

2018 VCE Further Mathematics Trial Examination 1



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VICTORIAN CERTIFICATE OF EDUCATION 2018

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

Use the following information to answer Questions 1 and 2

The back-to-back stem and leaf below shows the number of newspapers purchased each month by a sample of men and women.

Men				Women		
8	4	0		4	4	4
9	5	1		2	7	9
0	0	2		4	5	
6	3	1		3		
	2	4		6		

Key 1 | 2 = 12

Question 1

What percentage of women in the sample purchased at least 24 newspapers each month?

- A. 20%
- B. 30%
- C. 40%
- D. 60%
- E. 70%

Question 2

What was the upper quartile for the number of newspapers purchased by this sample of men each month?

- A. 15
- B. 30
- C. 33
- D. 36
- E. 39.9

Question 3

The table below shows the length of 10 leaves in a sample

Length of leaf (cm)	8	7	4	13	9	12	9	5	10	7
------------------------	---	---	---	----	---	----	---	---	----	---

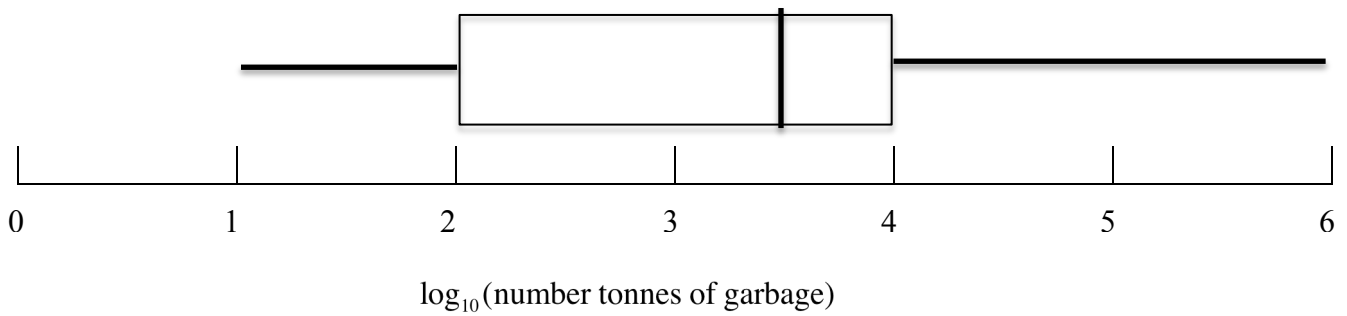
The mean, standard deviation and range of this sample are closest to respectively

- A. 8.4, 2.8, 8
- B. 8.33, 2.7, 8
- C. 8.33, 2.7, 9
- D. 8.4, 2.9, 9
- E. 8.4, 2.8, 9

Question 4

Data is collected on the number of tonnes of garbage collected each week in a particular street.

The results are shown in the boxplot below.



25% of the data is greater than

- A. 10 tonnes
- B. 100 tonnes
- C. 1000 tonnes
- D. 10000 tonnes
- E. 100000 tonnes

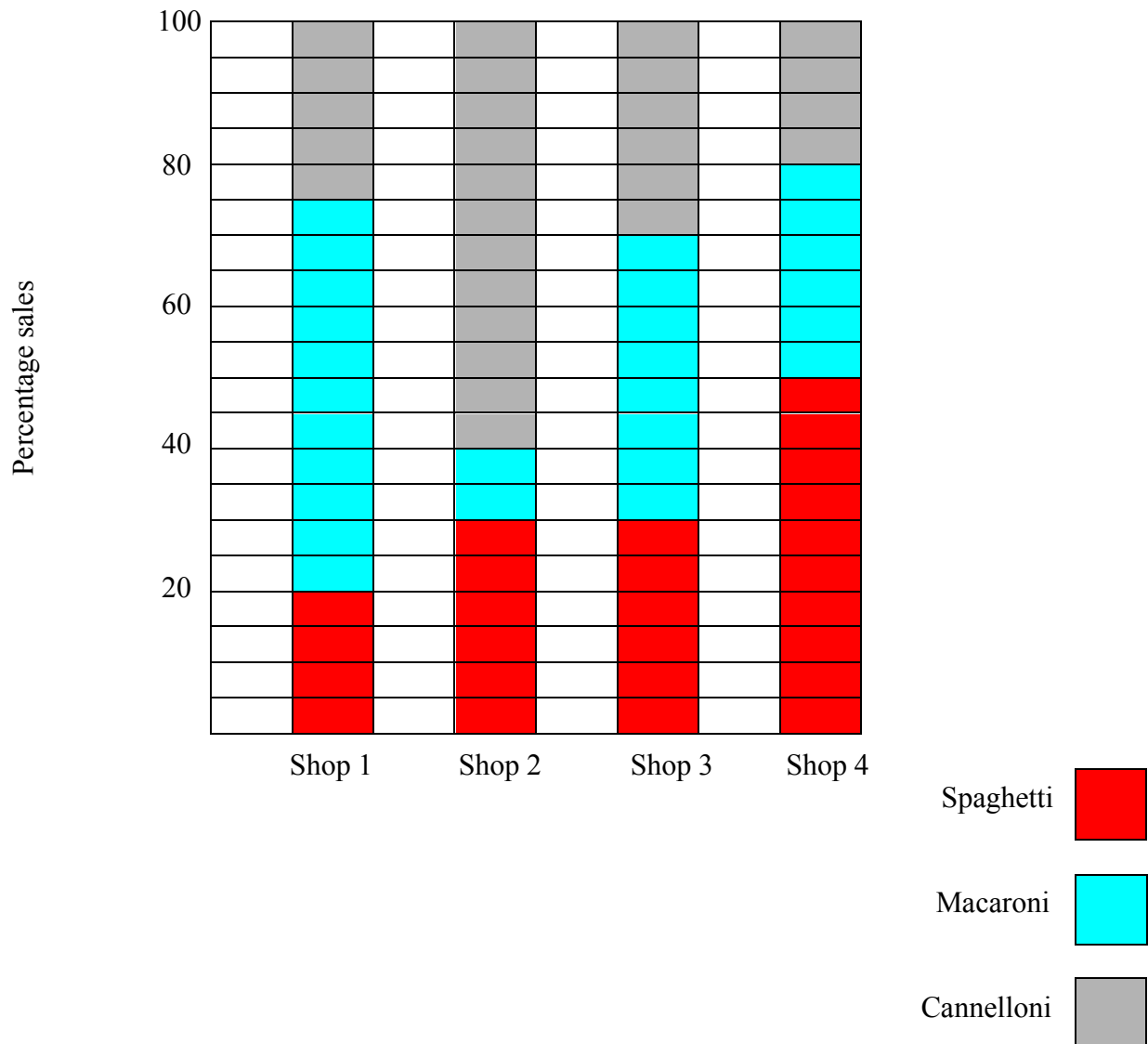
Question 5

The speed of cars on a freeway is normally distributed. For a two-hour period on a certain day, police fine motorists exceeding the speed limit of 100 km/hr. They fine 150 motorists out of 6000, and note that the mean speed is 90 km/hr. The standard deviation is

- A. 2
- B. 3
- C. 5
- D. 10
- E. 14

Use the following information to answer Questions 6 to 8

The graph below shows the percentage sale of three different types of pasta in four different shops.



Question 6

The variables, *sales* and *shops* are

- A. Numerical and categorical respectively.
- B. Nominal and ordinal respectively.
- C. Categorical and numerical respectively
- D. Both are ordinal variables.
- E. Both are numerical variables.

Question 7

What was the percentage sale of macaroni in shop 3?

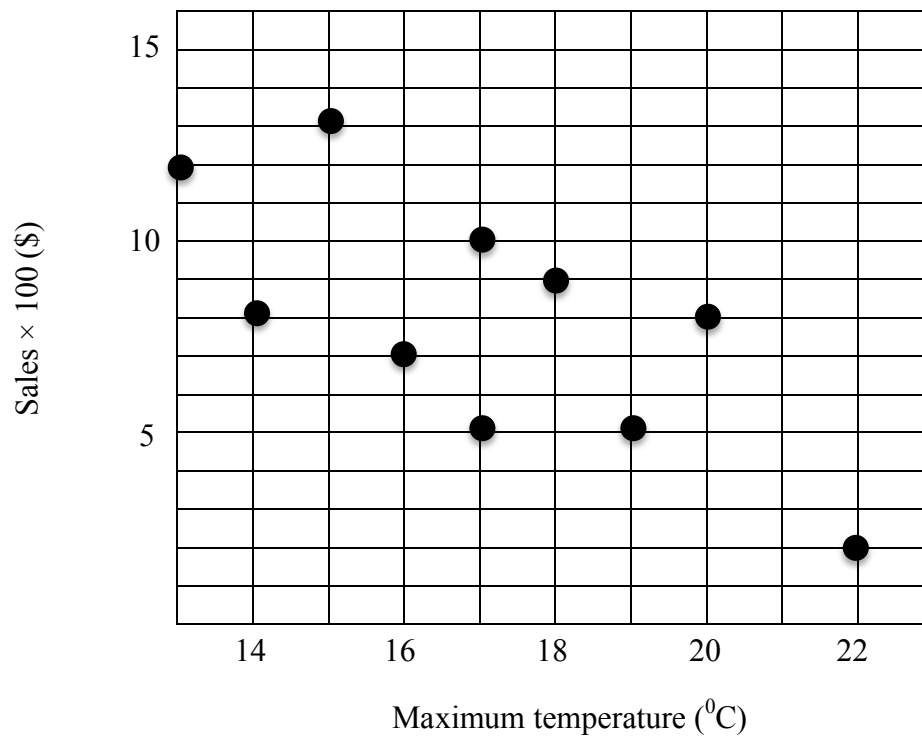
- A. 20%
- B. 30%
- C. 40%
- D. 60%
- E. 70%

Question 8

Which one of the following statements is true?

- A. Shop 1 sold more spaghetti than cannelloni.
- B. Shop 3 had the least percentage sales of cannelloni.
- C. Shops 1 and 2 sold the same percentage of spaghetti.
- D. The percentage of macaroni sold in shop 4 was less than double the percentage of macaroni sold in shop 2.
- E. Shop 1 sold more macaroni than spaghetti and cannelloni combined.

Use the following information to answer Questions 9 to 11



The above scatterplot shows the sale of soup and maximum temperature over ten days.

Question 9

The equation of the least squares line is closest to

- A. $Sales = 2277 - 87 \times \text{maximum temperature}.$
- B. $\text{Maximum temperature} = 2277 - 87 \times \text{sales}.$
- C. $Sales = 1350 - 87 \times \text{maximum temperature}.$
- D. $\text{Maximum temperature} = 1350 - 87 \times \text{sales}.$
- E. $Sales = 13 - 48 \times \text{maximum temperature}.$

Question 10

When the least squares line on the scatterplot is used to predict the sales of soup, the residual when the temperature is 15° is closest to

- A. -328
- B. -203
- C. 3
- D. 203
- E. 328

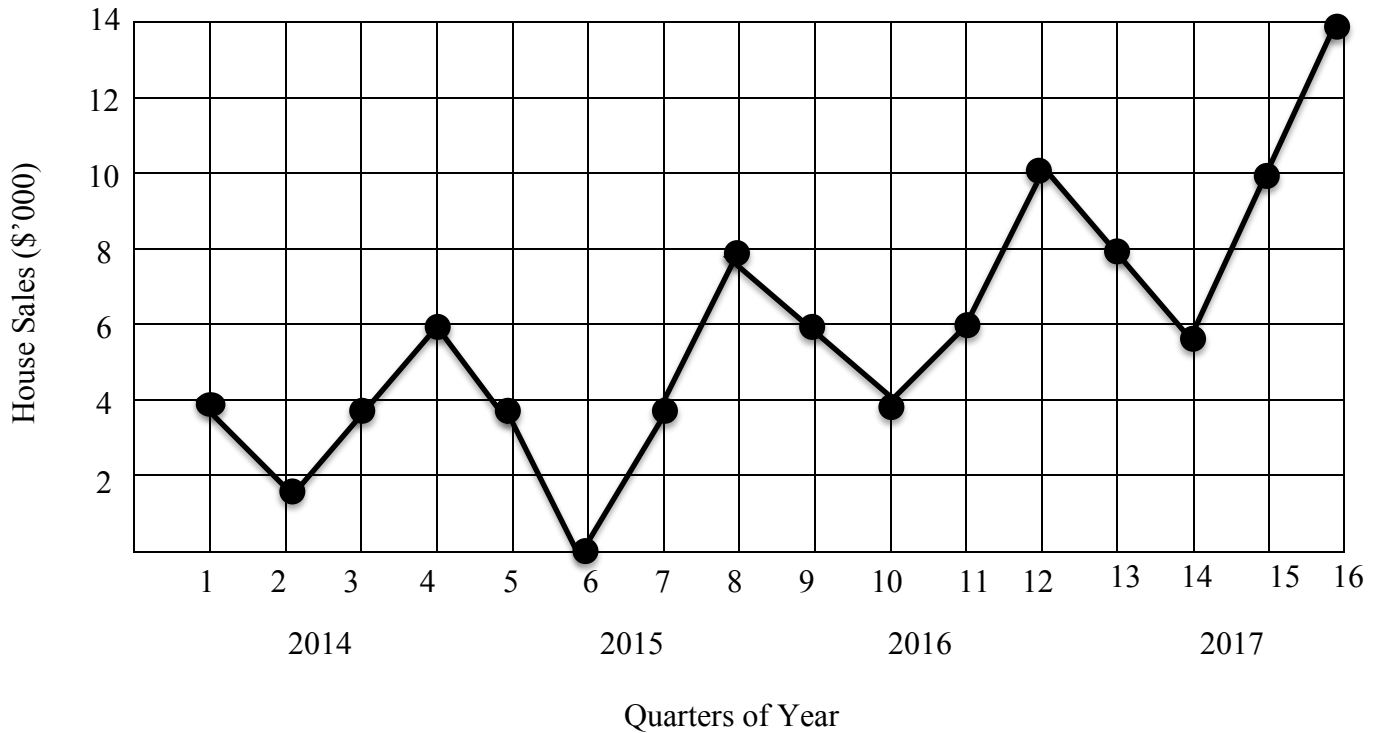
Question 11

From the given information, which one of the following statements is true?

- A. The regression line predicts that on average, the sale of soup decreases by about \$50 for each 1°C rise in maximum temperature.
- B. 48.4% of the variation in sales cannot be explained by the variation in maximum temperature.
- C. The coefficient of determination is approximately -0.5
- D. Pearson's correlation coefficient indicates that there is a weak negative association between sales of soup and maximum temperature.
- E. A falling maximum temperature causes people to buy more soup.

Use the following information to answer Questions 12 and 13

The quarterly house sales in Mount Beautiful over a four-year period are shown in the time series plot below.



Question 12

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

- A. Seasonality only.
- B. Decreasing trend with irregular fluctuations
- C. Cyclical with an increasing trend.
- D. Seasonality with an increasing trend.
- E. Cyclical.

Question 13

The five mean smoothed house sales for the first quarter in 2016 is closest to

- A. \$3600
- B. \$4800
- C. \$5000
- D. \$5600
- E. \$6800

Question 14

The revenue from sales each month for the first year of a four-year period is shown in the table below.

Month	Revenue (\$)
January	7000
February	8000
March	9000
April	3500
May	7000
June	7500
July	9000
August	12000
September	9000
October	14500
November	16200
December	11300

This information is used to determine the seasonal index for each month of this year. The seasonal index for November is closest to

- A. 1.8
- B. 1.7
- C. 1.5
- D. 1.3
- E. 1.0

Use the following information to answer Questions 15 and 16

A trend line was fitted to deseasonalised quarterly data for a certain year. The seasonal index for three of the quarters is shown in the table below.

Quarter	1	2	3	4
Seasonal Index	1.3	0.9	1.1	

The equation of the trend line is *deseasonalised sales* = $823000 + 21400 \times \text{the quarter number}$

Question 15

Using this trend line, the actual sales for the fourth quarter will be closest to

- A. \$636020
- B. \$845100
- C. \$937180
- D. \$1175300
- E. \$1298000

Question 16

To correct for seasonality, the percentage change in the number of sales for the fourth quarter would be closest to

- A. An increase of 23%
- B. A decrease of 23%
- C. An increase of 43%
- D. A decrease of 53%
- E. An increase of 53%

Recursion and financial modelling**Question 17**

The recurrence relation $V_1 = -10$ $V_{n+1} = 3V_n + 9$ models a sequence.

The first five terms of this sequence are

- A. -10, -21, -54, -153, -450
- B. -10, -21, 72, 225, 684
- C. -10, 39, 126, 387, 1170
- D. -10, 21, -72, 225, -684
- E. -10, 21, -54, 153, -450

Question 18

A printer is depreciated using the reducing balance depreciation method. The value of the printer in dollars after n years, V_n , is modeled by the recurrence relation $V_0 = 8000$ $V_{n+1} = 0.64V_n$

The rule for the value of the printer after ten years is

- A. $V_n = 8000^n \times 0.64$
- B. $V_n = 8000 \times 0.64^n$
- C. $V_n = 8000^n \times 0.36$
- D. $V_n = 8000 \times 0.36^n$
- E. $V_n = 8000 \times 1.64^n$

Question 19

John invests \$2000 in a bank at 6% annual interest, compounding monthly. He adds \$600 to this account at the end of each month just after the interest has been paid. The recurrence relation that models this situation where V_n is the value of the investment in dollars after n months is

- A. $V_0 = 2000 \quad V_{n+1} = 0.94V_n + 600$
- B. $V_0 = 2000 \quad V_{n+1} = 0.94V_n - 600$
- C. $V_0 = 2000 \quad V_{n+1} = 1.06V_n + 600$
- D. $V_0 = 2000 \quad V_{n+1} = 1.06V_n - 600$
- E. $V_0 = 2000 \quad V_{n+1} = 1.005V_n + 600$

Question 20

Lucy purchased carpet for \$6000. The carpet is expected to have a scrap value of \$150 after ten years, using flat rate depreciation.

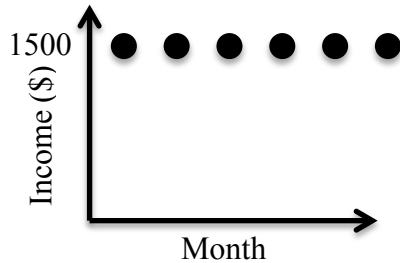
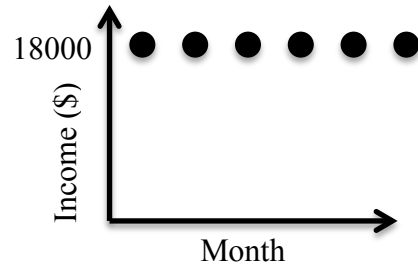
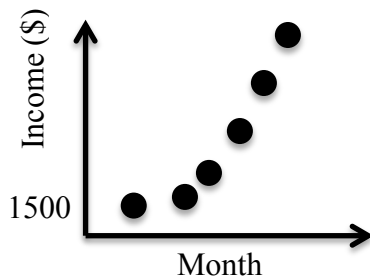
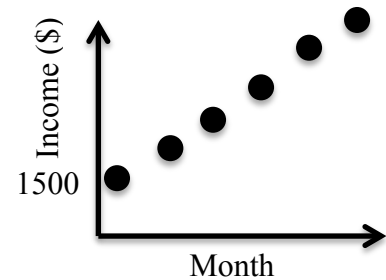
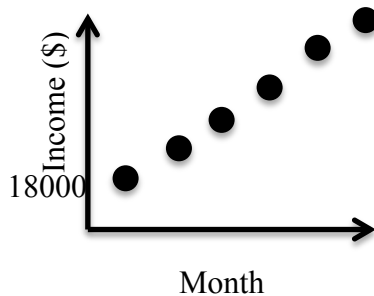
Which one of the following expressions could be used to find the value of the carpet, in dollars, after four years?

- A. 0.6×6000
- B. $6000 - 0.4 \times 150$
- C. $6000 - (6000 - 150) \times 0.4$
- D. $6000 - (6000 - 150) \div 0.4$
- E. $6000 \times 0.4 - 150$

Question 21

Sam puts \$600000 into a perpetuity account, which pays 3% per annum compounding monthly.

Which one of the following graphs shows the amount of money that Sam will receive as income from this account each month?

A.**B.****C.****D.****E.**

Question 22

The reducing balance depreciation for a car purchased for \$28000 with a scrap value of \$4000 after 8 years is closest to

- A. 12.3%
- B. 15.2%
- C. 18.4%
- D. 21.6%
- E. 22.8%

Question 23

Grace wants to be paid a monthly annuity of \$1200. For this purpose she invests \$50000 at 5% interest per annum, compounding monthly.

The length of time she can be paid the annuity is closest to

- A. 3 years.
- B. 3 years and 10 months.
- C. 4 years and 6 months.
- D. 5 years.
- E. 5 years and 2 months.

Question 24

Mr. and Mrs. Smith borrow \$800000 at 4% per annum compounding monthly to buy a house. They agree to pay back the loan in equal monthly installments over 25 years. After 15 years, they find themselves in a position where they can repay \$5500 per month. The total number of years that it will have taken them to repay the loan will now be closest to

- A. 24 years
- B. 23 years
- C. 22 years
- D. 21 years
- E. 20 years

END OF SECTION A

SECTION B - Modules**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

If A is a 3×4 matrix and B is a 4×2 matrix, then the order of matrix $2AB$ is

- A. 4×4
- B. 2×3
- C. 4×6
- D. 3×2
- E. 6×4

Question 2

For which value of a would the following have no solution?

$$\begin{bmatrix} 4 & -5 \\ 6 & a \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$$

A. -7.5

B. -5

C. -3

D. 3

E. 7.5

Question 3

$$\begin{bmatrix} 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} P \\ Q \\ R \\ S \\ T \end{bmatrix} \text{ equals}$$

A. $\begin{bmatrix} T \\ S \\ R \\ P \\ Q \end{bmatrix}$

B. $\begin{bmatrix} T \\ R \\ S \\ Q \\ P \end{bmatrix}$

C. $\begin{bmatrix} T \\ R \\ S \\ P \\ Q \end{bmatrix}$

D. $\begin{bmatrix} S \\ T \\ Q \\ R \\ P \end{bmatrix}$

E. $\begin{bmatrix} S \\ T \\ Q \\ P \\ R \end{bmatrix}$

Question 4

A factory makes dresses, shirts and pants. A retailer bought from the factory 200 dresses at \$50 each, 140 shirts at \$30 each and 120 pants at \$40 each.

He then sold all the dresses for \$100 each, all the shirts for \$90 each, half the pants for \$60 each and the remainder of the pants for \$30 each.

Which one of the following would give the total profit made by the retailer?

A.

$$\begin{bmatrix} 200 & 140 & 120 \end{bmatrix} \begin{bmatrix} 100 \\ 90 \\ 30 \end{bmatrix}$$

B.

$$\begin{bmatrix} 200 & 140 & 120 \end{bmatrix} \begin{bmatrix} 50 \\ 60 \\ 30 \end{bmatrix}$$

C.

$$\begin{bmatrix} 200 & 140 & 120 \end{bmatrix} \begin{bmatrix} 50 \\ 60 \\ 10 \end{bmatrix}$$

D.

$$\begin{bmatrix} 200 & 140 & 60 & 60 \end{bmatrix} \begin{bmatrix} 50 & 100 \\ 140 & 90 \\ 30 & 60 \\ 30 & 30 \end{bmatrix}$$

E.

$$\begin{bmatrix} 200 & 140 & 60 & 60 \end{bmatrix} \begin{bmatrix} 50 & 100 \\ 140 & 90 \\ 30 & 60 \\ 30 & -30 \end{bmatrix}$$

Question 5

$$x + z = 9$$

$$3x - y = 1$$

$$2x + 3y - z = 12$$

The solution of the simultaneous equation above is given by

A.
$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{6} \begin{bmatrix} 1 & 3 & 1 \\ 3 & -3 & 3 \\ 11 & -3 & -1 \end{bmatrix} \begin{bmatrix} 9 \\ 1 \\ 12 \end{bmatrix}$$

B.
$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{12} \begin{bmatrix} 1 & 3 & 1 \\ 3 & -3 & 3 \\ 11 & -3 & -1 \end{bmatrix} \begin{bmatrix} 9 \\ 1 \\ 12 \end{bmatrix}$$

C.
$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 & 0 & 1 \\ 3 & -1 & 0 \\ 2 & 3 & -1 \end{bmatrix} \begin{bmatrix} 9 \\ 1 \\ 12 \end{bmatrix}$$

D.
$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{6} \begin{bmatrix} 1 & 0 & 1 \\ 3 & -1 & 0 \\ 2 & 3 & -1 \end{bmatrix} \begin{bmatrix} 9 \\ 1 \\ 12 \end{bmatrix}$$

E.
$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \frac{1}{12} \begin{bmatrix} 1 & 3 & 2 \\ 0 & -1 & 3 \\ 1 & 0 & -1 \end{bmatrix} \begin{bmatrix} 9 \\ 1 \\ 12 \end{bmatrix}$$

Question 6

$$X = \begin{bmatrix} 6 & 11 & 16 & 21 \\ 7 & 12 & 17 & 22 \\ 8 & 13 & 18 & 23 \end{bmatrix} \quad Y = \begin{bmatrix} 1 & -1 & -3 & -5 \\ 4 & 2 & 0 & -2 \\ 7 & 5 & 3 & 1 \end{bmatrix}$$

$$Z = X - Y$$

What is the rule for finding the elements in Z where z_{ij} is the element in row i and column j

- A. $2i + 7j$
- B. $7j - 2i$
- C. $7i - 2j$
- D. $7i + 2j$
- E. $2i - 7j$

Question 7

Five teams, **A**lbatross, **B**udgerigar, **C**ockatoo, **D**ove and **E**gret compete in a round robin.

The following matrix shows the results.

		<i>loser</i>				
		<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>winner</i>	<i>A</i>	0	0	1	1	0
	<i>B</i>	1	0	1	0	1
	<i>C</i>	0	0	0	1	0
	<i>D</i>	0	1	0	0	1
	<i>E</i>	1	0	1	0	0

Here, a 1 in row 2, column 1 indicates that the Budgerigars beat the Albatross team.

When the two-step dominance score is added to the one-step dominance score, which one of the following is true?

- A.** Albatross comes first and Dove comes last.
- B.** Albatross comes first and Cockatoo comes last.
- C.** Budgerigar comes first and Cockatoo comes last.
- D.** Budgerigar comes first and Dove comes last.
- E.** Egret comes first and Dove comes last.

Question 8

From a country town, 400 people travel to supermarkets each week in three different larger towns. The towns are Ardeen, Blaxland and Costers.

In the first week, 45% of the people go to Ardeen, 30% go to Blaxland and the rest go to Costers.

The towns that the people select each week change according to the transition matrix below.

$$T = \begin{matrix} & \begin{matrix} A & B & C \end{matrix} \\ \begin{bmatrix} 0.3 & 0.7 & 0.1 \\ 0.2 & 0.1 & 0.6 \\ 0.5 & 0.2 & 0.3 \end{bmatrix} \end{matrix}$$

Which one of the following is true according to the above information?

- A. In the first week, 70 people went to the supermarket in Blaxland.
- B. In the long term, most people will shop at the supermarket in Blaxland.
- C. In the second week, most people shopped at the supermarket in Costers.
- D. In the third week, most people shopped at the supermarket in Ardeen.
- E. 27% of the people will shop at the supermarket in Blaxland in the second week.

End of Module 1

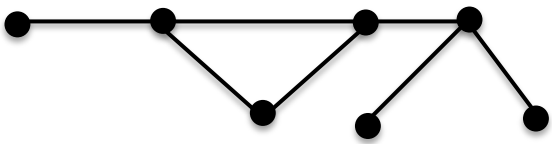
Module 2: Networks and decision mathematics

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.

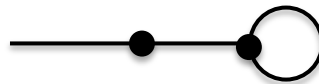
Question 1

Which one of the following is a tree?

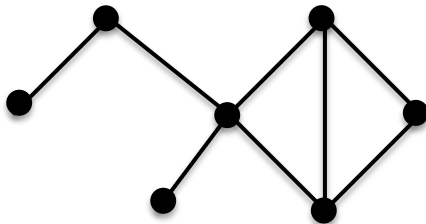
A.



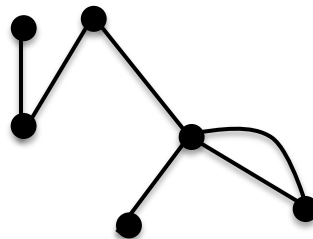
B.



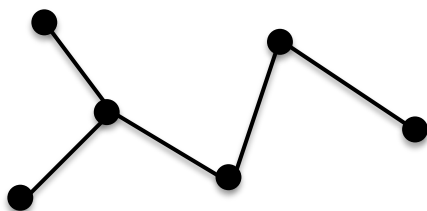
C.

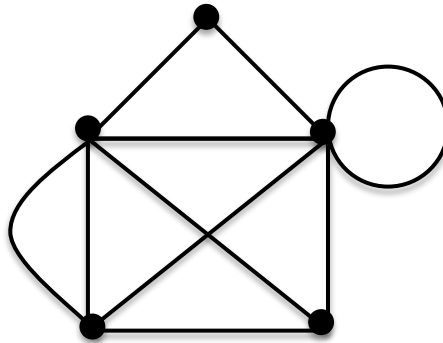


D.



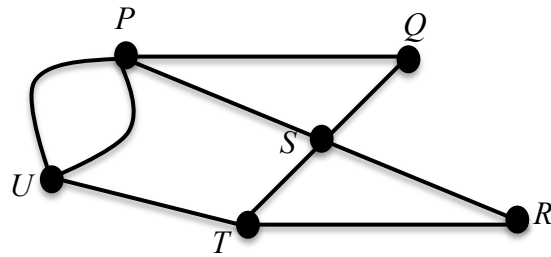
E.



Question 2

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

- A. 17
- B. 18
- C. 19
- D. 20
- E. 21

Question 3

In the graph above, an Eulerian circuit would exist if an extra line were drawn between

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

Use the following information to answer questions 4 and 5.

There are four tasks, P , Q , R and S to be completed by four people T , U , V and W in the minimum amount of time. Table 1 shows the time in minutes that each person takes to complete each task.

Table 1

	T	U	V	W
P	12	8	11	7
Q	6	5	7	5
R	11	12	9	12
S	4	7	4	5

The Hungarian algorithm is applied to Table 1 to produce table 2.

Table 2

	T	U	V	W
P	5	1	4	0
Q	1	0	2	0
R	2	3	0	3
S	0	3	0	1

Question 4

Which one of the following is true if the tasks are to be completed in the minimum amount of time?

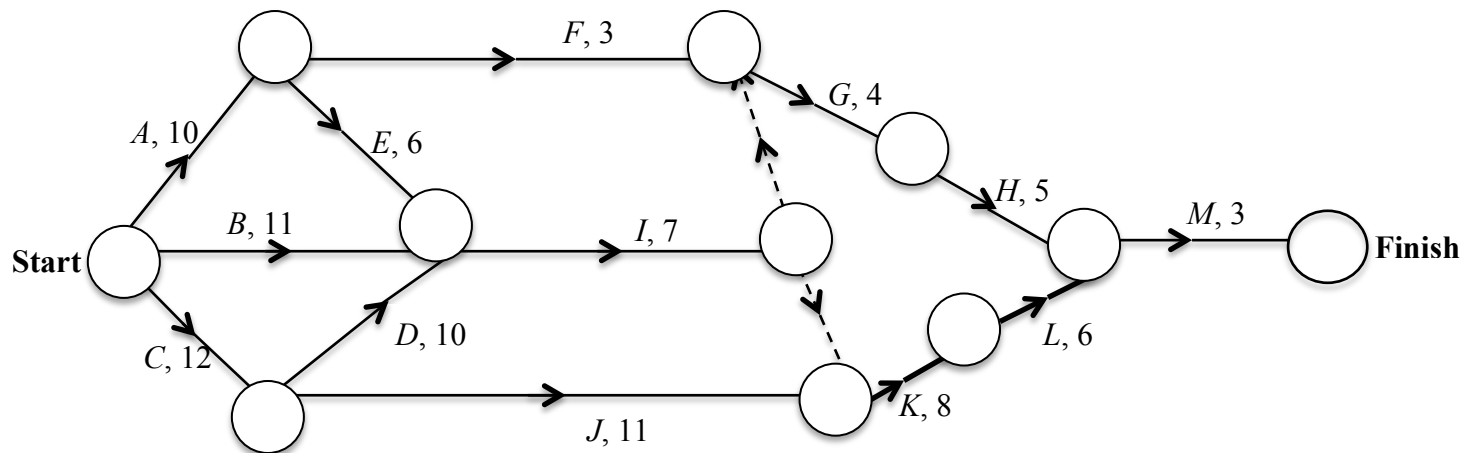
- A. V should do task Q .
- B. V should do task R .
- C. W should do task Q .
- D. U should do task S .
- E. U should do task P .

Question 5

The minimum time for all the tasks to be completed is

- A. 20 minutes.
- B. 23 minutes.
- C. 25 minutes.
- D. 30 minutes.
- E. 35 minutes.

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

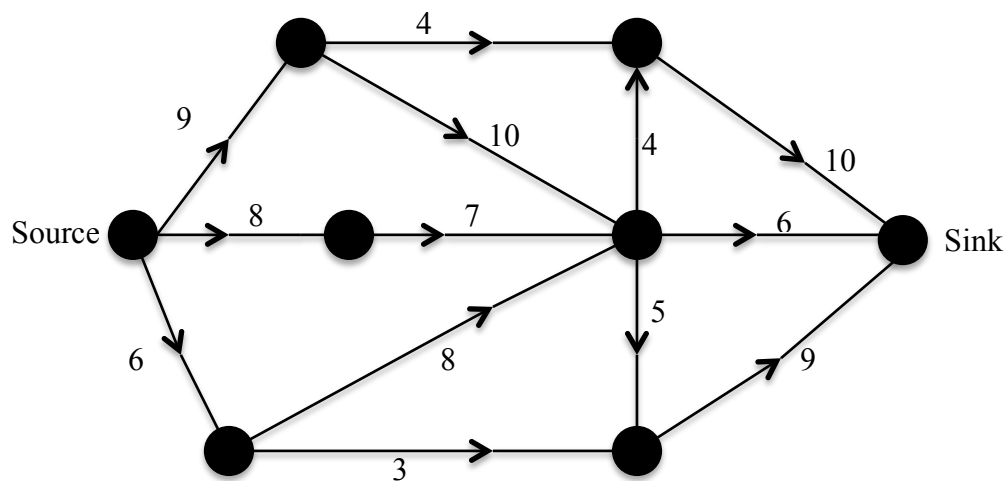
The critical path for the project is

- A. $A - F - G - H - M$
- B. $C - D - I - K - L - M$
- C. $C - D - E - F - G - H - M$
- D. $B - I - G - H - M$
- E. $B - I - K - L - M$

Question 7

Which one of the following will cause the critical path to change?

- A. Activity *A* takes 5 days longer than expected.
- B. Activity *J* takes 5 days longer than expected.
- C. Activity *F* takes 20 days longer than expected.
- D. Activity *K* takes 5 days longer than expected.
- E. Activity *E* takes 7 days longer than expected.

Question 8

The flow of water through pipelines, in litres per minute, is shown in the network above.

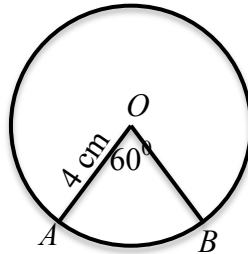
The maximum flow of water from the source to the sink in litres per minute is

- A. 17
- B. 19
- C. 22
- D. 23
- E. 25

End of Module 2

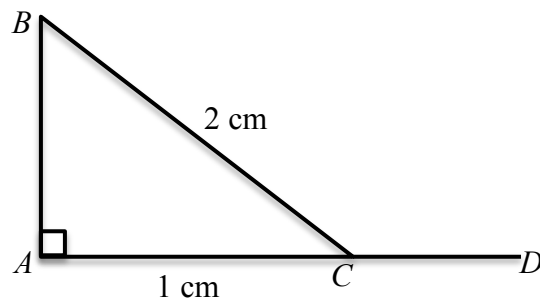
Module 3: Geometry and measurement

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

In the above diagram, O is the centre of the circle. $AO = 4 \text{ cm}$ and $\angle AOB = 60^\circ$
The area of the minor sector, AOB is closest to

- A. 8.4 cm^2
- B. 11.2 cm^2
- C. 16.8 cm^2
- D. 33.5 cm^2
- E. 67 cm^2

Question 2

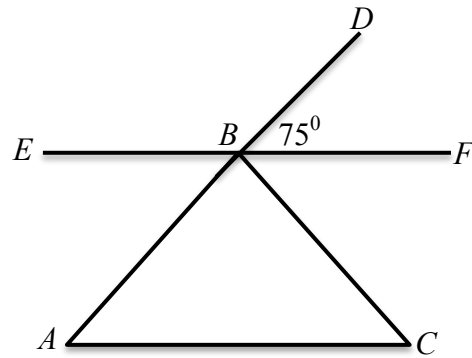
The size of $\angle BCD$ is

- A. 117°
- B. 120°
- C. 150°
- D. 153°
- E. 160°

Question 3

The above right cones are similar. The surface area of B is 342 cm^2 and the surface area of A is 38 cm^2 . If the perpendicular height of B is 12 cm, then the perpendicular height of A is closest to

- A. 1.3 cm
- B. 2 cm
- C. 2.9 cm
- D. 4 cm
- E. 5.7 cm

Question 4

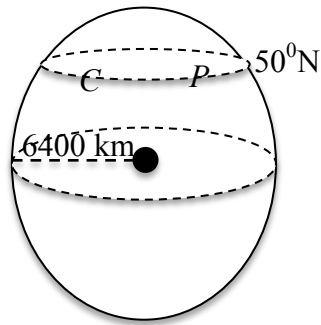
$$AB = BC$$

EF is parallel to AC

$$\angle DBF = 75^\circ$$

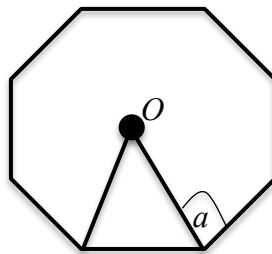
What is the size of $\angle ABC$?

- A. 30°
- B. 37.5°
- C. 45°
- D. 60°
- E. 75°

Question 5

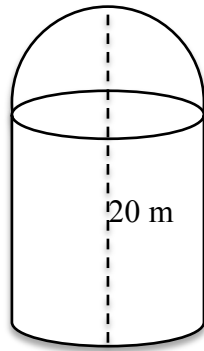
The position of Calgary is 50°N , 114°W and the position of Paris is 50°N , 2°E .
The distance around the 50°N parallel of latitude between the two cities is closest to

- A. 1296 km
- B. 8042 km
- C. 8329 km
- D. 9926 km
- E. 12957 km

Question 6

The above regular octagon has a centre at O . The size of the angle marked a is closest to

- A. 30°
- B. 36°
- C. 45°
- D. 54°
- E. 67.5°

Question 7

The butterfly enclosure shown above is in the shape of a cylinder with a hemispherical top. The height of the structure is 20 m and the diameter of the base is 18 m. The surface area of the enclosure is closest to

- A. 1385 m²
- B. 1640 m²
- C. 1708 m²
- D. 1894 m²
- E. 2149 m²

Question 8

Melissa flies 75 km on a bearing of 204°T and then travels 50 km on a bearing of 150°T . The distance she now is from her starting point is closest to

- A. 98 km
- B. 102 km
- C. 112 km
- D. 125 km
- E. 138 km

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

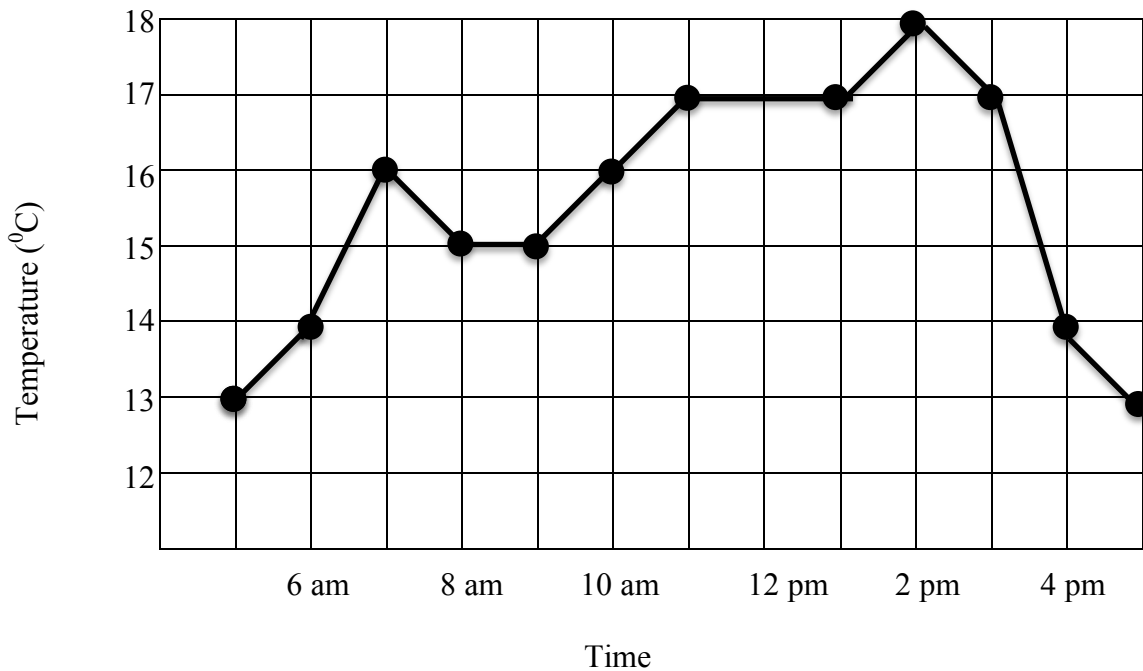
What is the equation of the line joining the points (3, 0) and (3, -2)?

- A. $y = 3x - 11$
- B. $y = -2x + 3$
- C. $y = 3x$
- D. $y = 3$
- E. $x = 3$

Question 2

What is the y intercept of the line joining the points (3, 4) and (5, 10)?

- A. (0, 5)
- B. (0, 3)
- C. (0, -5)
- D. (3, 0)
- E. (5, 0)

Question 3

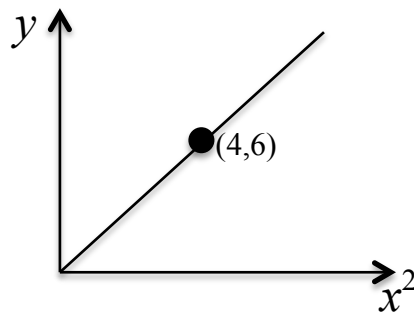
The above graph shows the temperature in a certain city over a twelve-hour period. Which one of the following statements is **FALSE**?

- A. The maximum temperature reached in this time period was 18°C
- B. The temperature was above 16°C for five hours during this time period.
- C. There was no change in temperature for one hour either side of midday.
- D. The greatest change in temperature occurred between 3 pm and 4 pm.
- E. The greatest rise in temperature was between 6 am and 7 am.

Question 4

Kevin bought 2 burgers and 7 hotdogs at the football and paid \$24 for them.
Sean bought 3 burgers and 5 hotdogs at the football and paid \$22.80 for them.
Rory bought 4 burgers and 2 hotdogs at the football. How much did Rory pay?

- A. \$19.20
- B. \$20.80
- C. \$21.20
- D. \$24.80
- E. \$26.20

Question 5

A graph of y versus x^2 is shown above.

The rule connecting x and y is

- A. $y = \frac{3}{2}x^2$
- B. $y = \frac{2}{3}x^2$
- C. $y = 3x^2$
- D. $y = \frac{1}{3}x^2$
- E. $y = \frac{3}{8}x^2$

Question 6

Jake makes 800 shirts to sell in his shop.

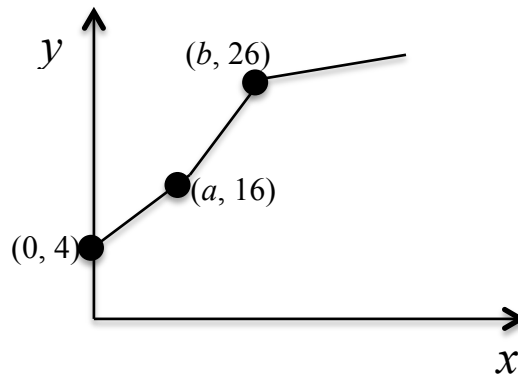
The cost, \$ C , of producing n shirts is $C = 24.6n + 360$.

Jake sells $\frac{3}{4}$ of the shirts for \$36 each and the remainder is sold at a discount price.

Jake's overall profit for the shirts is \$3960.

The selling price of each discounted shirt was

- A. \$34.95
- B. \$28.00
- C. \$20.00
- D. \$18.00
- E. \$12.00

Question 7

The rule for the line segment graph above is given below.

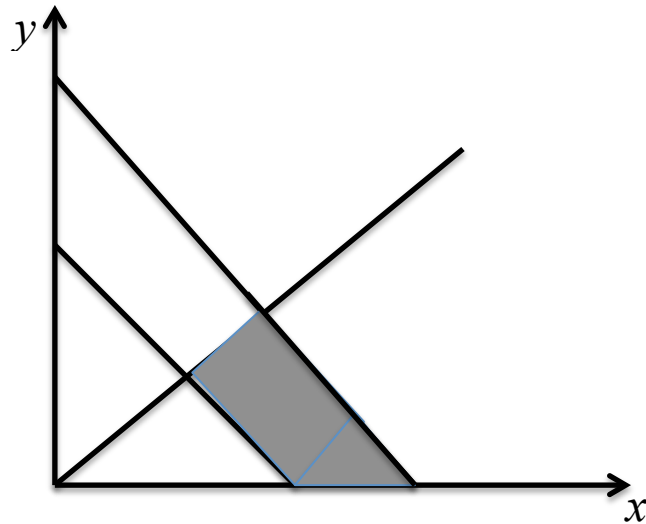
$$y = 3x + 4 \quad 0 \leq x \leq a$$

$$y = 5x - 4 \quad a < x \leq b$$

$$y = cx + 14 \quad b < x \leq 10$$

The values of a , b and c are

- A. $a = 2, b = 6, c = 12$
- B. $a = 4, b = 8, c = 2\frac{1}{3}$
- C. $a = 2, b = 8, c = 2\frac{1}{3}$
- D. $a = 4, b = 6, c = 2$
- E. $a = 4, b = 6, c = 12$

Question 8

The above graph shows the feasible region shaded for a linear programming problem where $x \geq 0$, $y \geq 0$, $x + y \geq 30$, $x + y \leq 60$ and $y \leq 2x$

Which one of the following statements is true?

- A. (35, 30) lies in the feasible region.
- B. (20, 41) lies in the feasible region.
- C. (5, 10) lies in the feasible region.
- D. (12, 22) lies in the feasible region.
- E. (40, 30) lies in the feasible region.

End of Module 4

**End of 2018 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 2×2 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 2×2 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:	$A = \frac{1}{2}bc \sin(\theta^0)$
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:	$r \times \frac{\pi}{180} \times \theta^0$
area of a circle:	πr^2
area of sector	$\pi r^2 \times \frac{\theta^0}{360}$
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 2018

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 2018

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)

	Matrices	Module 1	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
	Networks & decision mathematics	Module 2	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
	Geometry and measurement	Module 3	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
	Graphs and relations	Module 4	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

Please DO NOT fold, bend or staple this form