

2010 Further Mathematics Trial Exam 1 Solutions
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SECTION A Core: Data analysis

1	2	3	4	5	6	7	8	9	10	11	12	13
C	A	E	C	D	D	E	A	B	E	E	D	A

SECTION B

Module 1: Number patterns and applications

1	2	3	4	5	6	7	8	9
A	A	C	E	D	A	E	C	C

Module 5: Networks and decision mathematics

1	2	3	4	5	6	7	8	9
E	D	C	D	A	A	E	D	E

Module 6: Matrices

1	2	3	4	5	6	7	8	9
B	C	D	E	D	A	C	C	B

SECTION A Core: Data analysis

Q1 From the stemplot the modal class is 35-39 has the highest percentage. **C**

Q2 From the stemplot
(females 80-84) + (males 80-84) + (females 85+) + (males 85+)
 $\approx 1.1 + 0.8 + 1.1 + 0.5 = 3.5$ **A**

Q3 The stemplot shows the Australian population is aging. **E**

Q4 Find the gradient of the line joining the end points.
 $\frac{2.9 - 1.9}{20} \times \text{million} = \frac{1}{20} \times \text{million} = 50000$ **C**

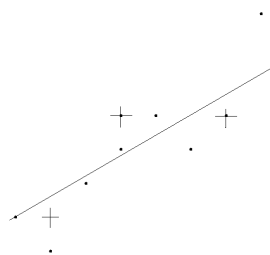
Q5 The distribution peaked at the low end. **D**

Q6 The mid points of the intervals are 0, 8, 20, 29.5, 37, 40, 44.5 and 54.5.

Average = $\frac{1}{2210556} (0 \times 82495 + 8 \times 262884 + 20 \times 204850 + 29.5 \times 214869 + 37 \times 368918 + 40 \times 439048 + 44.5 \times 252283 + 54.5 \times 385209) \approx 34.4$ **D**

Q7 **E**

Q8 **A**



Q9 $\log_{10} y$ will straighten the graph. **B**

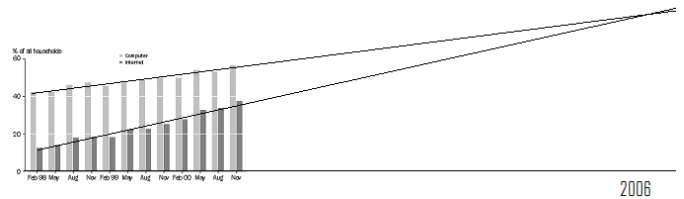
Q10 Random pattern. **E**

Q11 Seasonal index = $\frac{\text{actual}}{\text{adjusted}} = \frac{5.4}{5.2} \approx 1.04$ **E**

Q12 **D**

Nov		Dec		Jan		Feb		Mar
5.6		5.5		5.2		5.3		5.4
			5.4		5.35			
				5.38				

Q13 **A**



SECTION B

Module 1: Number patterns and applications

Q1 $1 + 3 + 6 + 10 + 15 = 35$ **A**

Q2 Difference between adjacent terms:
 $483 - 240 = 243 = 3^5$
 $240 - 159 = 81 = 3^4$
 $159 - 132 = 27 = 3^3$
 $132 - t_2 = 3^2 = 9, \therefore t_2 = 123$
 $123 - t_1 = 3^1 = 3, \therefore t_1 = 120$ **A**

Q3 $t_1 + t_2 = t_3 + t_4 = \dots = -1$. There are 189 pairs not counting the last term.
The value of the series = $-1 \times 189 + 379 = 190$ **C**

Q4
 $5 + 2(5 \times 0.9) + 2(5 \times 0.9^2) + 2(5 \times 0.9^3) + 2(5 \times 0.9^4) + 2(5 \times 0.9^5)$
 ≈ 42 **E**

Q5 $5 + \frac{a}{1-r} = 5 + \frac{9}{1-0.9} = 95$ **D**

Q6 $t_1 = -2, t_2 = \frac{1}{2}(10 - 2) = 6, t_3 = \frac{1}{2}(10 - 6) = 2,$
 $t_4 = \frac{1}{2}(10 - 2) = 4, t_5 = \frac{1}{2}(10 - 4) = 3$ **A**

Q7

Q8 $y_1 = 200$, $y_2 = 0.95 \times 200 + 50 = 240$

$y_3 = 0.95 \times 240 + 50 = 278$

Q9 $t_{n+1} = 0.95t_n + 50$, $t_1 = 200$

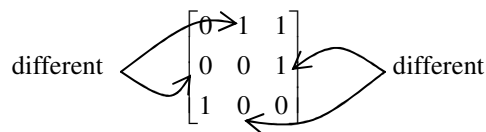
Module 5: Networks and decision mathematics

Q1 $v + f = e + 2 = 11 + 2 = 13$

Q2

Q3

Q4



Q5 One-step matrix is

$$\begin{bmatrix} 0 & 2 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$$

Two-step matrix is

$$\begin{bmatrix} 0 & 2 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}^2 = \begin{bmatrix} 0 & 0 & 2 & 1 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 2 & 1 & 1 \end{bmatrix}$$

Q6 $16 + 9 + 12 = 37$

Q7 Maximum flow = minimum cut = $21 + 12 = 33$

Q8

Q9 $2 + 5 + 10 + 8 = 25$

Module 6: Matrices

Q1 $\begin{bmatrix} 2 & -1 \\ 1 & 0 \end{bmatrix} - 3 \begin{bmatrix} -2 & a \\ b & 1 \end{bmatrix} = \begin{bmatrix} 8 & 2 \\ -2 & -3 \end{bmatrix}$

$\therefore -1 - 3a = 2$, $a = -1$

Q2 $\begin{bmatrix} 1 & b \\ a & -1 \end{bmatrix} \begin{bmatrix} -4 & b \\ b & 2 \end{bmatrix} = \begin{bmatrix} 0 & 3b \\ -2 & -4 \end{bmatrix}$

$$\begin{bmatrix} -4 + b^2 & 3b \\ -4a - b & ab - 2 \end{bmatrix} = \begin{bmatrix} 0 & 3b \\ -2 & -4 \end{bmatrix}$$

$\therefore -4 + b^2 = 0$, $-4a - b = -2$, $ab - 2 = -4$

$\therefore b = -2$

E

Q3 Inverse does not exist when the determinant is zero, i.e.

$$3n + 2m = 0, \frac{m}{n} = -\frac{3}{2} = -1.5$$

C

Q4 Change the system of equations to

C

$$1z + 0x + 1y = -2$$

$$3z + 0x - 1y = 0$$

$$0z + 1x - 2y = 3$$

E

Q5

D

E

Q6

A

D

Q7

C

$\begin{bmatrix} 0.80 & 0.30 \\ 0.20 & 0.70 \end{bmatrix}^n$ becomes $\begin{bmatrix} 0.60 & 0.60 \\ 0.40 & 0.40 \end{bmatrix}$ when n is large, i.e. in the

D

long run the probability of drinking tea is 0.60.

Number of cups of tea in a year = $365 \times 0.60 = 219$

C

Q8

C

$$\begin{bmatrix} 0.90 & 0.10 & 0.05 \\ 0.08 & 0.85 & 0 \\ 0.02 & 0.05 & 0.95 \end{bmatrix}^2 \begin{bmatrix} 50 \\ 60 \\ 40 \end{bmatrix} = \begin{bmatrix} \dots \\ 50.99 \\ \dots \end{bmatrix}$$

Q9

B

A

$$\begin{bmatrix} 0.90 & 0.10 & 0.05 \\ 0.08 & 0.85 & 0 \\ 0.02 & 0.05 & 0.95 \end{bmatrix}^{-2} \begin{bmatrix} 50 \\ 60 \\ 40 \end{bmatrix} = \begin{bmatrix} \dots \\ 74.08 \\ \dots \end{bmatrix}$$

A

E

D

E

Please inform mathline@itute.com re conceptual, mathematical and/or typing errors