

# 2015 VCE Further Mathematics Trial Examination 2



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STUDENT NUMBER

Letter

Figures									
Words									

**VICTORIAN CERTIFICATE OF EDUCATION  
2015  
FURTHER MATHEMATICS**

**Trial Written Examination 2 (Analysis task)**

Reading time: 15 minutes

Total writing time: 1 hour 30 minutes

**QUESTION AND ANSWER BOOK**

**Structure of book**

**Core**

Number of questions	Number of questions to be answered
3	3

**Modules**

Number of modules	Number of modules to be answered
6	3

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

**Materials supplied**

- Question and answer book of 37 pages.
- Working space is provided throughout the book.
- There is a detachable sheet of miscellaneous formula supplied.

**Instructions**

- Detach the formula sheet from the book during reading time.
- Write your **student number** in the space provided above on this page.
- All written responses must be in English.

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

# 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: 
$$z = \frac{x - \bar{x}}{s_x}$$

least squares line: 
$$y = a + bx \text{ where } b = r \frac{s_y}{s_x} \text{ and } a = \bar{y} - b\bar{x}$$

residual value: 
$$\text{residual value} = \text{actual value} - \text{predicted value}$$

seasonal index: 
$$\text{seasonal index} = \frac{\text{actual figure}}{\text{deseasonalised figure}}$$

**Module 1: Number patterns**

arithmetic series: 
$$a + (a + d) + \dots + (a + (n - 1)d) = \frac{n}{2}[2a + (n - 1)d] = \frac{n}{2}(a + l)$$

geometric series: 
$$a + ar + ar^2 + \dots + ar^{n-1} = \frac{a(1 - r^n)}{1 - r}, r \neq 1$$

infinite geometric series: 
$$a + ar + ar^2 + ar^3 + \dots = \frac{a}{1 - r}, |r| < 1$$

**Module 2: Geometry and trigonometry**

area of a triangle: 
$$\frac{1}{2}bc \sin A$$

Heron's formula: 
$$A = \sqrt{s(s - a)(s - b)(s - c)} \text{ where } s = \frac{1}{2}(a + b + c)$$

circumference of a circle: 
$$2\pi r$$

area of a circle: 
$$\pi r^2$$

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 cylinder: 
$$\pi r^2 h$$

volume of a prism: 
$$\text{area of base} \times \text{height}$$

volume of a pyramid: 
$$\frac{1}{3} \text{area of base} \times \text{height}$$

Pythagoras' theorem:  $c^2 = a^2 + b^2$

sine rule:  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

cosine rule:  $c^2 = a^2 + b^2 - 2ab \cos C$

### Module 3: Graphs and relations

#### Straight line graphs

gradient (slope):  $m = \frac{y_2 - y_1}{x_2 - x_1}$

equation:  $y = mx + c$

### Module 4: Business-related mathematics

simple interest:  $I = \frac{\text{Pr}T}{100}$

compound interest:  $A = PR^n$  where  $R = 1 + \frac{r}{100}$

hire purchase: effective rate of interest  $\approx \frac{2n}{n+1} \times \text{flat rate}$

annuities:  $A = PR^n - \frac{Q(R^n - 1)}{R - 1}$ , where  $R = 1 + \frac{r}{100}$

### Module 5: Networks and decision mathematics

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

### Module 6: 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  $\det A \neq 0$

## END OF FORMULA SHEET

**Specific Instructions**

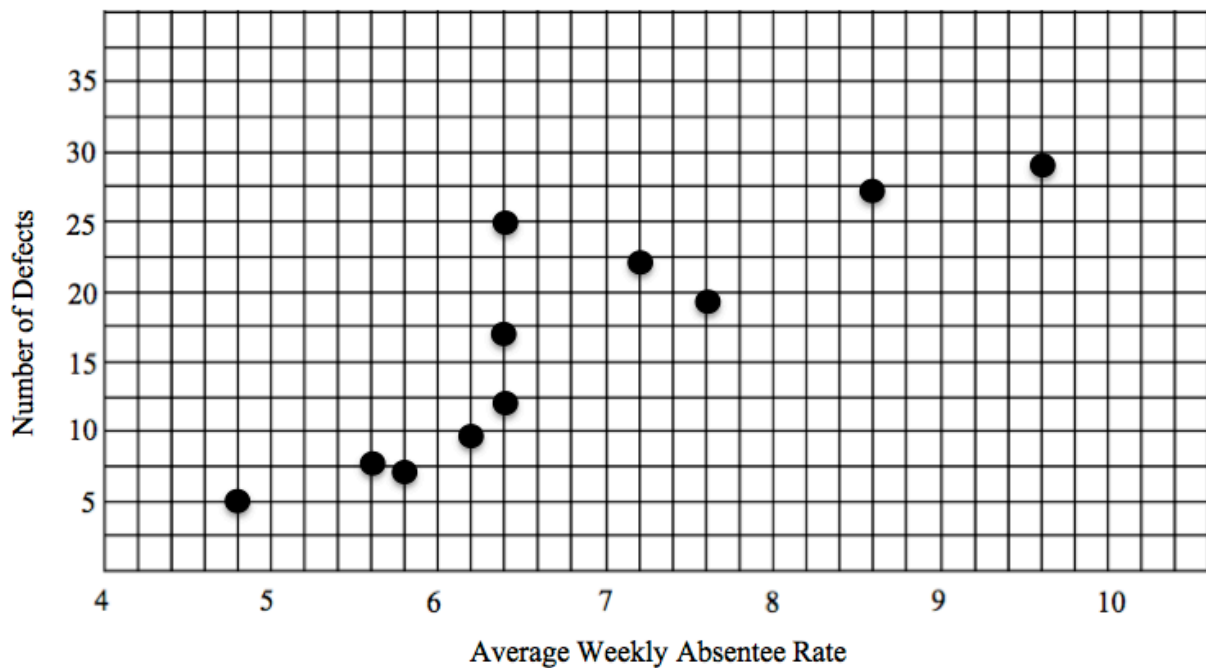
This task paper consists a core and six modules. Students should answer **all** questions in the core and then select **three** modules and answer **all** questions within the modules selected.

		<b>Page</b>
<b>Core:</b>	Data analysis	2
 <b>Module</b>		
Module 1:	Number patterns and applications .....	7
Module 2:	Geometry and trigonometry .....	12
Module 3:	Graphs and relations .....	16
Module 4:	Business-related mathematics .....	21
Module 5:	Networks and decision mathematics .....	24
Module 6:	Matrices .....	31

**Core: Data analysis****Question 1**

The production manager of a computer company examined the relationship between the absentee rate of its workers and the number of defects produced in the manufacture of the computer. The following table shows the data she collected from a sample of 12 weeks.

Average weekly absentee rate	Number of defects in that week
7.2	22
6.4	17
6.2	9
5.6	8
6.4	12
4.8	5
5.8	7
7.6	19
6.4	25
9.6	29
8.6	27
8.2	32



- a. One piece of data from the table is missing from the graph. Insert this piece of data on the graph above.

1 mark



**Core: Data analysis****Question 1 (continued)**

- b.** What is the equation of the least squares regression line for this data? Give all values in this answer to the nearest integer.

---

1 mark

- c.** Show the least squares regression line on the above graph.

1 mark

- d.** What does the gradient of this line tell you in terms of the daily absentee rate and the number of defects?

---

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1 mark

- e.** What is the residual value for the point that you inserted on this graph?

---

1 mark

**Core: Data analysis****Question 2**

A survey of 20 customers of each of two companies was carried out to examine the waiting time in days for them to receive their new computer after they had purchased it. The results are listed in the table below.

Company A	Company B
15	10
28	18
13	26
2	14
19	9
8	6
23	12
17	5
22	22
24	25
5	30
7	11
15	19
20	14
12	7
26	13
28	31
13	12
20	7
9	8

**Core: Data analysis**

**Question 2 (continued)**

- a. The customer services manager of company B has decided that more than 14 days wait for a purchased computer is unacceptable. What percentage of those surveyed from his company had unacceptable waiting times?

\_\_\_\_\_

1 mark

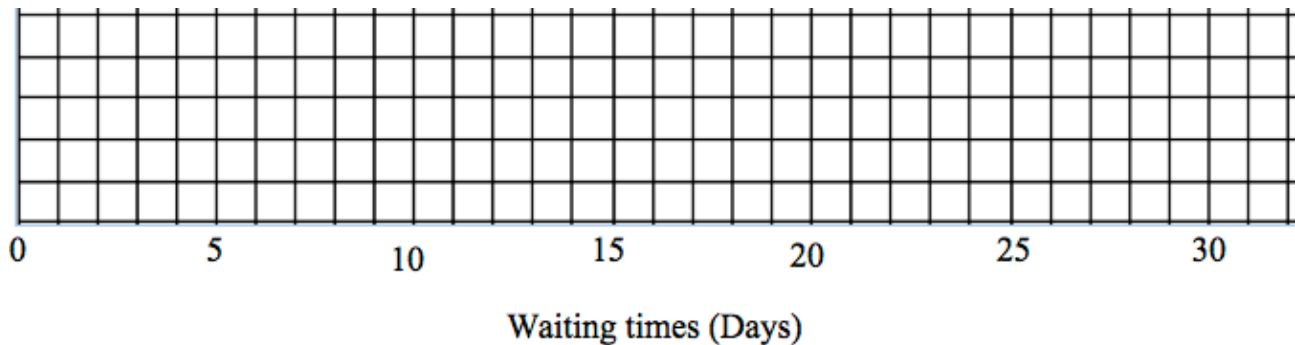
- b. What was the mean and standard deviation for company A? Give your answers to one decimal place.

Mean = \_\_\_\_\_

Standard Deviation = \_\_\_\_\_

2 marks

- c. Draw a box plot for waiting times for company B.



2 marks

**Core: Data analysis****Question 3**

Computer company, C, has waiting times that are normally distributed with a mean waiting time of 15 days and a standard deviation of 2 days.

- a. What percentage of waiting times are less than 15 days?

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1 mark

- b. What percentage of customers would have to wait more than 19 days for their computer?

---

1 mark

- c. What percentage of customers would have to wait between 11 and 21 days for their computer?

---

1 mark

Computer Company, D, also has waiting times that are normally distributed. Only 2.5% of people buying computers from company D have to wait more than 12 minutes, but 16% of customers have to wait less than 3 minutes.

- d. What are the mean and standard deviation for the waiting times in company D?

Mean

---

Standard Deviation

---

2 marks

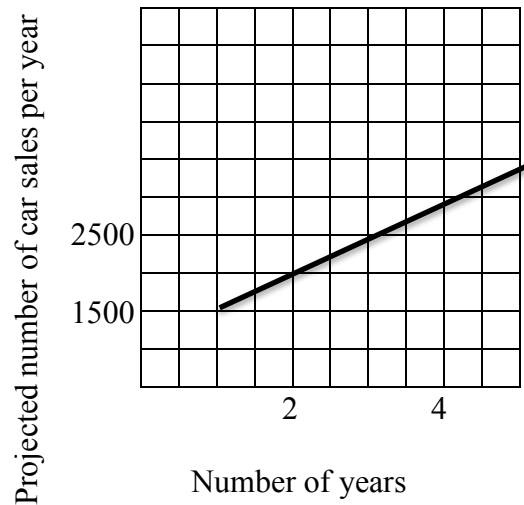
**Total = 15 marks****End of Core: Data analysis**

**Module 1: Number patterns and applications**

If you choose this module, all questions are to be answered.

**Question 1**

A company is planning to produce a small electric car. The expected sales of this car are given in the graph below.



- a. How many of these cars does the company expect to sell in the first year?

---

1 mark

- b. If the projected number of sales each year continues according to the above graph, how many more cars would the company expect to sell each year?

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1 mark

**Module 1: Number patterns and applications**

**Question 1 (continued)**

c. How many of these cars does the company expect to sell in the tenth year of production?

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1 mark

d. What is the total number of expected sales of this car over the first ten years of production?

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1 mark

e. In what year of production would the yearly sales of this car be expected to first exceed 15600?

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1 mark

**Module 1: Number patterns and applications****Question 2**

The company begins production and produces 1500 cars in the first year, 2100 cars in the second year and 2940 cars in the third year. If the production continues in this way

- a. Show why the number of cars produced each year forms a geometric sequence.

---

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1 mark

- b. How many cars will be produced in the sixth year?  
Give your answer to the nearest whole number.

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1 mark

- c. If the company's prediction for sales is correct, and it keeps producing cars at the above rate, how many cars would remain unsold at the end of the ten-year period?  
Give your answer to the nearest whole number.

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1 mark

To overcome this problem, the company decides to reduce its rate of production after the first six years. From this time on, the production rate drops by 5% each year.

- d. How many cars will be produced in the seventh year of production.  
Give your answer to the nearest whole number.

---

---

1 mark

**Module 1: Number patterns and applications****Question 2 (continued)**

Cars not sold in the country of origin in a particular year are all sold overseas.

- e. What will be the first year that the demand for cars in the country of origin will be greater than the number of cars available for sale?

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1 mark

**Question 3**

Mr. Choi sells the cars and in the first year his salary is \$45000, plus a bonus of \$2000. Each year his salary is 10% more than the previous year's income, but his bonus remains constant. A difference equation for his income can be written in the form

$$I_{n+1} = pI_n + q \quad I_1 = k$$

- a. What are the values of  $p$ ,  $q$ ,  $k$  and  $I_2$ ?

---

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2 marks



**Module 1: Number patterns and applications****Question 3 (continued)**

- b. Ms. Abdullah earns \$48000 in the first year for selling cars and a bonus of \$2000. If her salary increases by 8% per year and her bonus increases by \$180 per year, in what year will her income first exceed \$200000?

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2 marks

- c. Mrs. Douglas has an income given by the difference equation

$$I_{n+1} = 1.05I_n + k \quad I_1 = \$30000$$

If her income in the third year of working for the company is \$41,751, what is the value of  $k$ ? Give your answer to the nearest whole number.

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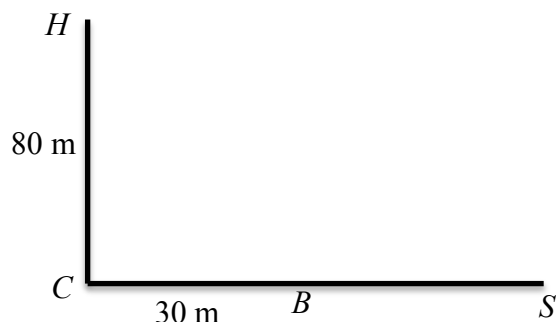
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1 mark

**Total = 15 marks****End of Module 1: Number patterns and applications**

**Module 2: Geometry and trigonometry**

If you choose this module, all questions are to be answered.

**Question 1**

A small shopping centre consists of a baker,  $B$ , a chocolate shop,  $C$ , a supermarket,  $S$  and a hairdresser,  $H$ . The chocolate shop, the baker and the supermarket lie in a straight line, going in an east-west direction. The hairdresser is due north of the chocolate shop. The butcher and the hairdresser are 30m and 80 m respectively from the chocolate shop.

- a. How far is the butcher from the hairdresser? Give your answer to one decimal place.

---

1 mark

- b. What is the size of angle  $HSB$ ? Give your answer to the nearest degree.

---

1 mark

- c. If the supermarket and the hairdresser are equidistant from the butcher, what is the size of angle  $HSB$ ? Give your answer to the nearest degree.

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1 mark

- d. What is the true bearing of the hairdresser from the supermarket? Give your answer to the nearest degree.

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1 mark

**Module 2: Geometry and trigonometry****Question 2**

A green grocer, G, moves into the shopping centre. Her shop is at a bearing of  $120^\circ$  T from the chocolate shop and  $200^\circ$  T from the supermarket.

- a. What is the size of angle  $CSG$ ?

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1 mark

- b. What is the size of angle  $CGS$ ?

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1 mark

- c. How far is the green grocer from the supermarket? Give your answer to the nearest metre.

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1 mark

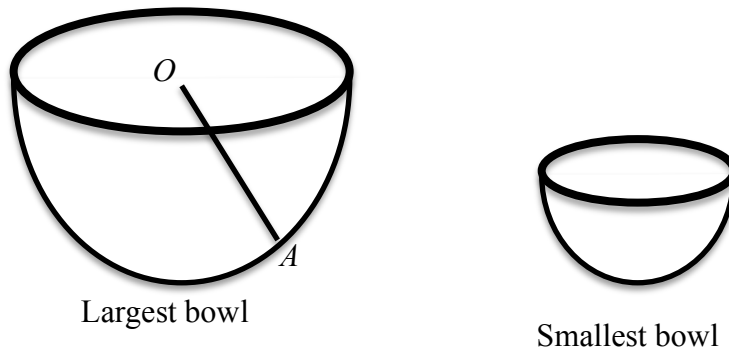
- d. If the boundary of the shopping centre is given by  $HCGSBH$ , what is the total area of the shopping centre? Give your answer to the nearest square metre.

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1 mark

**Module 2: Geometry and trigonometry****Question 3**

In his salon, the hairdresser uses similar hemispherical bowls.



- a. If the diameter of the largest of his bowls is 28 cm, what is the length of  $OA$ ?

---

1 mark

- b. What is the volume of the largest bowl? Give your answer to the nearest cubic centimetre.

---

1 mark

- c. If the ratio of the volume of the largest to the smallest bowl is  $64 : 1$ , then what is the radius of the smallest bowl?

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1 mark

- d. Water is poured into the large bowl to a depth of 8 centimetres. What is the radius of the surface of the water? Give your answer to two decimal places.

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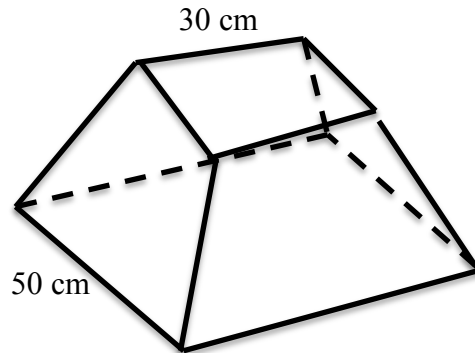


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1 mark

**Module 2: Geometry and trigonometry****Question 4**

The chocolate shop owner displays her best individual chocolates in a glass case in her window. The box has been made from a square pyramid with a base of 50 cm that has had the top of the pyramid cut off to give the truncated shape shown below. The top of the case is a square of side length 30 cm. The height of the case is 40 cm.



- a. Show that the height of the pyramid before it was truncated was 100cm.

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1 mark

- b. What was the area of each triangular face of the original pyramid? Give your answer to the nearest square centimetre.

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1 mark

- c. What is the total surface area of the display case? Give your answer to the nearest square metre.

---

1 mark

**Total 15 marks****End of Module 2: Geometry and trigonometry**

**Module 3: Graphs and relations**

If you choose this module, all questions are to be answered.

**Question 1**

A company makes rain jackets and snow jackets. Each snow jacket takes 10 minutes to cut and 30 minutes to stitch. Each rain jacket takes 20 minutes to cut and 20 minutes to stitch. The total number of minutes available for cutting the jackets is 160, and for stitching is 240.

If  $x$  is the number of snow jackets produced and  $y$  the number of rain jackets produced, then two of the inequalities representing the constraints are given below.

$$y \geq 0$$
$$3x + 2y \leq 24$$

- a. Write down the inequality for the time taken to cut the jackets.

---

1 mark

Each snow jacket is to be lined whereas each rain jacket is to be unlined. It takes 6 minutes to line a snow jacket and the maximum amount of time available to line the jackets is 36 minutes.

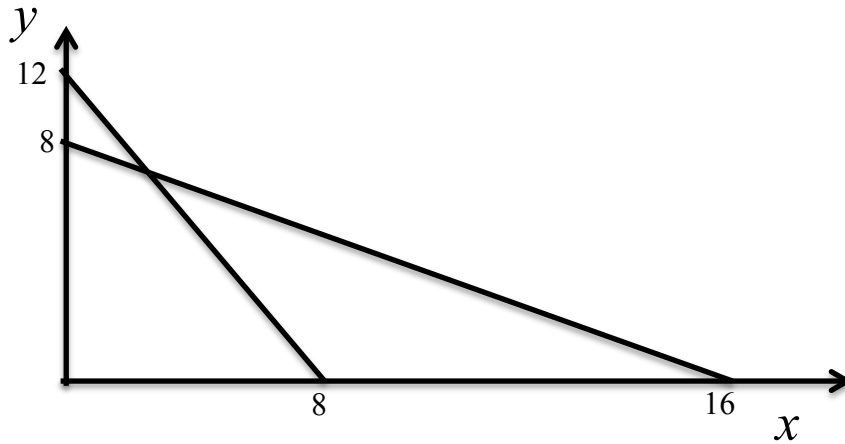
- b. Write an inequation for the time taken to line the jackets.

---

1 mark

**Module 3: Graphs and relations****Question 1 (continued)**

Two of the lines representing the inequalities are shown in the graph below.



- c. On the graph above draw the missing line so that the region satisfying all the constraints can be found.

1 mark

- d. On the graph, shade the region that satisfies all the constraints.

1 mark

- e. The profit for each snow jacket is \$200 and for each rain jacket is \$120. Write an equation to show the profit in terms of  $x$  and  $y$ .

---

1 mark

- f. What is the maximum profit?

---



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2 marks

**Module 3: Graphs and relations****Question 1 (continued)**

- g.** How many snow jackets and how many rain jackets should be made to maximize the profit?

---

1 mark

- h.** The company decides to line the rain jackets instead of lining the snow jackets. The time taken to line a rain jacket is 3 minutes. There is at least 9 minutes available for this lining process. This means that they can now make a profit of \$260 on each snow jacket and \$100 on each rain jacket. By how much will their overall maximum profit be changed because of this change in the lining of the jackets?

---

1 mark

**Question 2**

The sale of lined rain jackets and unlined snow jackets for a particular week is given in the table below.

Type of jacket	Number of Sales		Sale price per jacket
	Male	Female	
Snow	60	30	\$400
Rain	180	50	\$200

- a.** How many rain jackets were sold in this week?

---

1 mark

- b.** What was the cost of producing a rain jacket that was sold in this week?

---

1 mark



**Module 3: Graphs and relations****Question 3**

Mr. and Mrs. Green buy lined snow jackets and take their family of 3 children to the snow for seven days. They stay at the bottom of the mountain where accommodation is cheaper but it costs them \$10 for the car, including the driver, and \$2 per passenger to enter the ski fields each day. Lift tickets can be purchased for \$20 per child per week and \$45 per adult per week.

- a. How much will it cost them for entry to the ski fields and for their lift tickets if they ski each day they are there?

---

1 mark

The daily cost of parking is given in the table below.

Time (hours)	Cost (\$)
$0 \leq t < 2$	0
$2 \leq t < 4$	2.50
$4 \leq t < 5$	5.00
$t \geq 5$	$5.00 + 0.1(2t - 4)$

- b. What is the cost of parking for 8 hours?

---

1 mark

**Module 3: Graphs and relations****Question 3 (continued)**

- c. The cost for parking for the week was \$42. Mr. Green parked for 4 hours on two days of the week and on the other days of the week he parked for  $t$  hours. What was the value of  $t$ ?

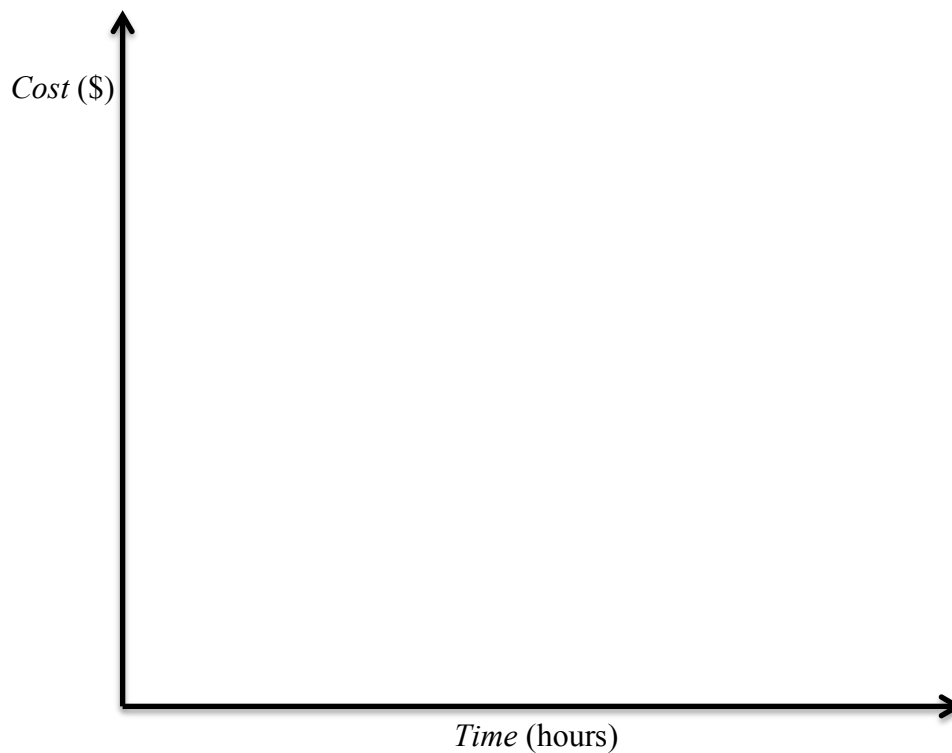
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1 mark

**d.**

On the axes below, draw a graph to show the cost of parking for the first 10 hours.



1 mark

**Total = 15 marks****End of Module 3: Graphs and relations**

**Module 4: Business-related mathematics**

If you choose this module, all questions are to be answered.

**Question 1**

Aisha decides to start her own gym. She has \$80,000 in her bank account and decides to borrow \$332,000 to purchase a building for her gymnasium. The building costs \$400,000.

- a. How much money will she have left in her bank account after purchasing the building?

---

1 mark

She purchases gym equipment for \$18,000 and pays a  $33\frac{1}{3}\%$  deposit. Aisha agrees to repay the money for the gym equipment in monthly instalments of \$420 over 3 years.

- b. How much deposit does she pay?

---

1 mark

- c. How much interest will she pay?

---

1 mark

- d. What is her annual interest rate for the equipment? Give your answer to one decimal place.

---

1 mark

- e. What is her effective interest rate for the equipment per annum? Give your answer to the nearest whole number.

---

1 mark

**Module 4: Business-related mathematics****Question 2**

Aisha can claim a flat rate depreciation of 6% for her gym equipment from the taxation department.

- a. How much can she claim each year?

---

1 mark

- b. How long will it take for the gym equipment to be written off if it is considered worthless when it reaches a value of \$5040?

Give your answer to the nearest whole number.

---

1 mark

- c. Aisha wishes to write her equipment off after 10 years, so decides to use the reducing balance method of depreciation. What rate of depreciation will she need to use?

Give your answer to the nearest whole number.

---

1 mark

**Question 3**

The \$332,000 that Aisha borrowed for the building for her gymnasium costs her 5.2% per annum, calculated on the outstanding monthly balance.

- a. If she wants to repay this money in full in 18 years, how much money will she have to repay each month? Give your answer to the nearest dollar.

---

1 mark

After 5 years of repaying the loan in this way, Aisha inherits \$350,000 from her grandfather. She decides to use \$150,000 of this money to reduce the loan.

- b. How much will she owe on the loan after the loan has been reduced in this way? Give your answer to the nearest dollar.

---

1 mark

- c. Aisha now decides to repay \$1916 per month. How many more years will it take her to repay the loan? Give your answer to the nearest year.

---

1 mark

**Module 4: Business-related mathematics****Question 3 (continued)**

- d. How much will Aisha's last repayment be if she continues to repay \$1916 per month except for the last month?

---

1 mark

**Question 4**

- a. Aisha decides to invest in the stock market and for this purpose she takes out an interest only loan of \$80,000. If the interest on the loan is 6.5% per annum, compounding monthly, what will be her monthly repayments? Give your answer to the nearest cent.

---

1 mark

- b. After 2 years, Aisha sells her shares for \$120000. What is her profit?

---

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1 mark

- c. Aisha places this profit, together with the remainder of the money received from her grandfather, in a perpetuity account that compounds monthly. She wishes to receive \$1530 from this account each month. What interest rate will she need to receive to achieve this? Give your answer to the nearest whole number.

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1 mark

**Total = 15 marks****End of Module 4: Business-related mathematics**

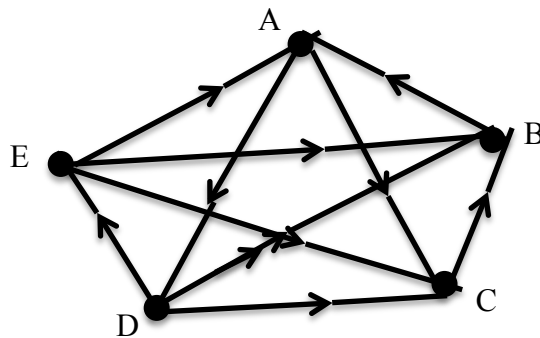
**Module 5: Networks and decision mathematics**

If you choose this module, all questions are to be answered.

**Question 1**

Five country towns, Aliceville, Beaconstown, Carramatta, Dixonvale and Edithaven, play competition football against each other.

The results are shown in the following graph.



- a. Edithaven defeated Carramatta. Name the other teams that were defeated by Edithaven

---

- b. Complete the adjacency matrix for the first step dominance.

1 mark

$$D^1 = \begin{array}{c} A \\ B \\ C \\ D \\ E \end{array} \begin{array}{ccccc} A & B & C & D & E \\ \left[ \begin{array}{ccccc} 0 & 0 & & & 0 \\ 1 & 0 & & & 0 \\ 0 & 1 & & & 0 \\ 0 & 1 & & & 1 \\ & & & & 0 \end{array} \right] \end{array}$$

1 mark

**Module 5: Networks and decision mathematics****Question 1 (continued)**

c. What information does the sum of the rows of  $D^1$  give us?

---

1 mark

d. Complete the 2-step dominance matrix,  $D^2$

---

1 mark

e. Rank the teams from first to last.

---

1 mark

**Module 5: Networks and decision mathematics****Question 2**

The distances between the five towns are listed in the table below.

<b>Aliceville</b>				
25 km	<b>Beaconstown</b>			
30 km	15 km	<b>Carramatta</b>		
----	50 km	----	<b>Dixonvale</b>	
40 km	----	20 km	45 km	<b>Edithaven</b>

- a. Draw a network to show the distances and the connections between the towns.

1 mark

- b. A new water pipe connecting each of the 5 towns is to be installed. Draw a diagram to show the connections between the towns so that the least amount of piping will need to be used.

1 mark



**Module 5: Networks and decision mathematics**

**Question 2 (continued)**

- c. What is the minimum length of pipe required to connect all the towns?

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1 mark

- d. Mimi wants to plan a trip to travel on all the roads linking the five country towns. She would like to travel on each road only once. Is this possible?  
Give a reason why or why not.

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1 mark

**Module 5: Networks and decision mathematics**

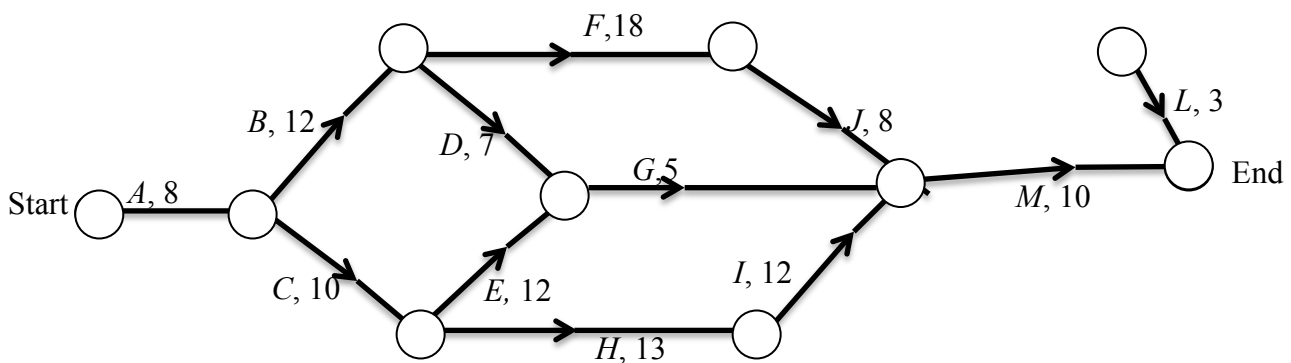
**Question 3**

The mayor of Aliceville is having a new library built for the town. The table below gives the steps required to complete this project and the number of days required for the completion of each activity.

**Steps to complete the project**

Activity	Immediate Predecessor	Activity time
A		8
B	A	12
C	A	10
D	B	7
E	C	12
F	B	18
G		5
H	C	13
I	H	12
J	F	8
K	F	4
L	K	3
M	G, J, I	10

The graph for competing this project is given below.



**Module 5: Networks and decision mathematics****Question 3 (continued)**

- a. Complete the table, “Steps to Complete the Project”, by filling in the missing information for activity G. 1 mark
- b. Complete the above graph by filling in the missing line. 1 mark
- c. What is the shortest time to complete the project?  

---

 1 mark
- d. What is the float time for activity G?  

---

 1 mark

**Module 5: Networks and decision mathematics****Question 3 (continued)**

The project could have its total time reduced by bringing in more workers, but these extra workers are only able to work on activities E, F or H. The times and costs of employing these extra workers is given in the table below.

Activity	Maximum number of days reduction	Cost per day for activity reduction
<b>E</b>	8	\$585
<b>F</b>	13	\$800
<b>H</b>	3	\$1560

- e. If only one of these three activities can have extra workers employed, which one should it be? Give a reason for your answer.

---

1 mark

- f. What will be the minimum extra cost involved if this activity is reduced in time?

---

1 mark

**Total = 15 marks****End of Module 5: Networks and decision mathematics**

**Module 6: Matrices**

If you choose this module, all questions are to be answered.

**Question 1**

Three people, May, Natalie and Owen buy apples, bananas, oranges and mangoes at each of 2 shops, A and B. Each of them buys exactly the same variety and amount of fruit in each shop. The variety and amount of fruit bought in each shop by each person is shown in the table below.

<b>Fruit</b>	<b>May</b>	<b>Natalie</b>	<b>Owen</b>
Apple	6	2	5
Banana	5	3	4
Orange	3	3	1
Mango	1	4	2

- a. Express this information as a  $3 \times 4$  matrix,  $X$ .

---

1 mark

The costs of apples, bananas, oranges and mangoes are 80 cents, 60 cents, 50 cents and \$3.10 respectively in shop A and 50 cents, 70 cents, 30 cents and \$4.50 respectively in shop B.

- b. Express these costs as a  $4 \times 2$  matrix,  $Y$ .

---

1 mark

**Module 6: Matrices****Question 1 (continued)**

c. Find  $XY$ .

---

1 mark

d. What does the element,  $a_{2,1}$ , represent?

---

1 mark

e. How much did Owen spend on fruit?

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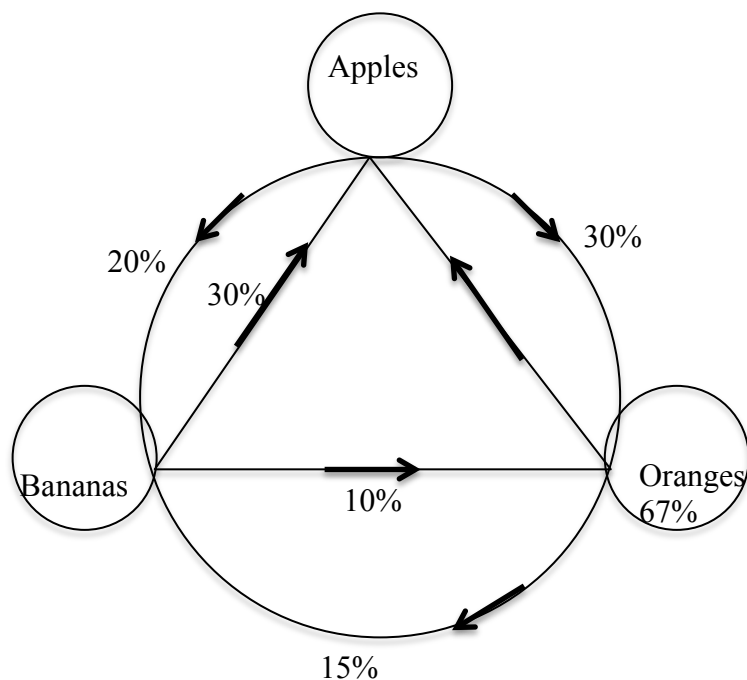
1 mark

**Module 6: Matrices****Question 2**

The owner of shop A observes a certain pattern in the buying habits of people who buy only apples or bananas or oranges.

30% of the people who only buy bananas this week, only buy apples the next week.  
 10% of the people who only buy bananas this week, only buy oranges the next week.  
 67% of the people who only buy oranges this week, only buy oranges the next week.  
 15% of the people who only buy oranges this week, only buy bananas the next week.  
 20% of the people who only buy apples this week, only buy bananas the next week.  
 30% of the people who only buy apples this week, only buy oranges the next week.

- a. Using the above information, complete the diagram below.



1 mark

**Module 6: Matrices****Question 2 (continued)**

- b. Complete the transition matrix below, by converting the percentages to decimals.

$$\begin{array}{r}
 \text{From} \\
 \text{Apple} \quad \text{Banana} \quad \text{Orange} \\
 \text{To} \begin{array}{l} \text{Apple} \\ \text{Banana} \\ \text{Orange} \end{array} \left[ \begin{array}{ccc} & & \\ & & \\ & & \end{array} \right]
 \end{array}$$

1 mark

- c. 900 people buy only apples, bananas or oranges this week at shop A. 300 buy only apples and 500 buy only oranges. Write down the column matrix  $S_0$ , which describes this situation.

---

1 mark

- d. How many people do you expect to buy only bananas next week?

---

1 mark



**Module 6: Matrices**

**Question 2 (continued)**

e. How many people do you expect to buy only oranges in 3 weeks time?

---

1 mark

f. In the long term, how many people do you expect to buy only apples?

---

1 mark

**Module 6: Matrices****Question 3**

Natalie uses matrix  $A = \begin{bmatrix} 3 & 1 \\ 5 & 2 \end{bmatrix}$  to code a secret message, which she sends to May. The girls have agreed on a certain number representing a certain letter, but they use the matrix code to stop others being able to work out what the message is saying.

This time, Natalie's coded message is a matrix  $C = \begin{bmatrix} 20 & 10 & 67 \\ 35 & 19 & 114 \end{bmatrix}$ . She pre-multiplies her original message, B, by her coding matrix to get her coded message.

- a. Write the matrix, D, which May needs to use in order to decode the real message, matrix B.

---

1 mark

- b. In terms of some or all of the matrices, A, B, C and D write an equation to show how Natalie got matrix C

---

1 mark

- c. In terms of all of the matrices, A, B, C and D show the equation May will have to use to decode Natalie's message.

---

1 mark

**Module 6: Matrices****Question 3 (continued)**

- d. What is the numerical decoded message?

---

1 mark

**Total = 15 marks**

**End of Module 6: Matrices**

**End of 2015 VCE Further Mathematics Trial Examination 2  
Question and Answer Book**

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