

FURTHER MATHEMATICS

Written Examination 2



2016 Trial Examination

SOLUTIONS

Core – Data Analysis

Question 1

a. 127 - 128

1 mark

b. 125 - 126

1 mark

c. $\frac{35}{51} \times 100 = 69\%$

1 mark

d. The distribution of heights is negatively skewed.

1 mark

Question 2

a. 170 cm

1 mark

b. *Lower extreme* = $160 - 1.5 \times 20 = 130$
Any value lower than 130 will be an outlier.

1 mark

c. 11 students (45 cm).

The middle 50% of Grade 10 students are less variable than the middle 50% of Grade 11 students.

2 marks

d. 25%.

1 mark

Question 3

a. With increase of one day in absence, the grade in the final exam reduces by approximately 1.654

2 marks

b. 87.32% of variation in final grade can be explained by the variation in number of absent days.

1 mark

c. $Grade = 91.704 - 1.654 \times 32 \approx 39$

1 mark

Question 4

a. There is a moderate, positive linear association between height and foot length.

1 mark

b. $Foot\ length = 4.87 + 0.12 \times height$

2 marks

c. $Foot\ length = 27.67\ cm$

As it is a case of extrapolation it may not be very reliable.

2 marks

Question 5

- a. $0.45 \times 80 = 36$ words 1 mark
- b. $Proportion = 0.846 - 0.182 \times \log(time)$ 2 marks
- c. $Proportion = 0.846 - 0.182 \times \log(15) = 0.22$ 1 mark
- d. $Residual = 0.20 - 0.22 = -0.02$ 1 mark
- e. There is no clear pattern from the residual plot suggesting the transformed data is linearly related. 1 mark

Core – Recursion and Financial Modelling

Question 1

- a. $11000 + \frac{9}{1200} \times 11000 - 950 = \10132.50 1 mark
- b. $a = 1 + \frac{9}{1200} = 1.0075, \quad b = 950$ 2 marks
- c. Generate on CAS: 10132.50, 9258.49, 8377.93, 7490.77, **\$6596.95** 1 mark
- d. $950 + 149.669 = \$1099.67$ 1 mark
- e. $12 \times 950 + 149.669 - 11000 = \549.67 1 mark

Question 2

a. $14000 - 2 \times 1050 = \11900

1 mark

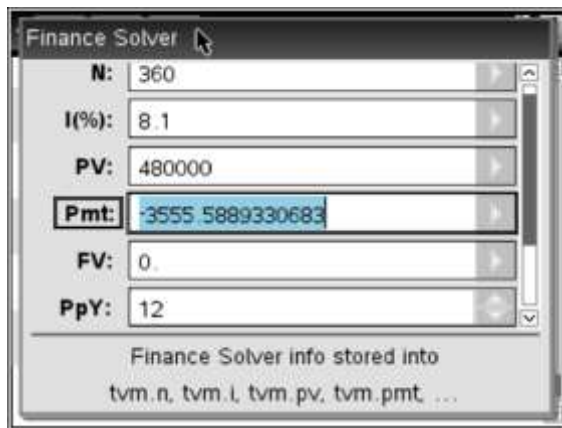
b. After 8 years

1 mark

c. $7644 = 8500 \times R^5 \rightarrow R = 0.978$
 $r = 2.2\%$

1 mark

d. \$3556



1 mark

e. $360 \times 3556 - 480000 = \800160

1 mark

f. $1 + \frac{8.1}{1200} = 1.00675$

1 mark

Module 1: Matrices

Question 1

a. Number of students participating in Dance from Yr 8. 1 mark

b. $12 + 45 + 15 = 72$ 1 mark

Question 2

a. $a = 27$ 1 mark

b. Students attending the dance club in one month will continue attending dance club in the next month. 1 mark

c. $\begin{bmatrix} 62 \\ 29 \\ 51 \end{bmatrix}$ 1 mark

d. $\frac{60}{100} \times 83 = 49.8 \approx 50$ 1 mark

e. $T^6 \times S_0 = \begin{bmatrix} 10 \\ 4 \\ 128 \end{bmatrix}$
4 students. 1 mark

Question 3

a. Number of columns in N is not the same as the number of rows in A 1 mark

b. $AN = [1386 \quad 1363]$

The product matrix represents the total money paid by all year 7 and year 8 students each month.

1 mark

c. $0.70[28 \quad 19 \quad 13] = [19.60 \quad 13.30 \quad 9.10]$

1 mark

d. $Total = 4[1386 \quad 1363] + 2[19.60 \quad 13.30 \quad 9.10] \begin{bmatrix} 12 & 15 \\ 45 & 38 \\ 15 & 17 \end{bmatrix} = [7484.40 \quad 7360.20]$

Total from year 8 students = \$7360.20

2 marks

Total 12 marks

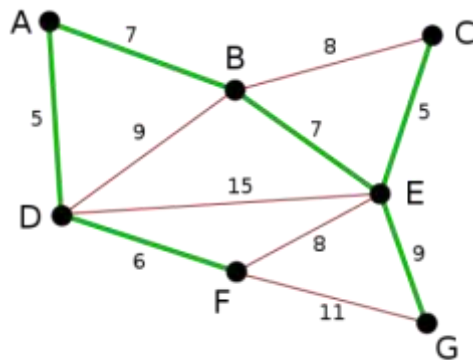
Module 2: Graphs and Networks

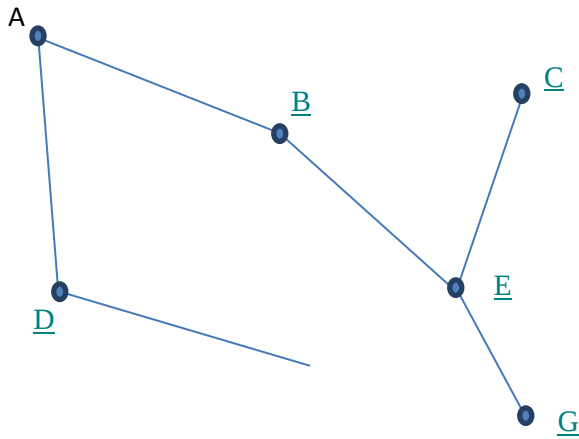
Question 1

- a. 9 km 1 mark
- b. $A \rightarrow D \rightarrow F \rightarrow G$
Shortest distance = 22 km 1 mark
- c. $v + f - e = 7 + 6 - 11 = 2$ 1 mark
- d. $A \rightarrow D \rightarrow B \rightarrow C \rightarrow E \rightarrow F \rightarrow G$. Hamiltonian path 2 marks

Question 2

a.





2 marks

b. 9 km

1 mark

Question 3

a. $1 \rightarrow 4 \rightarrow 3 \rightarrow 2 \rightarrow 7$

1 mark

b. $12 + 9 + 5 + 16 = 42$ km.

1 mark

Question 4

a. D, F, G and 50

1 mark

b. 125 minutes.

1 mark

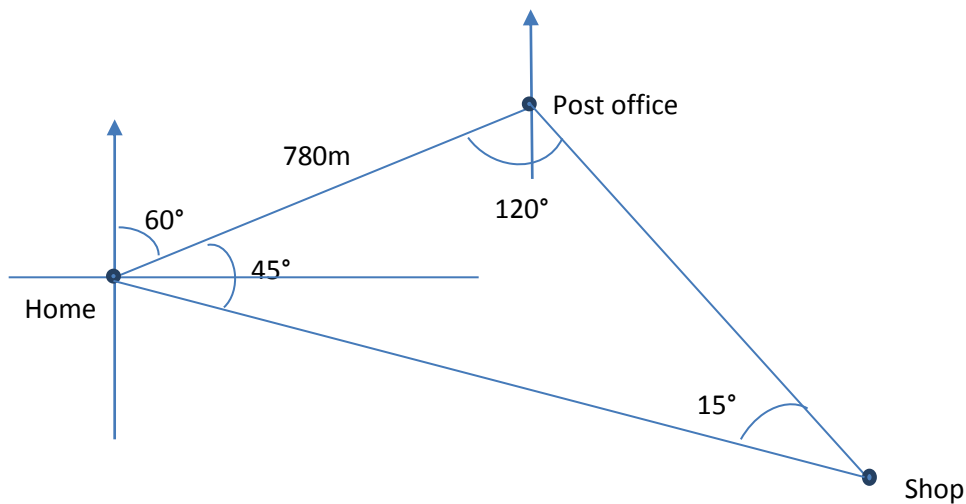
Total 12 marks

Module 3: Geometry, measurement and trigonometry**Question 1**

a. $180^\circ + 60^\circ = 240^\circ$

1 mark

b.



1 mark

c. $0.71975 \times 1000^2 = 719750 \text{ m}^2$

1 mark

d. $0.5 \times 780 \times x \times \sin(120^\circ) = 719750 \rightarrow x = 2131 \text{ m}$

Or

$$\frac{x}{\sin 45^\circ} = \frac{780}{\sin 15^\circ} \rightarrow d = 2131 \text{ m}$$

1 mark

e. If d is the distance from the shop to home then

$$d = \sqrt{780^2 + 2131^2 - 2 \times 780 \times 2131 \times \cos(120^\circ)} = 2610 \text{ m}$$

Or

$$\frac{d}{\sin 120^\circ} = \frac{780}{\sin 15^\circ} \rightarrow d = 2610 \text{ m}$$

$$\text{Total distance travelled } 780 + 2131 + 2610 = 5521 \text{ m}$$

2 marks

Question 2

a. $\cos(65^\circ) = \frac{x}{6.8} \rightarrow x \approx 2.87 \text{ cm}$

$$\text{Area} = \frac{1}{2} \times (17 + 17 + 2.87 + 2.87) \times 6.8 \times \sin(65^\circ) = 122.46 \text{ cm}^2$$

2 marks

b. $\text{Area of table top} = 400^2 \times \frac{122.46}{100^2} = 1959 \text{ m}^2$

1 mark

Question 3

a. 43°N

1 mark

b. $R(0^\circ, 80^\circ - 123^\circ) = R(0^\circ, 43^\circ\text{W})$

1 mark

c. $123^\circ \times 60 \times \cos(43^\circ) = 5397 \text{ nM}$

1 mark

Total 12 marks

Module 4: Graphs and Relations

Question 1

a. 900

1 mark

b. 14 weeks

1 mark

Question 2

a. 500

1 mark

b. $a = 500, b = \frac{600-500}{40-0} = \frac{5}{2}$

1 mark

c. As the advertising cost increases by \$1, the number of sales increases by 2.5.

1 mark

d. $Sales = 500 + \frac{5}{2} \times 30 = 575$

1 mark

Question 3

a. \$400

1 mark

b. $a = 150, b = 500$

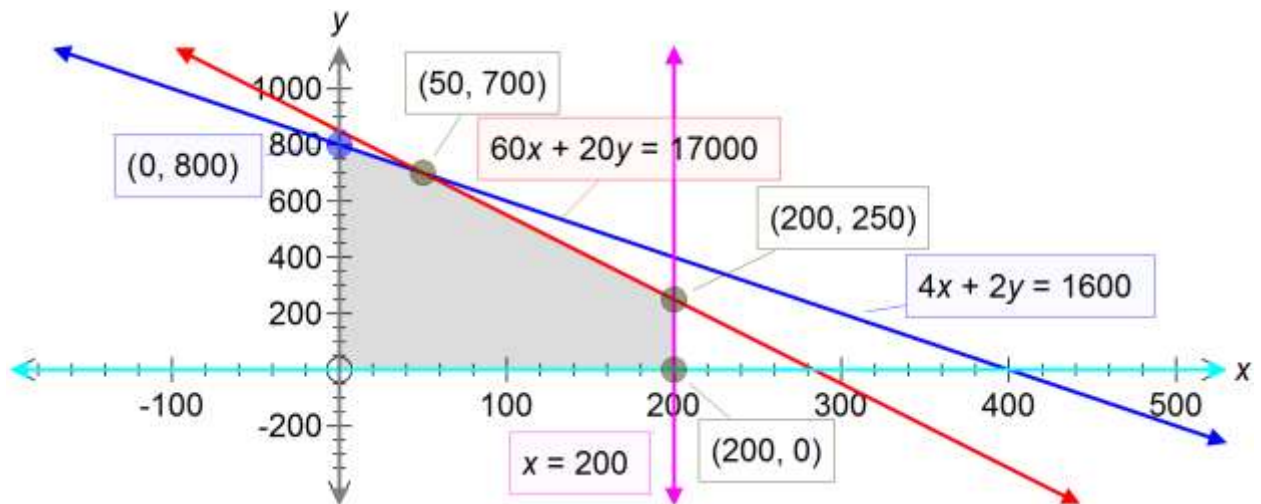
1 mark

Question 4

a. $60x + 20y \leq 17000$

1 mark

b.



2 marks

c. $z(0, 800) = \$24000$, $z(50, 700) = \$25000$, $z(200, 250) = \$23500$
50 boots and 700 shoes.

1 mark

Total 12 marks