2008 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	B	B	D	C	E	C	A	A	A	E	B	A

SECTION B

Module 1: Number patterns and applications

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

Module 5: Networks and decision mathematics

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

Module 6: Matrices

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

SECTION A Core: Data analysis

Q1 There are 20 students with weights greater than 63, the mode. $\frac{20}{25}\times 100\% = 80\%$ C

Q2 To be an outlier it must be $\le Q_1 - 1.5\times IQR$ or $\ge Q_3 + 1.5\times IQR$. $Q_1 = 65.5$, $Q_3 = 77.5$, $IQR = 77.5 - 65.5 = 12$ $\therefore 90$ is not an outlier. B

Q3 $2.066 - 1.972 = 0.094$, $\frac{0.094}{1.972}\times 100\% \approx 4.8\%$. B

Q4 2007: $55\% \times 1.972 = 1.0846$
2008: $53\% \times 2.066 = 1.09498$
$1.09498 - 1.0846 = 0.01038$, $\frac{0.01038}{1.0846}\times 100\% \approx 1\%$. D

Q5 From 1990 to 2007 the average % growth in annual demand for crude oil for non-OECD and OECD countries are 32% and 20% respectively. C

Q6 E

Q7 C

Q8 $a = 30.9$, $b = -1.52$, $r = -0.567$, $\bar{x} = 4.56$, $s_x = 2.61$.

Use $a = \bar{y} - b\bar{x}$, $b = r\frac{s_y}{s_x}$ to find $\bar{y} = 24.0$, $s_y = 7.00$. A

Q9 (x_L, y_L) is $(2,5)$ and (x_U, y_U) is $(7,13)$.
Slope $= \frac{13-5}{7-2} = \frac{8}{5} = 1.6$. A

Q10 The extra point $(6,12)$ belongs to the middle group of points and does not affect the calculation of the slope. A

Q11 E

Q12

Year	March quarter	June quarter	Sept. quarter	Dec. quarter	Average
2005	68	72	79	90	77.25
2006	96	104	103	108	102.75
2007	100	97	99	93	97.25

Seasonal index for the June quarter over the three years
$= \left(\frac{72}{77.25} + \frac{104}{102.75} + \frac{97}{97.25}\right) \div 3 = 0.981$. B

Q13 Seasonally adjusted number of computers sold in the December quarter 2006 $= 10800 \div 1.0575 = 10213$. A

SECTION B

Module 1: Number patterns and applications

Q1 The next three terms are $\frac{6^2}{2}, \frac{7^2}{2}, \frac{8^2}{2}$, i.e. $18, \frac{49}{2}, 32$. C

Q2 $T_4 = 2^{4-1} = 8$, $T_5 = -2 + (5-1)5 = 18$. D

Q3 Total
$= 1\times 2 + 2\times 3 + 3\times 4 + 4\times 5 + 5\times 6 + 6\times 7 + 7\times 8 = 168$. A

Q4

No. of lines	1	2	3	4	5
No. of parts	2	4	7	11	16

The pattern: $2 + 2 = 4$, $4 + 3 = 7$, $7 + 4 = 11$, $11 + 5 = 16$. C

Q5 $T_n = T_{n-1} + n$ E

Q6 $T_n = \frac{n(n+1)}{2} + 1$ C

Q7 The next two terms are $8 + 13 = 21$ and $13 + 21 = 34$, $\therefore 34 - 21 = 13$. C

Q8 The nth term is $t_n = 2^n$. $S_{22} = S_{20} + t_{21} + t_{22}$,

$\therefore\ S_{22} - S_{20} = t_{21} + t_{22} = 2^{21} + 2^{22} = 2^{21} + 2 \times 2^{21} = 3\left(2^{21}\right)$ E

Q9 $t_{n+1} = 5t_n$, $\therefore t_2 = 5t_1 = \frac{1}{2}$, $\therefore t_1 = \frac{1}{10} = 0.1$.

$\therefore t_2 = 0.1(5) = \frac{0.1}{5}\left(5^2\right) = 0.02\left(5^2\right)$, $\therefore t_n = 0.02\left(5^n\right)$. A

Module 5: Networks and decision mathematics

Q1 No. of vertices = 7, no. of edges = 8, sum of degrees of vertices = 16.

D

Q2 Euler's formula: $v - e + f = 2$. $\therefore e - v = f - 2 = 6$ C

Q3 An Euler path is a path that includes every edge just once.

C

Q4 A Hamiltonian path is a path that passes through each vertex just once, and the starting vertex is different from the finishing vertex.

E

Q5 A spanning tree is a subgraph and a tree containing all the vertices of the graph. C is not a subgraph. C

Q6 $53 + 8 + 17 + 16 + 7 + 22 = 123$ D

Q7 Maximum flow = minimum cut = 3 B

Q8 A critical path has the longest time to complete a project.

D

Q9 E

Module 6: Matrices

Q1 Subtraction of matrices having different orders is not defined. E

Q2 $(4 \times 1) \times (1 \times 4)$ gives (4×4) E

Q3 $X\begin{bmatrix} -2 & 1 & 0 \\ 0 & -1 & 1 \end{bmatrix} = \begin{bmatrix} 4 & -2 & 0 \\ -2 & 2 & -1 \end{bmatrix}$

X must be a 2×2 matrix for the product to be defined. D

Q4

$$\begin{bmatrix} 3 & 2 & 3 \\ 5 & 2 & 1 \\ 4 & 3 & 2 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 162 \\ 158 \\ 184 \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 & 2 & 3 \\ 5 & 2 & 1 \\ 4 & 3 & 2 \end{bmatrix}^{-1}\begin{bmatrix} 162 \\ 158 \\ 184 \end{bmatrix}$$ C

Q5

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 & 2 & 3 \\ 5 & 2 & 1 \\ 4 & 3 & 2 \end{bmatrix}^{-1}\begin{bmatrix} 162 \\ 158 \\ 184 \end{bmatrix} = \begin{bmatrix} 18 \\ 24 \\ 20 \end{bmatrix} \qquad \therefore \begin{bmatrix} y \\ z \end{bmatrix} = \begin{bmatrix} 24 \\ 20 \end{bmatrix}$$ A

Q6 The matrices in C, D and E are singular and do not have an inverse.

$$\begin{bmatrix} p & q \\ r & s \\ t & u \end{bmatrix}\begin{bmatrix} 1 & 3 & 0 \\ 1 & 4 & 0 \end{bmatrix} = \begin{bmatrix} & & \\ & & \\ 0 & & \end{bmatrix} \neq \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$\therefore \begin{bmatrix} 1 & 3 & 0 \\ 1 & 4 & 0 \end{bmatrix}$ has no left multiplicative inverse. A

Q7 72% of Q's customers return to Q, $\therefore$28% go to the other two outlets. A

Q8 $\begin{bmatrix} 0.75 & 0.12 & 0.10 \\ 0.13 & 0.72 & 0.08 \\ 0.12 & 0.16 & 0.82 \end{bmatrix}^5 \begin{bmatrix} 2500 \\ 3100 \\ 1900 \end{bmatrix} \approx \begin{bmatrix} 2304 \\ 2114 \\ 3082 \end{bmatrix}$ D

Q9 $\left(\begin{bmatrix} 0.75 & 0.12 & 0.10 \\ 0.13 & 0.72 & 0.08 \\ 0.12 & 0.16 & 0.82 \end{bmatrix}^{-1}\right)^2 \begin{bmatrix} 2500 \\ 3100 \\ 1900 \end{bmatrix} \approx \begin{bmatrix} 2670 \\ 4643 \\ 187 \end{bmatrix}$ A

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