

2012 Further Mathematics Trial Exam 1 Solutions

Free download from www.itute.com © Copyright itute.com 2012

SECTION A Core: Data analysis

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

SECTION B

Module 1: Number patterns and applications

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

Module 5: Networks and decision mathematics

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

Module 6: Matrices

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

SECTION A Core: Data analysis

Q1 $3 + 5 + 6 + 5 + 5 + 3 + 2 + 1 = 30$ B

Q2 D

Q3
$$\frac{5 \times 5 + 15 \times 7 + 25 \times 10 + 35 \times 10 + 45 \times 9 + 55 \times 9 + 65 \times 7 + 75 \times 2}{59} \approx 37.88$$
 B

Q4 Range = $89 - 33 = 56$, median = $\frac{68 + 69}{2} = 68.5$ C

Q5 $IQR = Q_3 - Q_1 = 74 - 57 = 17$
 $Q_1 - 1.5 \times IQR = 57 - 25.5 = 31.5$ A

Q6 $\frac{0.5}{0.34 + 0.5} \approx 0.6 = 60\%$ C

Q7 $z = \frac{x - \mu}{\sigma} = \frac{8.4 - 6.0}{1.5} = 1.60$ D

Q8 $\bar{y} = a + b\bar{x} = 0 + \frac{6}{8} \times 3.7 \approx 2.8$ E

Q9 $\frac{s_y}{s_x} = \frac{b}{r} = \frac{\frac{6}{8}}{0.95} \approx 0.8$ E

Q10 B

Q11 B

Q12 A

Q13 Gradient = $\frac{5.5 - 3}{44 - 9} \approx 0.0714$ E

SECTION B

Module 1: Number patterns and applications

Q1 1, 1, 3, 4, 5, 7, 7, 10, 9, 13, 11, 16, 13, 19, 15, 22 E

Q2 Common difference of 4.2 D

Q3 $S_{13} = \frac{13}{2}(a + l)$, $3.25 = \frac{13}{2}(a + l)$, $a + l = 0.5$
 $\therefore t_6 + t_8 = 0.5$, $t_7 = \frac{t_6 + t_8}{2} = 0.25$, $\therefore t_6 + t_7 + t_8 = 0.75$ C

Q4 $1.4 \times r^3 = -4.725$, $r = -1.5$, $1.4 \times r + 1.4 \times r^2 = 1.05$ D

Q5 $t_1 = 1$, $t_2 = 3$, $t_3 = 5$,
 $\therefore$ it is an arithmetic sequence, $d = 2$, $t_7 = 1 + (7 - 1)2 = 13$ C

Q6 Geometric sequence, $r = 1 - 0.025 = 0.975$
 $0.975^n < 0.5$, $n > 27.3779$, at least 28 weeks E

Q7 $t_{n+1} - 2t_n = n(n + 1)$, $t_1 = 3$, $t_2 = 8$, $t_3 = 22$, $t_4 = 56$
 $t_5 = 132$ A

Q8 $f_{10} - 10 = f_{11}$, $f_{11} + f_{10} = f_{12}$, $f_{12} + f_{11} = 12$
 $\therefore f_{10} = f_{11} + 10$, $f_{11} + f_{11} + 10 = f_{12}$, $\therefore f_{11} = \frac{f_{12}}{2} - 5$
 $\therefore f_{12} + \frac{f_{12}}{2} - 5 = 12$, $\frac{3f_{12}}{2} = 17$, $f_{12} = \frac{34}{3} \approx 11.3$ B

Q9 $A_{n+1} = (1 + 0.05)A_n - 15000$, $A_{n+1} - A_n = 0.05A_n - 15000$ C

Module 5: Networks and decision mathematics

Q1 The minimum number of edges = $\frac{17 \times 16}{2} = 136$ A

Q2 A

Q3 $V = E - F + 2$. If F is odd, then V and E cannot be both even or both odd. The numbers do not add up for A. C

Q4 All the vertices are even for Graph III, an Euler path may start on any vertex. C

Q5 E

Q6 $27 + 21 + 22 + 17 + 21 + 19 + 26 + 21 + 29 = 203$ D

Q7

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

Q can reach P and R using one-stage route, and S using two-stage route.

R can reach P and Q using two-stage route, and S using one-stage route.

S can reach P and Q using one/two-stage route, and R using two-stage route.

E

Q8 Minimum cut = 10

E

Q9 D can finish Q and R in 3 hours; A can finish P in 3 hours; C can finish S in 3 hours.

E

Q8

$$\left(\begin{bmatrix} 0.95 & 0.015 & 0.005 \\ 0.04 & 0.98 & 0.075 \\ 0.01 & 0.005 & 0.92 \end{bmatrix}^{-1} \right)^2 \begin{bmatrix} 0.58 \\ 0.37 \\ 0.05 \end{bmatrix} \approx \begin{bmatrix} 0.63 \\ 0.33 \\ 0.04 \end{bmatrix} \quad \text{B}$$

Q9

$$\begin{bmatrix} 0.95 & 0.015 & 0.005 \\ 0.04 & 0.98 & 0.075 \\ 0.01 & 0.005 & 0.92 \end{bmatrix}^n \begin{bmatrix} 0.58 \\ 0.37 \\ 0.05 \end{bmatrix} \rightarrow \begin{bmatrix} 0.21973 \\ 0.70852 \\ 0.07175 \end{bmatrix} \text{ for large } n.$$

B

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

Module 6: Matrices

Q1

C

$$\begin{aligned} \text{Q2 } \left(\begin{bmatrix} 3 \\ 2 \\ 1 \end{bmatrix} - 2 \begin{bmatrix} -1 \\ 2 \\ 1 \end{bmatrix} \right) \begin{bmatrix} -1 & 0 & 1 \end{bmatrix} &= \begin{bmatrix} 5 \\ -2 \\ -1 \end{bmatrix} \begin{bmatrix} -1 & 0 & 1 \end{bmatrix} \\ &= \begin{bmatrix} -5 & 0 & 5 \\ 2 & 0 & -2 \\ 1 & 0 & -1 \end{bmatrix} \end{aligned}$$

C

Q3

D

Q4

D

Q5

$$\begin{bmatrix} 1 & -2 & 0 \\ 0 & 3 & -4 \\ -6 & 0 & 5 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ 5 \\ 7 \end{bmatrix}$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 1 & -2 & 0 \\ 0 & 3 & -4 \\ -6 & 0 & 5 \end{bmatrix}^{-1} \begin{bmatrix} 3 \\ 5 \\ 7 \end{bmatrix} = -\frac{1}{99} \begin{bmatrix} 45 & 30 & 24 \\ 72 & 15 & 12 \\ 54 & 36 & 9 \end{bmatrix} \begin{bmatrix} 3 \\ 5 \\ 7 \end{bmatrix} \quad \text{A}$$

$$\text{Q6 } \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} 2 & 1 & -1 & -1 \\ 1 & 2 & -1 & -1 \\ 1 & 1 & -2 & -1 \\ 1 & 1 & -1 & -2 \end{bmatrix}^{-1} \begin{bmatrix} 4 \\ 3 \\ 2 \\ 1 \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \\ 0 \\ 1 \end{bmatrix}$$

$$a - b + c - d = 2 - 1 + 0 - 1 = 0$$

E

Q7

D