The Australian Education Academy
2005

FURTHER MATHEMATICS - UNIT 3 & 4

TRIAL EXAMINATION 2 - (ANALYSIS TASK)

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

Student's name: _____

Directions to students

This exam consists of Section A and Section B.
Section A contains a set of extended answer questions from the core, "Data Analysis".
Section A is compulsory and is worth 15 marks.
Section B consists of 5 modules. You should choose 3 of these modules and answer every question in each of your chosen modules. Each of the modules is worth 15 marks.
There is a total of 60 marks available for this exam.
The marks allocated to each of the four questions are indicated throughout.
Students may bring up to two A4 pages of pre-written notes into the exam.
Formula sheets can be found on pages 20-21 of this exam.

These questions have been written and published to assist students in their preparations for the 2005 Further Mathematics Examination 2. The questions and associated answers and solutions do not necessarily reflect the views of the Victoria Curriculum and Assessment Authority. The association gratefully acknowledges the permission of the Authority to reproduce the formula sheet.

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Section A

Core Data Analysis
Three questions. Total 15 marks
Answer all questions in the spaces provided

Question 1

The ages of a group of people attending a classical music recital are shown below.

Age :- 25, 36, 12, 43, 28, 50, 14, 32

a. Use the above data set to calculate the mean of a group of people attending a classical music recital.

_____

_____

_____

1 mark

b. Use the same above data set and calculate the median people attending a classical music recital.

_____

_____

1 mark

c. Using the above parts and calculate the variance of the above distribution.

_____

_____

_____

2 marks

d. What is the percentage of the age group between 27 to 43.

_____

_____

1 mark

Question 2

The table given below gives data relating the percentage of lectures attend by students in a semester and the corresponding mark for each student in the exam for that subject.

Lecture Attendance (%)	70	59	80	64	86	95	78	66
Exam Result (%)	85	60	88	70	90	98	86	65

Table 1

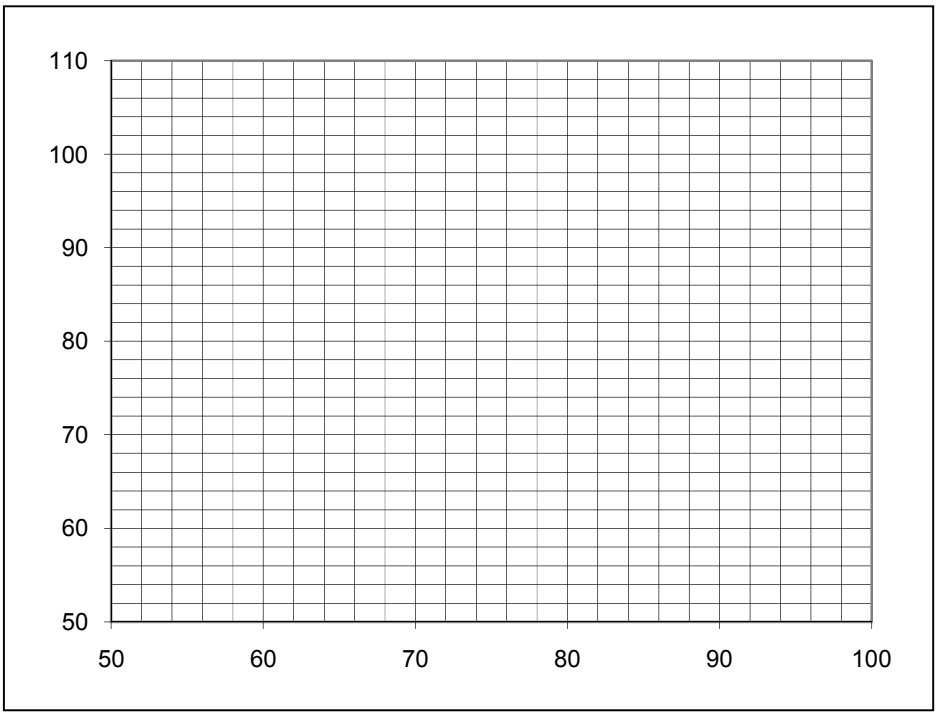
a. What is the independent variable and dependant variable for the above data set.

Independent variable:- _____

Dependant variable :- _____

1 mark

b. Construct a scatter plot for the above data set using the below graph.



2 marks

c. Find the q-correlation coefficient for the above data set.

_____

_____

_____

_____

1 mark

d If you got Pearson's product- moment correlation coefficient (r) as 0.75. Describe the scatter plot in most suitable way.

_____

1 mark

Question 3

Consider the following table from a survey conduct at a new television manufacturing factory. It shows the percentage of defective televisions product on 10 different days after the opening of the factory.

Day	2	4	5	6	8	10	14	15	18	20
Defective rate (%)	18	17	16	10	8	9	6	5	4	2

Table 2

a. Find the equation of the regression line for the data set above, using the 3-median method.

_____

_____

_____

3 marks

b. Find the residuals based upon part (a) regression line.

_____

_____

_____

2 marks
Total 15 marks

Section B

Section B consists of 5 modules. Select any 3 modules
Total marks 60
Answer all question in each of those chosen modules.

Module 1: Number patterns and applications

If you choose this module, all questions must be answered.

Question 1

On the first day Mary hears a rumour. On the second day she tells 3 friends. On the third day each of these 3 friends tell 3 friends of their own friends, and so on.

a. Write the geometric sequence for first for days of the above real-life situation.

_____

_____

_____

2 marks

b. How many people are told of the rumour on the 10^{th} day.

_____

_____

_____

1 mark

c. When the 5^{th} day how many friends tell the rumour.

2 marks

Question 2

The amount of garbage (in tonnes) collected in a particular area by local council each year is recorded over 3 successive years. The data are shown given below.

Year	Amount of garbage
1 (1990)	6.4
2 (1991)	8.5
3 (1992)	10.6

Table 3

If the amount collected each year were to continue to follow a arithmetic sequence.

a. Write down a rule for the amount of the garbage t_n which would be collect in the area in year n.

2 marks

b. What is the amount of garbage in year 1995.

1 mark

c. In which year would be amount of garbage collected 40 tonnes.

2 marks

Question 3

Olivia began her silver coin collection in 1970. The following table shows her coin collection.

Year	No of coins
1970	2
1971	6
1972	8

Table 4

a. Write down the geometric equation for the above data set.

2 marks

b. Write down the first order differences equation for the above data set.

1 mark

c. Using the part (a) and part (b) find the equation for the above data set for t_{n+1}, using n terms.(except t_n terms)

_____

_____

_____

2 marks

Total 15 marks

Module 2: Geometry and Trigonometry

If you choose this module, all questions must be answered.

Question 1

A cylinder of modelling clay has dimension as follows.
Height is 30 cm and diameter is 5 cm. Then the entire cylinder of clay is remould to shape of a pyramid and it's height is 15 cm. It's base is square shape.

a. What is the volume of the cylinder? (round up to 2 decimal places)

_____

_____

_____

1 mark

b. Express in litres for your answer from part (a).

_____

_____

_____

2 marks

c. What is the length of one side of pyramid base?

_____

_____

_____

2 marks

Question 2

The boat sails through the river from port A to port B. The width of the river is 12 km. Port B, C and port D are located same side of the river. Distance from port B to port C is 5 km. The distances are shown below.

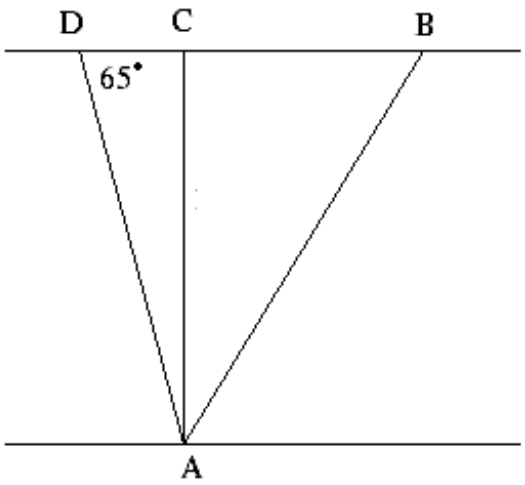


Figure 1

a. Calculate the distance, which the boat sails through the river.
(Round up to 2 decimal places)

_____

_____

_____

2 marks

b. What is the distance that the boat sails to port A to port D?
(Round up to 2 decimal places)

3 marks

Question 3

There are five communication towers as A, B, C, D, E are located as follows.

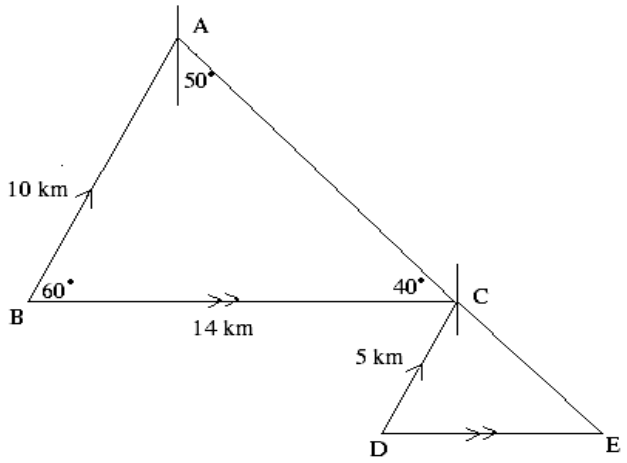


Figure 2

a. Calculate the distance from tower A to tower B.
(Round up to 2 decimal places)

2 marks

b. Calculate the distance from tower C to tower E.
(Round up to 2 decimal places)

_____

_____

_____

1 mark

c. Calculate the distance from tower B to tower D.
(Round up to 2 decimal places)

_____

_____

_____

2 marks

Total 15 marks

Module 3: Graphs and Relations

If you choose this module, all questions must be answered.

Question 1

A car salesman is paid commission at the rate of 1.5% on the first $30,000 worth of cars that he sells in a month and 1.2% on the second $25,000. After that 1% on the reminder.

a. If the car sales $25,000, how much the car salesman‘s commission?

_____

_____

_____

1 mark

b. If the car sales $25,000, how much the car salesman‘s commission?

_____

_____

2 marks

c. Write down the general equation for car salesman commission.

_____

_____

_____

1 mark

d. If the car salesman get commission as $1200. What is the car sales price?

_____

_____

_____

1 mark

Question 2

The cost of manufacturing computers depends on labour and row materials. The monthly cost (C) is related to the number of produced (n) by the equation C = 230 + 27n. The revenue (R) made from selling n computers is R = 300n – 250. Both C and R are in dollars.

a. If 15 computers manufactured what is the cost and revenue.

Cost = _____

Revenue = _____

2 marks

b. If the cost is $635, how much computers manufactured?

_____

_____

_____

1 mark

c. If the company get profit as $13170. How much computers the company manufactured?

_____

_____

2 marks

Question 3

An automobile manufactures, produce cars at two factories and ship them to either Victoria or New South Wales. Factory 1 produces 130 cars per week and Factory 2 produces 175 cars per week. Victoria requires 150 cars per week and New South Wales requires 90 cars per week The shipping cost (in dollars per car) are shown in the table below.

	Factory 1	Factory 2
Victoria	$130	$400
New South Wales	$350	$150

Table 5

Use linear programming techniques to determine the number of cars shipped between factories and distributors in order to total shipping cost.

a. Write down constrain equation for factory A.

_____

_____

_____

1 mark

b. Write down constrain equation for factory B.

_____

_____

_____

1 mark

c. Write down the objective function for the shipping cost.

3 marks

Total 15 marks

Module 4: Business Related Mathematics

If you choose this module, all questions must be answered.

Question 1

A cash price of a computer is $700. If the computer is purchased on time payment the total cost will be $950. A deposit of 10 % in cash price is required and the agreement is that the computer will be fully paid for in two years in equal quarterly instalments.

a. Calculate the value that customer has to deposit.

1 mark

b. Calculate the quarterly instalment (round up to nearest cent)

2 marks

c. Calculate the flat rate of interest.

1 mark

d. Calculate the effective interest rate.

1 mark

Question 2

A coin collection was purchased 15 years ago for $4500. It has increased in value at the same rate as inflation. It currently valued at $6047.62.

a. Find the inflation rate. (round up to two decimal places)

2 marks

b. How long will it take for the coins collection to treble in value?

2 marks

c. How long ago did it have a value of $5216.74 ?

1 mark

Question 3

John bought his car 8 years ago for $25,000. Its current market value is $18,000. Assume the straight-line depreciation.

a. Calculate the car's monthly depreciation.

_____

_____

_____

2 marks

b. Find the relationship between the book value and time.

_____

_____

_____

2 marks

c. Find when the car will have a value $33750.

_____

_____

_____

1 mark

Total 15 marks

Module 5: Network and Decision Mathematics

If you choose this module, all questions must be answered.

Question 1

Using the figure below and answer the following questions.

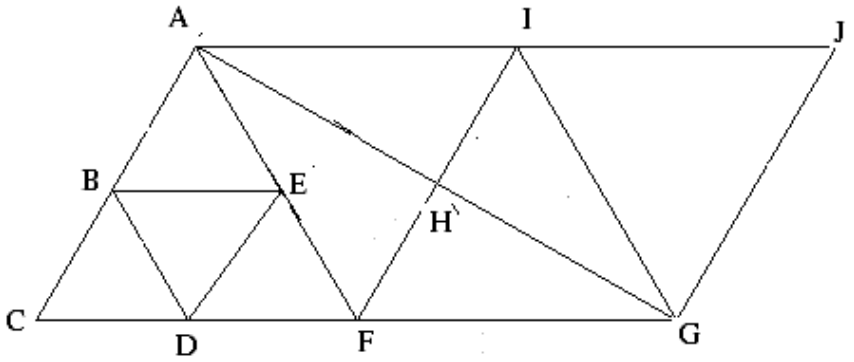


Figure 1

a. Write down 17 edges Hamiltonian path.

_____

_____

_____

2 marks

b. Write down Hamiltonian circuit using 14 edges.

_____

_____

_____

3 marks

Question 2

Consider the following activity table below.

Activity letter	Predecessor	Time (minutes)
A	-	10
B	A	8
C	A	6
D	B	3
E	B	5
F	C	4
G	E	8
H	G	10
I	C	3
J	H,I	1
K	E	2

Table 6

a. Prepare a network diagram for above activity table.

3 marks

b. Calculate the earliest completion time for the above network.

_____

2 marks

Question 3

A road map can be considered as a following matrix. When the nodes are the main towns and the edges are the roads.

	A	B	C	D	E	F
A	0	1	1	1	1	1
B	1	2	1	1	1	1
C	1	1	0	2	1	1
D	1	1	2	2	1	1
E	1	1	1	1	0	0
F	1	1	1	1	0	0

a. Construct a network for the above matrix.

3 marks

b. Write down Euler circuit for the above road map.

_____

_____

1 mark

c. Determine which towns have the roads that come to same town.

_____

_____

1 mark

Total 15 marks

Further Mathematics Formulas

Business-related mathematics

simple interest: $I = \dfrac{PrT}{100}$

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

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

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

Geometry and trigonometry

area of a triangle: $\dfrac{1}{2}bh$

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

area of circle: πr^2

volume of sphere: $\dfrac{4}{3}\pi r^3$

volume of cone: $\dfrac{1}{3}\pi r^2 h$

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

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

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

Graphs and relations

Straight line graphs

gradient: $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

equation: $y - y_1 = m(x - x_1)$ gradient-point form

$y = mx + c$ gradient-intercept form

$\dfrac{y - y_1}{x - x_1} = \dfrac{y_2 - y_1}{x_2 - x_1}$ two-point form

Number patterns and applications

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

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

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

linear difference equations: $t_n = at_{n-1} + b = a^{n-1}t_1 + b\dfrac{(a^{n-1} - 1)}{a - 1}, \ a \neq 1$

$= a^n t_0 + b\dfrac{(a^n - 1)}{a - 1}$

Networks and decision mathematics

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

Statistics

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