2022 VCAA Further Mathematics Exam 1 Solutions

SECTION A Core

Data analysis

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

9	10	11	12	13	14	15	16
E	C	B	B	B	C	B	A

Recursion and financial modelling

17	18	19	20	21	22	23	24
D	C	A	A	D	C	D	B

SECTION B

Module 1: Matrices

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

Module 2: Networks and decision mathematics

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

Module 3: Geometry and measurement

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

Module 4: Graphs and relations

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

Use CAS to save time

SECTION A Core

Data analysis

Q2 $\frac{12}{46} \approx .26 = 26\%$ B

Q3 $0.75 \times 46 = 34.5$, between 57 and 58 D

Q5 $\frac{68+95}{2}\% \times 2498 \approx 2036$ A

Q6 $\log_{10} 1000 = 3$, frequency $= 8+9+7+1 = 25$ D

Q8 $\log_{10} w = 2.698 + 0.009434 \times 30$, $w \approx 957$ D

Q10 $\frac{10}{10+18} \approx 0.36 = 36\%$ C

Q11 $\frac{10+35}{115} \approx 39\%$, $\frac{18+30}{126} \approx 38\%$ B

Q12 Gradient ≈ 7, response variable is *body length* B

Q14 $1 - 0.963^2 \approx 0.073 = 7.3\%$ C

Q15 $\frac{\frac{98+104+145+163+134+128}{6} + \frac{104+145+163+134+128+206}{6}}{2} \approx 138$ B

Q16 $\text{Deaseasonalised} = \frac{\text{actual}}{\text{seasonal index}} = \frac{\text{actual}}{1.25} = 0.8 \times \text{actual}$

$\therefore$ reduced by $0.2 = 20\%$ A

Recursion and financial modelling

Q17 $R_0 = 2$, $R_1 = 2 - R_0 = 0$, $R_2 = 2 - R_1 = 2$ D

Q18 $V_1 = 399176$, $V_2 = 398349.528$, $V_3 < 398000$ C

Q19 TVM Solver:
$I\% = 0.003 \times 12 = 3.6$, PV $= 400000$, PMT $= -2024$, FV $= 0$
P/Y=12, C/Y $= 12$, N ≈ 300, number of years $\approx \frac{300}{12} = 25$ A

Q20 $\frac{5475}{365 \times 10} = 1.50$ A

Q21 First statement is true by letting $m = 1$.
Verify the second statement by increasing m. Third statement is true $\because \frac{12\%}{12 \text{ month}} = 1\%$ per month.
First and Second statements render the Fourth statement false. D

Q23 Li: $L_5 = 4000 \times 1.0388^5 \approx 4838.60$
Check D, $J_5 = 3500 + 5 \times 267.72 = 4838.60$ D

Q24 Same additional amount per quarter.
TVM Solver: N $= 8$, I% $= 2.08$, FV $= 12700.95$, P/Y $= 4$, C/Y $= 4$, PMT ≈ -215.55 B

SECTION B

Module 1: Matrices

Q3 Check the available numbers, sum of each column entries $= 1$ C

Q5 Only *GF* results in a square matrix. D

Q6 $\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 & 1 & 1 \\ 1 & -1 & 1 \\ -1 & 1 & 0 \end{bmatrix}^{-1} \begin{bmatrix} 4 \\ 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 1 & -1 & -2 \\ 1 & -1 & -1 \\ 0 & 1 & 1 \end{bmatrix} \begin{bmatrix} 4 \\ 1 \\ 2 \end{bmatrix}$ E

Q7 $P = \begin{bmatrix} 0 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} \cdots \\ \cdots \\ m_{31} \\ \cdots \\ \cdots \end{bmatrix} = \begin{bmatrix} m_{31} & \cdots & \cdots & \cdots & \cdots \end{bmatrix}$ A

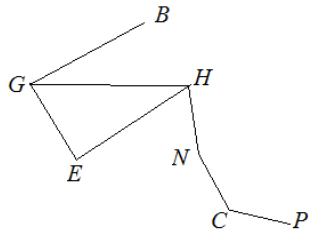
Q8 $\begin{matrix} M \\ A \\ P \\ E \end{matrix} \begin{bmatrix} 6 & 8 \\ 4 & 7 \\ 5 & 5 \\ 10 & 12 \end{bmatrix} \times \begin{matrix} H & I & J \end{matrix} \begin{bmatrix} 18 & 10 & 12 \\ 8 & 17 & 9 \end{bmatrix} = \begin{matrix} M \\ A \\ P \\ E \end{matrix} \begin{matrix} H & I & J \end{matrix} \begin{bmatrix} & & \\ & & \\ & & \\ & & \end{bmatrix}$

$\begin{bmatrix} 1 & 1 & 1 & 1 \end{bmatrix} \times \begin{matrix} M \\ A \\ P \\ E \end{matrix} \begin{matrix} H & I & J \end{matrix} \begin{bmatrix} & & \\ & & \\ & & \\ & & \end{bmatrix} = \begin{matrix} H & I & J \end{matrix} \begin{bmatrix} & & \end{bmatrix}$

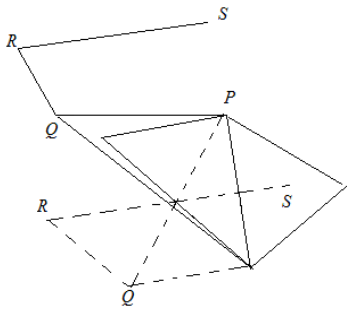
i.e. $\begin{bmatrix} 1 & 1 & 1 & 1 \end{bmatrix} \times \left(Q \times N^T \right) = \begin{matrix} H & I & J \end{matrix} \begin{bmatrix} & & \end{bmatrix}$ A

Module 2: Networks and decision mathematics

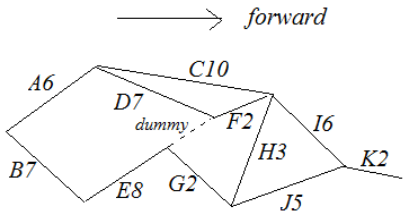
Q2 7 edges C



Q4 A



Q7 B



Q8 Critical path is *BEGHIK*
Float times: $A4$, $C4$, $D5$, $F3$, $J4$. Sum $= 4+4+5+3+4 = 20$
D

Module 3: Geometry and measurement

Q1 $\frac{360}{8} = 45$ D

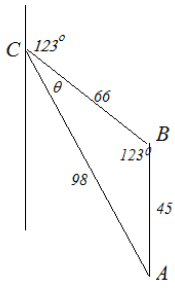
Q2 $\frac{1}{2} \times 3.0 \times h = 5.25$, $h = 3.5$ D

Q3 $38.5\% \times \pi r^2 = 5.25$, $r \approx 2.08$ B

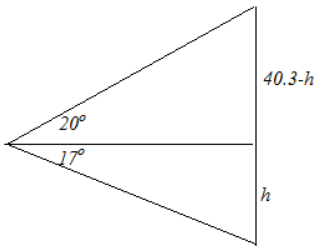
Q4 Difference in longitudes $= 122 - 77 = 45$
.: 3 hours difference. Williamsberg is ahead in time. C

Q5 $\frac{d}{300} = \frac{3}{15+3}$, $d = 50$ C

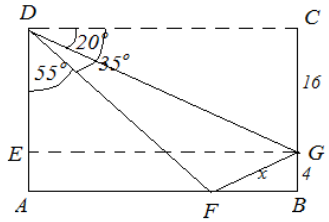
Q6 From the diagram below, the bearing from Chalton to Amberley must be greater than 123° E



Q7 $\frac{40.3-h}{\tan 20°} = \frac{h}{\tan 17°}$, $h \approx 18.4$ B



Q8 Let x metres be the length of the ramp.



$AF = 20\tan 55°$ $EG = 16\tan 70°$, $FB = EG - AF \approx 15.4$
$x \approx \sqrt{15.4^2 + 4^2} \approx 16$ C

Module 4: Graphs and relations

Q1 $H = 1.5 + 0.12 \times 8 = 2.46$ E

Q3 Profit $= 150 \times 75 - (1600 + 150 \times 40) = 3650$ A

Q4 Max. at $(20, 10)$, $Z_{max} = 3 \times 20 - 5 \times 10 = 10$ C

Q5 Cost of sedan $= s$, cost of wagon $= s + 7000$
$11s + 7(s + 7000) = 733000$, $s = 38000$ B

Q6 $x \geq 3$, $y = 2$, $\frac{x}{y} \geq \frac{3}{2}$, $x \geq \frac{3}{2}y$ B

Q7 $b = \frac{400}{25} + 30 = 46$, gradient of line $= \frac{0-800}{86-46} = -20$
The line is $V = -20t + c$, $0 = -20 \times 86 + c$, $c = 1720$ A

Q8 If $\frac{a}{b} = 7$, $Z = 7x + y$, Z_{min} at $(2, 12)$ D

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