

# 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.  $a = 1 + \frac{9}{1200} = 1.0075, b = 950$  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

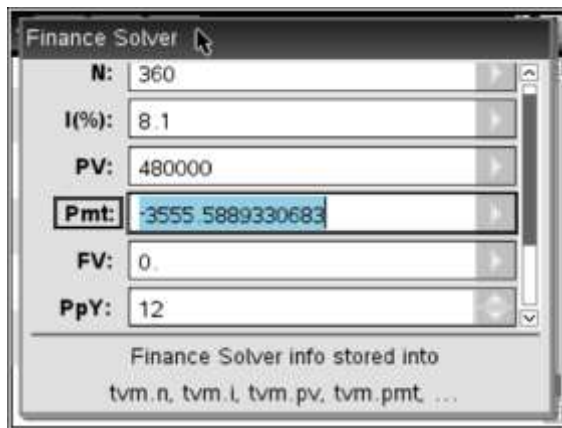
b. After 8 years

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

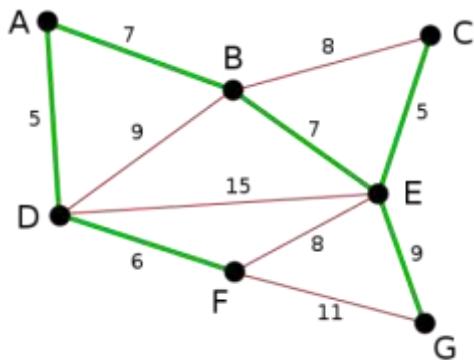
**Module 2: Graphs and Networks**

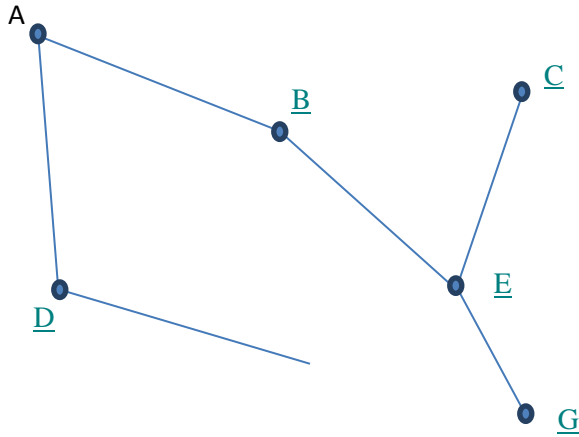
**Question 1**

- 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



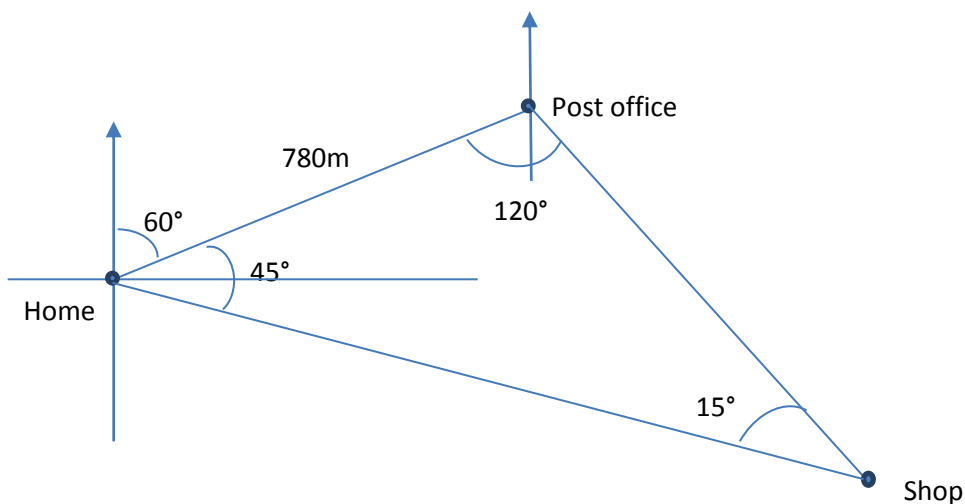
**Module 3: Geometry, measurement and trigonometry**

**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

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

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

2 marks

**Question 2**

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

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

1 mark

**Question 3**

a.  $43^\circ\text{N}$

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.**  $a = 150, b = 500$

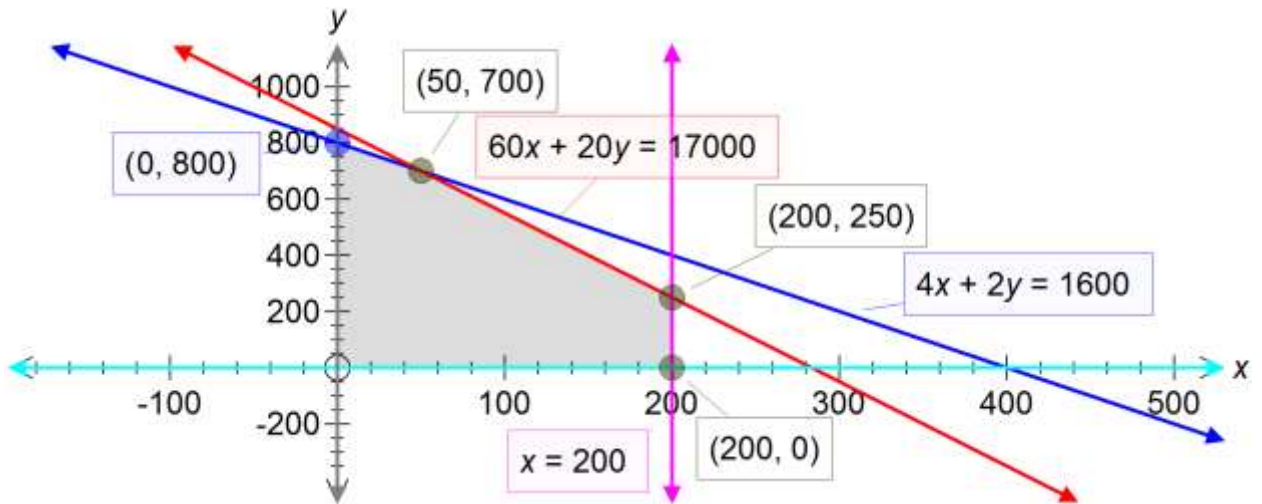
1 mark

**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