{bmatrix} 0.65 & 0.40 & 4.00 \end{bmatrix} \begin{bmatrix} 180 \\ 200 \\ 100 \end{bmatrix}$$

E. 
$$\begin{bmatrix} 180 \\ 200 \\ 100 \end{bmatrix} \begin{bmatrix} 1.00 & 0.40 & 0.80 \end{bmatrix}$$

**Question 6**

The results of five teams, the Panthers, the Quails, the Roosters, the Swallows and the Titans, in a football competition are given in the matrix below. 1 designates a win and 0 represents a loss.

$$\begin{array}{c}
 \text{Losers} \\
 P \quad Q \quad R \quad S \quad T \\
 \text{Winners} \begin{array}{l} P \\ Q \\ R \\ S \\ T \end{array} \left[ \begin{array}{ccccc}
 0 & 1 & 0 & 0 & 1 \\
 0 & 0 & 0 & 1 & 0 \\
 1 & 0 & 0 & 0 & 1 \\
 0 & 0 & 1 & 0 & 0 \\
 0 & 0 & 0 & 1 & 0
 \end{array} \right]
 \end{array}$$

The teams are ranked using the sum of their one-step and two-step dominance. The teams that came first, second and third respectively are

- A. Panthers, Roosters, Titans.
- B. Panthers, Roosters, Quails.
- C. Roosters, Panthers, Titans.
- D. Roosters, Panthers, Swallows.
- E. Quails, Roosters, Swallows.

**Question 7**

Matthew and Sara often play squash together. They each have an equal chance of winning the first game. If Sara wins a game, her confidence soars and her chance of winning the next game increases to 72%. If Matthew wins a game his chance of winning the next game is 60%. Sara's chance of winning the third game is closest to

- A. 56%
- B. 58%
- C. 60%
- D. 61%
- E. 63%

**Question 8**

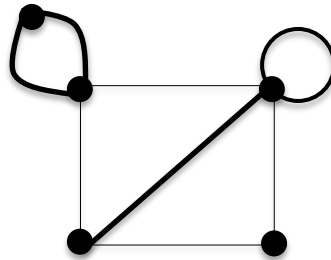
$A, B, C, D$  and  $E$  are matrices.  $(BA + C^3)CD$  is defined and  $BE$  is defined.  
 $D$  is a column matrix with four rows.  
 $E$  is a  $2 \times 3$  matrix  
The order of matrix  $A$  is

- A.  $2 \times 2$
- B.  $2 \times 4$
- C.  $4 \times 3$
- D.  $3 \times 2$
- E.  $4 \times 4$

**End of Module 1**

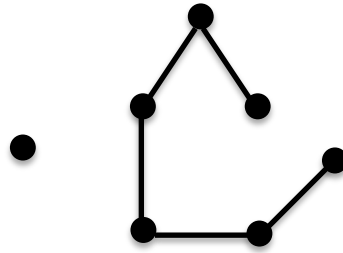
**Module 2: Networks and decision mathematics**

Before answering these questions you **must** shade the 'Networks and decision mathematics' box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

**Question 1**

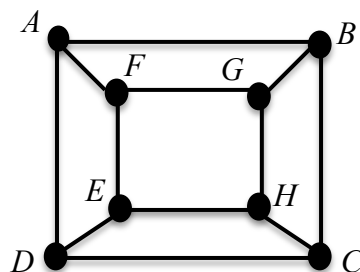
The sum of the degrees of the vertices of the above graph is

- A. 12
- B. 13
- C. 14
- D. 15
- E. 16

**Question 2**

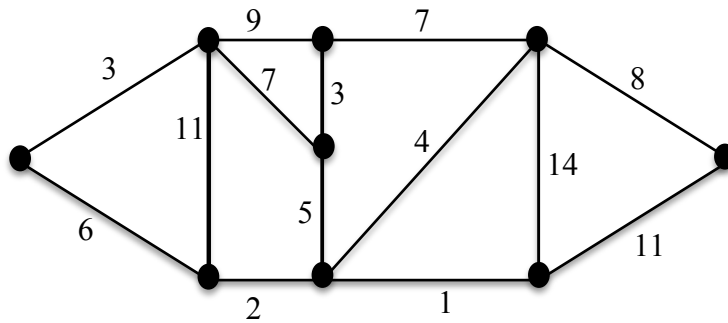
How many edges would need to be added to make this a complete graph?

- A. 1
- B. 2
- C. 10
- D. 16
- E. 23

**Question 3**

In the graph above, which one of the following is a Hamiltonian path?

- A.  $A - B - C - D - E - H - G - F - A$
- B.  $F - G - B - A - D - E - H - C$
- C.  $A - F - G - B - A - D - C - H - E$
- D.  $F - A - D - C - H - E - F - G$
- E.  $E - F - G - H - C - B - A - F$

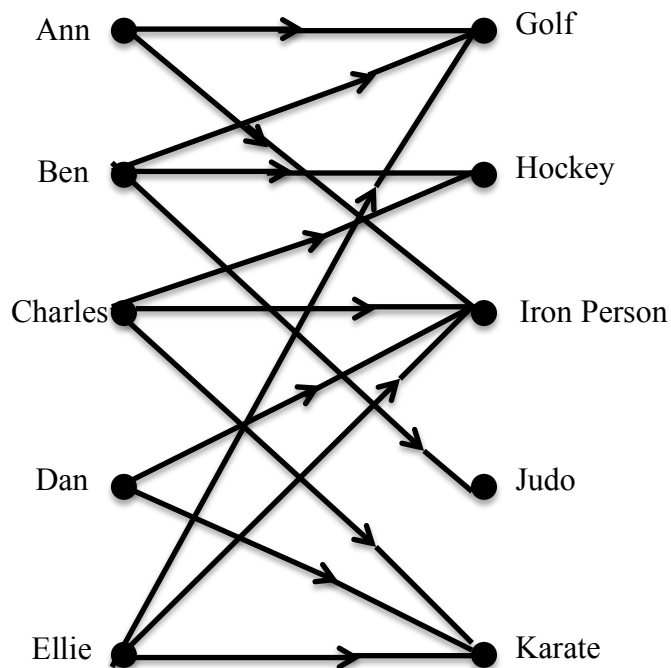
**Question 4**

The above graph shows the distance between 9 houses in kilometres. The houses need to be connected by a pipeline. The minimum length of pipeline required is

- A. 29 km.
- B. 31 km.
- C. 32 km.
- D. 34 km.
- E. 39 km.

**Question 5**

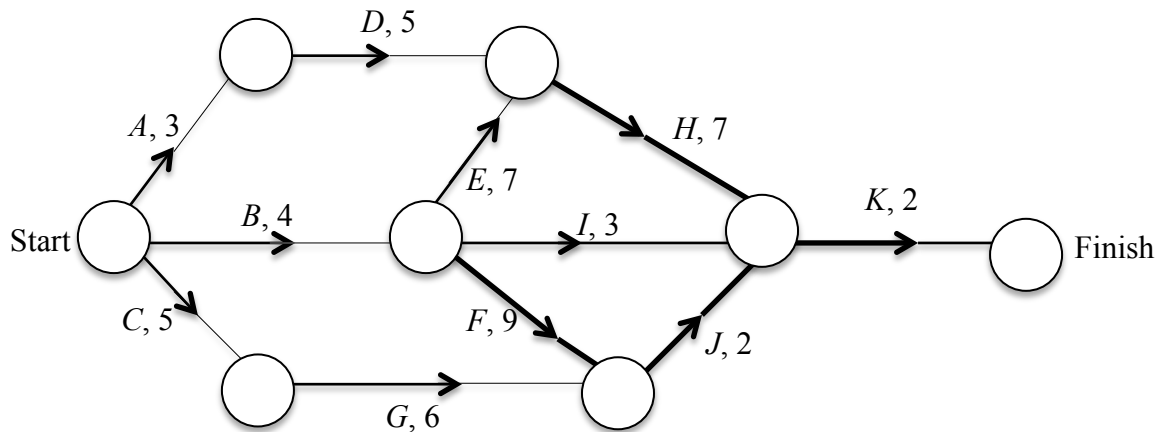
The bipartite graph below shows the sports that five people participated in last week.



Which one of the following statements is FALSE?

- A. More of these people participated in Karate than in Hockey.
- B. Judo was the least popular sport for this group of people.
- C. Ben was the only person who did not participate in the Iron Person.
- D. The total number of different sports participated in by Dan and Ellie was the same number as the different sports participated in by Charles and Ann.
- E. Ben and Dan did no sports in common.

Use the following information for questions 6 and 7.



The graph above shows activities that must be completed to finish a project and the completion time in days for each activity.

### Question 6

The critical path for the project is

- A. B – I – K
- B. B – F – J – K
- C. A – D – H – K
- D. C – G – J – K
- E. B – E – H – K

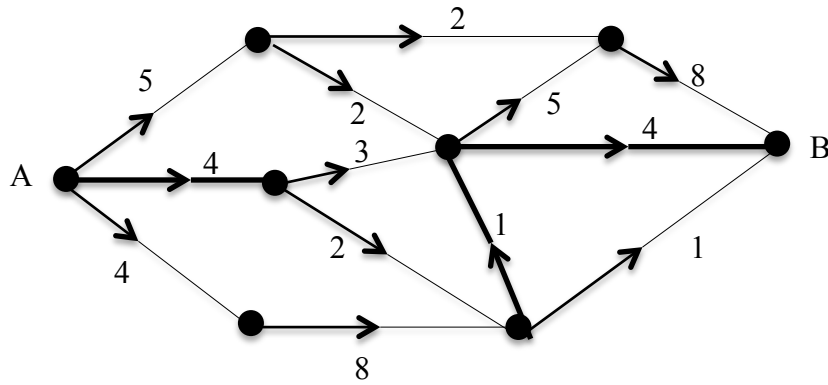
### Question 7

The float time for activity J is

- A. 0 days
- B. 1 day
- C. 2 days
- D. 3 days
- E. 5 days



**Question 8**



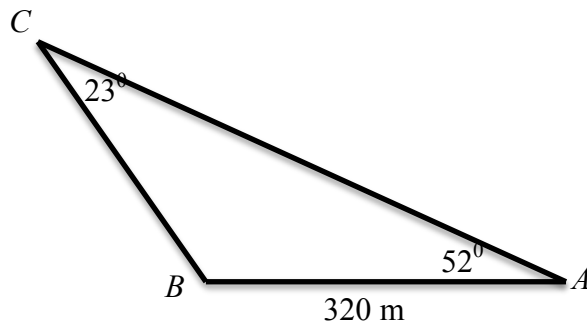
The directed graph above shows the number of packages that can travel along different sections of a conveyor belt in an hour. The maximum number of packages that can move from A to B in an hour is

- A. 7
- B. 8
- C. 9
- D. 10
- E. 12

**End of Module 2**

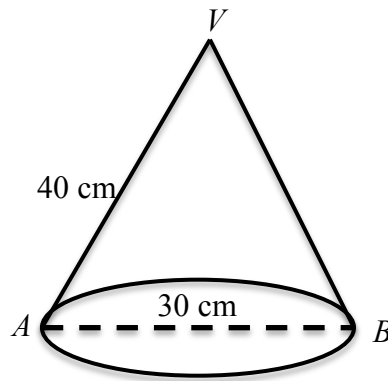
**Module 3: Geometry and measurement**

Before answering these questions you **must** shade the 'Geometry and measurement' box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

**Question 1**

$AB = 320$  m,  $\angle BAC = 52^\circ$  and  $\angle BCA = 23^\circ$   
The length of AC is closest to

- A. 645 m
- B. 652 m
- C. 791 m
- D. 823 m
- E. 837 m

**Question 2**

The above right circular cone has  $AB = 30$  cm and  $VA = 40$  cm.  
The height of the cone is closest to

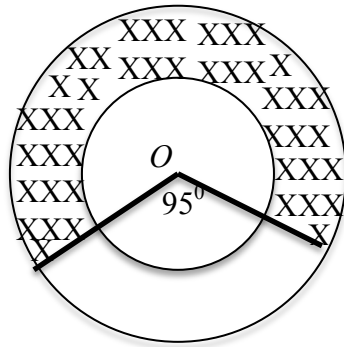
- A. 26 cm
- B. 37 cm
- C. 43 cm
- D. 46 cm
- E. 50 cm

**Question 3**

Two towns  $P$  and  $Q$  are in the same time zone.  $P$  is  $53^{\circ}$  N  $6^{\circ}$  W and  $Q$  is  $23^{\circ}$  N  $38^{\circ}$  E.

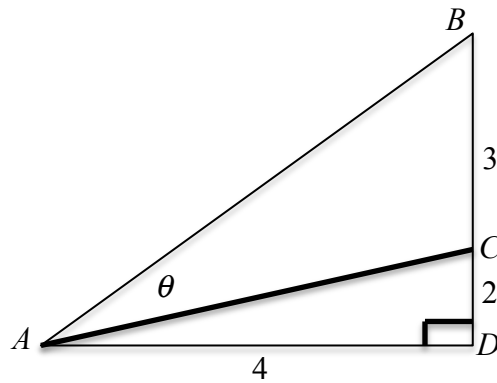
If  $1^{\circ}$  change in longitude gives four minutes time difference then which one of the following statements is true?

- A.  $Q$  would be 2 hours 8 minutes behind  $P$  in time.
- B.  $P$  would be 2 hours ahead of  $Q$  in time.
- C.  $Q$  would be 2 hours 8 minutes behind  $P$  in time.
- D.  $Q$  would be 2 hours ahead of  $P$  in time.
- E.  $Q$  would be 2 hours 56 minutes ahead of  $P$  in time.

**Question 4**

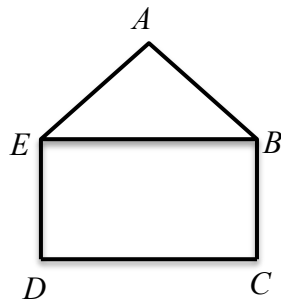
The radius of the smaller circle in the above diagram is 8 cm. The distance between the circumferences of the two circles is 4 cm.  $\angle AOB = 95^\circ$ . The area of the region shaded with crosses (XXX) is closest to

- A.  $40 \text{ cm}^2$
- B.  $66 \text{ cm}^2$
- C.  $111 \text{ cm}^2$
- D.  $126 \text{ cm}^2$
- E.  $185 \text{ cm}^2$

**Question 5**

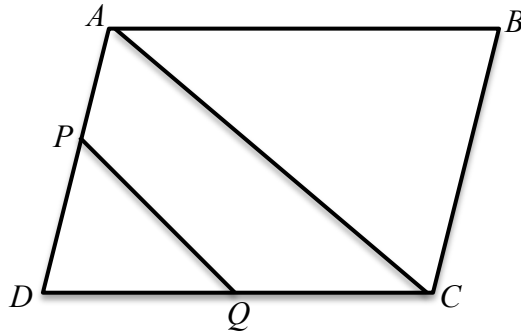
In the above diagram,  $AD = 4$  m,  $DC = 2$  m and  $CB = 3$  m. The size of angle  $\theta$  is closest to

- A.  $9^\circ$
- B.  $10^\circ$
- C.  $14^\circ$
- D.  $25^\circ$
- E.  $26^\circ$

**Question 6**

In the above figure,  $AB = AE = 4$  m.  $\angle EAB = 60^\circ$ . The perimeter of the shape is 24 m. The area of the shape is closest to

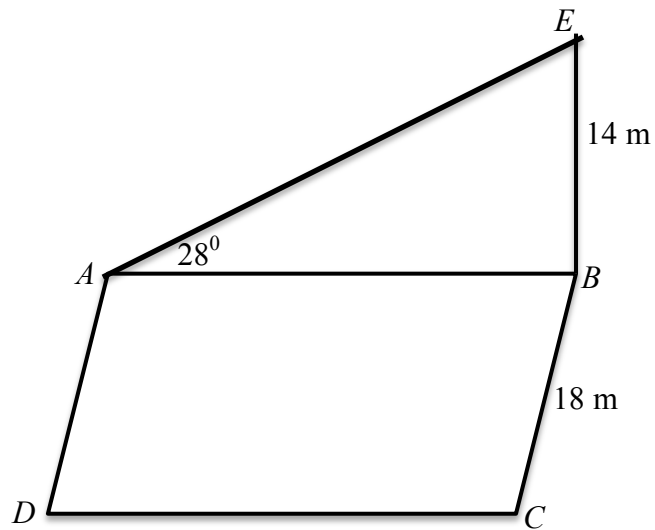
- A.  $31 \text{ m}^2$
- B.  $32 \text{ m}^2$
- C.  $34 \text{ m}^2$
- D.  $36 \text{ m}^2$
- E.  $38 \text{ m}^2$

**Question 7**

$ABCD$  is a parallelogram and  $PQ$  and  $AC$  are parallel.  
 $QD = 4$  cm and  $PD : AD = 3 : 5$

The length of  $QC$  is

- A.  $1\frac{1}{3}$  cm
- B.  $1\frac{3}{5}$  cm
- C.  $2\frac{2}{5}$  cm
- D.  $2\frac{3}{5}$  cm
- E.  $2\frac{2}{3}$  cm

**Question 8**

The diagram above shows a vertical flagpole,  $BE$ , standing at the corner of a horizontal rectangular plot of land,  $ABCD$ . The flagpole is  $14\text{ m}$  high and the angle of elevation of the top of the flagpole from  $A$  is  $28^\circ$ .  $BC$  is  $18\text{ m}$ .

The angle of elevation of the top of the flagpole from  $D$  is closest to

- A.  $24^\circ$
- B.  $28^\circ$
- C.  $34^\circ$
- D.  $36^\circ$
- E.  $38^\circ$

**End of Module 3**

**Module 4: Graphs and relations**

Before answering these questions you **must** shade the 'Graphs and relations' box on the answer sheet for multiple-choice questions and write the name of the module in the box provided.

**Question 1**

Which one of the following statements is **TRUE** about the line  $x = -10$ ?

- A. The line has a gradient of zero.
- B. The line has a negative gradient.
- C. The line has a positive gradient.
- D. The line passes through the point  $(0, -10)$ .
- E. The line passes through the point  $(-10, 0)$ .

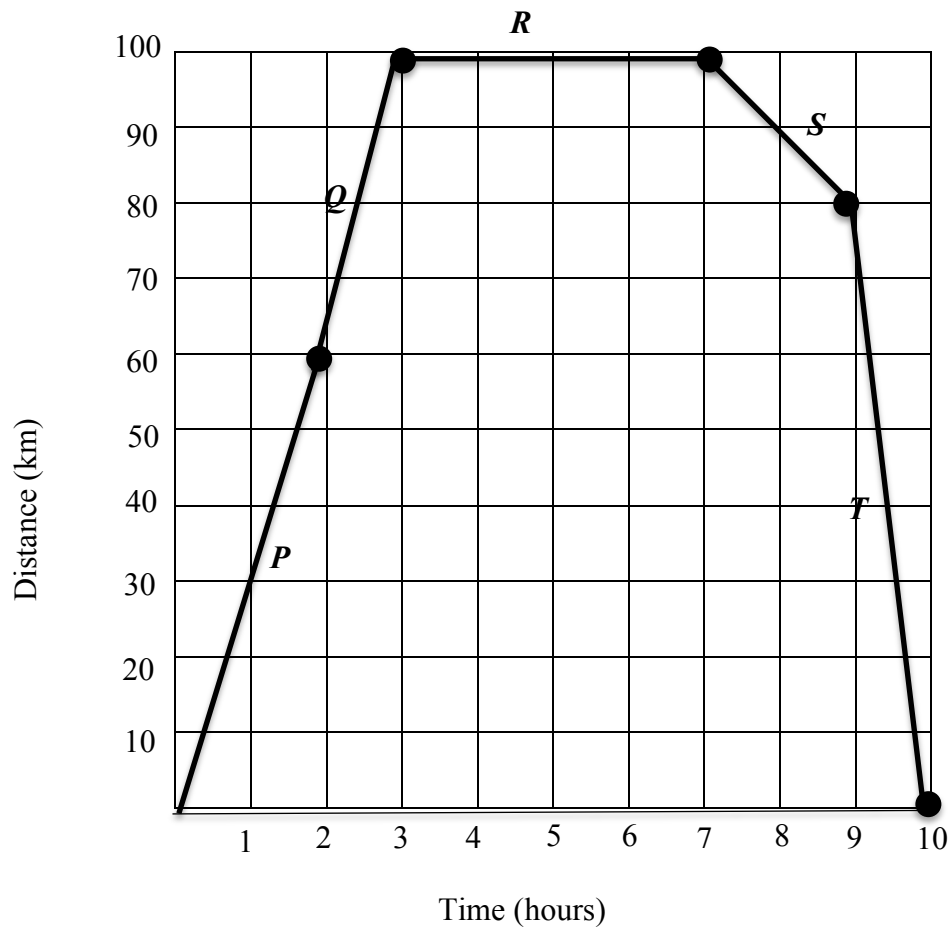
**Question 2**

The lines with equations  $3x + y - 9 = 0$  and  $x + 3y - 11 = 0$  meet at a point.  
The sum of the  $x$  and  $y$  values of this point is

- A. 3
- B. 5
- C. 6
- D. 7
- E. 9



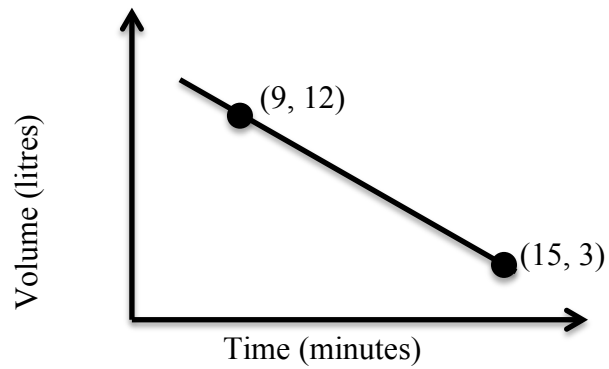
## Question 3



The above graph shows Sally's bike ride from home to her aunt's house and back home again.

During which section of the trip did Sally travel the fastest?

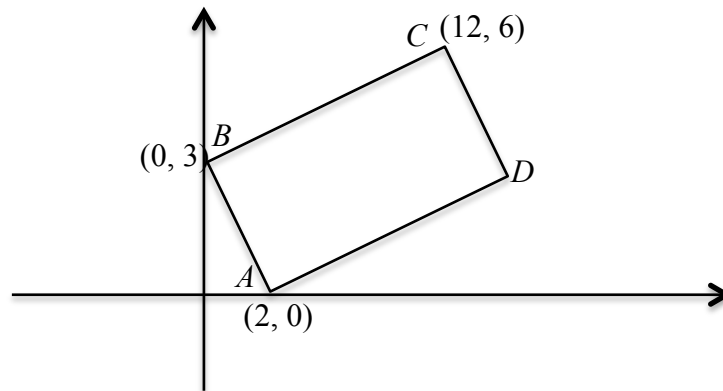
- A. *P*
- B. *Q*
- C. *R*
- D. *S*
- E. *T*

**Question 4**

The above graph shows how the volume of water in a container is changing with time.

The water in the container is

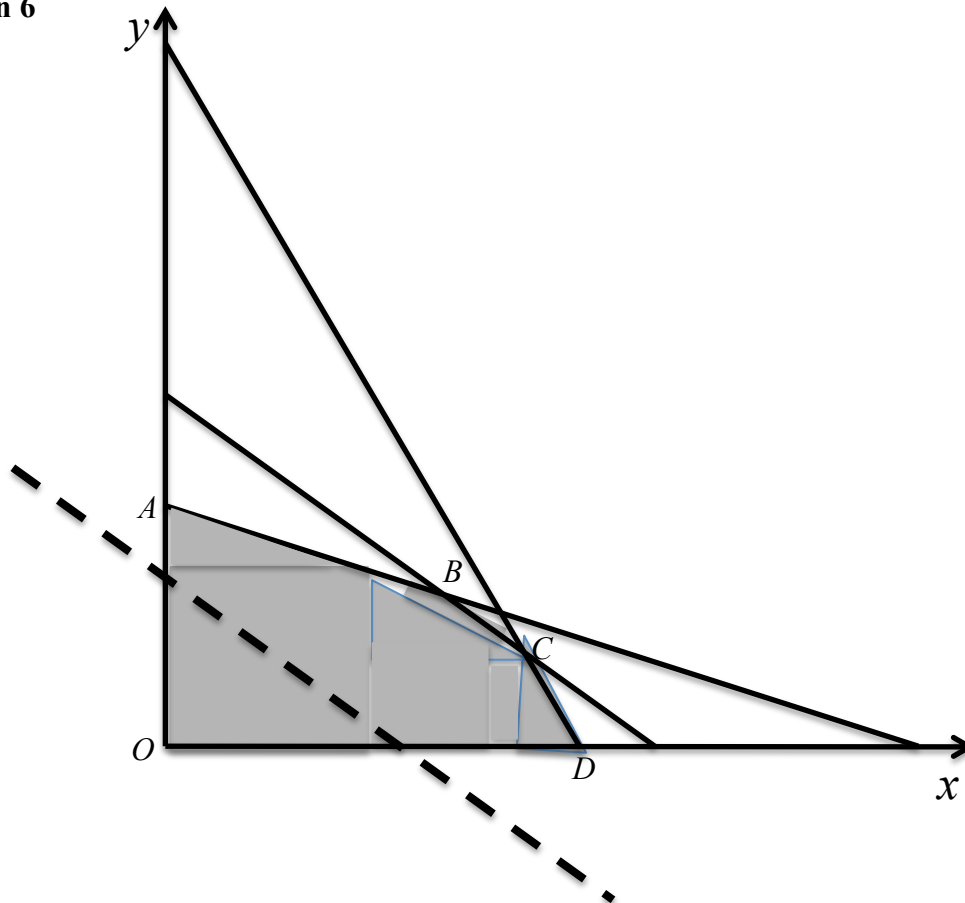
- A. Decreasing at a rate of 1.5 litres per minute.
- B. Decreasing at a rate of -1.5 litres per minute.
- C. Increasing at a rate of 1.5 litres per minute.
- D. Decreasing at a rate of  $\frac{2}{3}$  litres per minute.
- E. Decreasing at a rate of  $-\frac{2}{3}$  litres per minute.

**Question 5**

$ABCD$  is a rectangle.  $A$  is the point  $(2,0)$ ,  $B$  is the point  $(0, 3)$  and  $C$  is the point  $(12, 6)$ . The equation of the line  $AD$  is

- A.  $y - 4x - 8 = 0$
- B.  $y - 4x + 8 = 0$
- C.  $2y - x + 2 = 0$
- D.  $4y - x + 2 = 0$
- E.  $4y - x - 2 = 0$

## Question 6



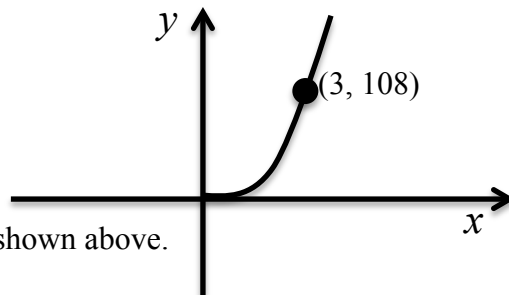
The feasible region bounded by  $OABCD$  for a linear programming problem is shaded in the diagram above.

The dotted line represents the objective function  $Z = ax + by$ .

The maximum value for the objective function occurs at

- A. Any point along the line segment  $BC$ .
- B. Point  $A$ .
- C. Point  $B$ .
- D. Point  $C$ .
- E. Point  $D$ .

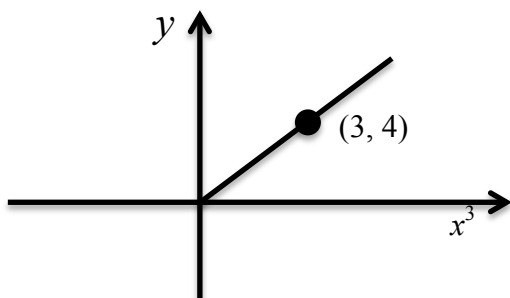
**Question 7**



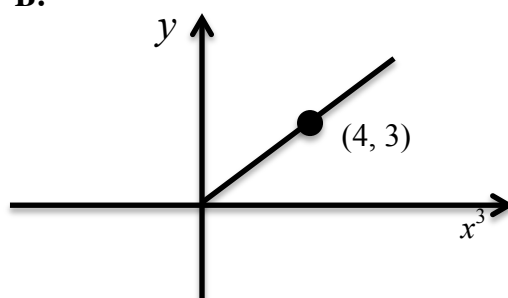
The graph of  $y = kx^3$  is shown above.

Which one of the following can also be used to represent the relationship between  $x$  and  $y$ ?

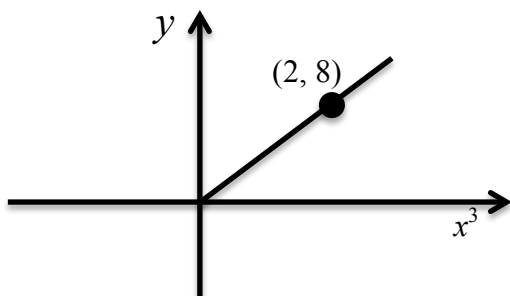
**A.**



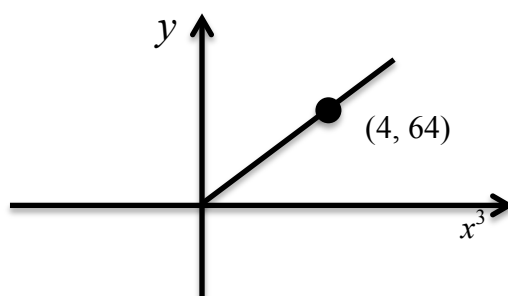
**B.**



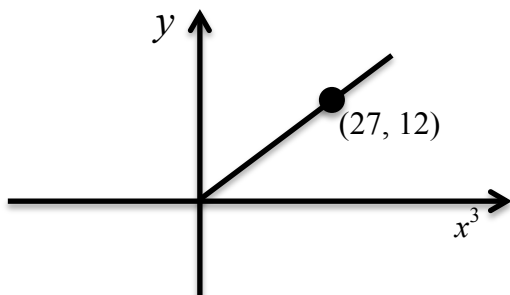
**C.**

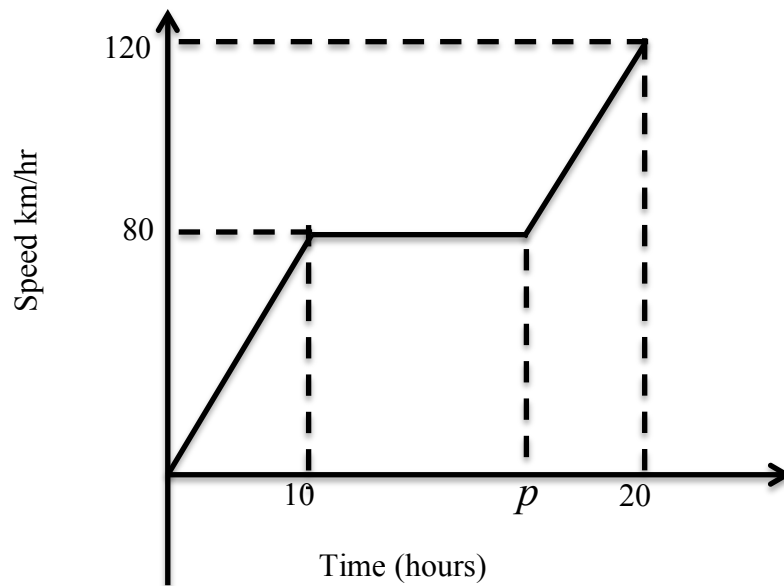


**D.**



**E.**



**Question 8**

Dave and Lisa drove 1360 km in 20 hours. The above graph shows their speed throughout the journey. The value of  $p$  in hours is

- A. 12
- B. 14
- C. 15
- D. 16
- E. 18

**End of Module 4**

**End of 2017 Further Mathematics Trial Examination 1  
Multiple Choice Question Book**

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# **FURTHER MATHEMATICS**

## **Written examinations 1 and 2**

### **FORMULA SHEET**

#### **Directions to students**

Detach this formula sheet during reading time.

This formula sheet is provided for your reference.

## Further Mathematics Formulas

### Core: Data analysis

standardised score:	$z = \frac{x - \bar{x}}{s_x}$
lower and upper fence in a boxplot	lower $Q_1 - 1.5 \times IQR$ upper $Q_3 + 1.5 \times IQR$
least squares line:	$y = a + bx$ where $b = r \frac{s_y}{s_x}$ and $a = \bar{y} - b\bar{x}$
residual value:	residual value = actual value – predicted value
seasonal index:	seasonal index = $\frac{\text{actual figure}}{\text{deseasonalised figure}}$

### Core: Recursion and financial modelling

first-order linear recurrence relation	$u_0 = a, \quad u_{n+1} = bu_n + c$
effective rate of interest for a compound interest loan or investment	$r_{\text{effective}} = \left[ \left( 1 + \frac{r}{100n} \right)^n - 1 \right] \times 100\%$

### Module 1: Matrices

determinant of a $2 \times 2$ matrix:	$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}; \det A = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$
inverse of a $2 \times 2$ matrix:	$A^{-1} = \frac{1}{\det A} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ where $\det A \neq 0$
recurrence relation:	$S_0 = \text{initial state}, \quad S_{n+1} = TS_n + B$

### Module 2: Networks and decision mathematics

Euler's formula:	$v + f = e + 2$
------------------	-----------------



**Module 3: Geometry and measurement**

area of a triangle:	$A = \frac{1}{2}bc \sin(\theta^\circ)$
Heron's formula:	$A = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{1}{2}(a+b+c)$
sine rule:	$\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)}$
cosine rule:	$a^2 = b^2 + c^2 - 2bc \cos(A)$
circumference of a circle:	$2\pi r$
length of an arc:	$r \times \frac{\pi}{180} \times \theta^\circ$
area of a circle:	$\pi r^2$
area of sector	$\pi r^2 \times \frac{\theta^\circ}{360}$
volume of a sphere:	$\frac{4}{3}\pi r^3$
surface area of a sphere:	$4\pi r^2$
volume of a cone:	$\frac{1}{3}\pi r^2 h$
volume of a prism:	area of base $\times$ height
volume of a pyramid:	$\frac{1}{3} \times$ area of base $\times$ height

**Module 4: Graphs and relations**

gradient (slope) of a straight line:	$m = \frac{y_2 - y_1}{x_2 - x_1}$
equation of a straight line:	$y = mx + c$

**END OF FORMULA SHEET**

# VCE FURTHER MATHEMATICS 2017

## Trial Written Examination 1

### ANSWER SHEET

NAME: \_\_\_\_\_

STUDENT  
NUMBER \_\_\_\_\_

SIGNATURE \_\_\_\_\_

### Instructions

- Write your name in the space provided above.
- Write your student number in the space provided above. Sign your name.
- Use a **PENCIL** for **ALL** entries.  
If you make a mistake, **ERASE** it - **DO NOT** cross it out.
- Marks will **NOT** be deducted for incorrect answers.
- **NO MARK** will be given if more than **ONE** answer is completed for any question.
- All answers must be completed like **THIS** example.

A	B	C	D	E
---	---	---	---	---

### Section A

1	A	B	C	D	E
2	A	B	C	D	E
3	A	B	C	D	E
4	A	B	C	D	E
5	A	B	C	D	E
6	A	B	C	D	E
7	A	B	C	D	E
8	A	B	C	D	E
9	A	B	C	D	E
10	A	B	C	D	E
11	A	B	C	D	E
12	A	B	C	D	E

13	A	B	C	D	E
14	A	B	C	D	E
15	A	B	C	D	E
16	A	B	C	D	E
17	A	B	C	D	E
18	A	B	C	D	E
19	A	B	C	D	E
20	A	B	C	D	E
21	A	B	C	D	E
22	A	B	C	D	E
23	A	B	C	D	E
24	A	B	C	D	E

Please turn over . . .

# VCE FURTHER MATHEMATICS 2017

## Trial Written Examination 1

### ANSWER SHEET

**Section B**

(Shade the boxes of the two modules selected **and** write the name of the modules you have selected. There are a total of four from which to choose)

	<b>Matrices</b>		<b>Module 1</b>	<b>1</b>	A	B	C	D	E
				<b>2</b>	A	B	C	D	E
			_____	<b>3</b>	A	B	C	D	E
			_____	<b>4</b>	A	B	C	D	E
			_____	<b>5</b>	A	B	C	D	E
				<b>6</b>	A	B	C	D	E
				<b>7</b>	A	B	C	D	E
				<b>8</b>	A	B	C	D	E
	<b>Networks &amp; decision mathematics</b>		<b>Module 2</b>	<b>1</b>	A	B	C	D	E
				<b>2</b>	A	B	C	D	E
			_____	<b>3</b>	A	B	C	D	E
			_____	<b>4</b>	A	B	C	D	E
			_____	<b>5</b>	A	B	C	D	E
				<b>6</b>	A	B	C	D	E
				<b>7</b>	A	B	C	D	E
				<b>8</b>	A	B	C	D	E
	<b>Geometry and measurement</b>		<b>Module 3</b>	<b>1</b>	A	B	C	D	E
				<b>2</b>	A	B	C	D	E
			_____	<b>3</b>	A	B	C	D	E
			_____	<b>4</b>	A	B	C	D	E
			_____	<b>5</b>	A	B	C	D	E
				<b>6</b>	A	B	C	D	E
				<b>7</b>	A	B	C	D	E
				<b>8</b>	A	B	C	D	E
	<b>Graphs and relations</b>		<b>Module 4</b>	<b>1</b>	A	B	C	D	E
				<b>2</b>	A	B	C	D	E
			_____	<b>3</b>	A	B	C	D	E
			_____	<b>4</b>	A	B	C	D	E
			_____	<b>5</b>	A	B	C	D	E
				<b>6</b>	A	B	C	D	E
				<b>7</b>	A	B	C	D	E
				<b>8</b>	A	B	C	D	E

*Please DO NOT fold, bend or staple this form*