2020 VCAA Further Mathematics Exam 1 Solutions

SECTION A Core

Data analysis

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

11	12	13	14	15	16	17	18	19	20
E	B	E	C	D	D	B	C	A	D

Recursion and financial modelling

21	22	23	24	25	26	27	28	29	30
A	C	C	D	B	E	B	C	B	B

SECTION B

Module 1: Matrices

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

Module 2: Networks and decision mathematics

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

Module 3: Geometry and measurement

1	2	3	4	5	6	7	8	9	10
E	B	C	B	D	C	E	C	E	C

Module 4: Graphs and relations

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

SECTION A Core

Data analysis

Q1 $220-150=70$ B

Q2 $300=Q_3$, $25\%\times 800=200$ D

Q3 Upper fence $=300+1.5\times(300-70)=645$ C

Q4 C

Q5 $\log_{10}10000=4$, percentage $=\dfrac{17}{20}\times 100\%=85\%$ E

Q6 Segments for below average, average and above average D

Q7 Number of wings A

Q8 $57=61-2\times 2=\mu-2\sigma$, $2.5\%\times 10000=250$ D

Q9 $\mu=670$, $\sigma=670-655=15$ D

Q10 A

Q11 percentage $=\dfrac{91}{161}\times 100\%=56.5\%$ E

Q12 percentage $=\dfrac{12}{70}\times 100\%=17.1\%$ B

Q13 E

Q14 $10^{1.160+0.03617\times 3}\approx 18.56$ C

Q15 The deseasonalised mean rainfall $=\dfrac{52.8}{0.741}\approx 71.26$

$\%$ increase $\approx\dfrac{71.26-52.8}{52.8}\times 100\%\approx 35\%$ D

Q16 The long-term mean for December $=\dfrac{1.072}{1.138}\times 81.1\approx 76.4$ D

Q17 The deseasonalised mean rainfall $=\dfrac{92.6}{1.222}\approx 75.8$ B

Q18 Six-mean smoothed monthly rainfall for August

$=\dfrac{1}{2}\left(\dfrac{92.6+77.2+\cdots+55.2}{6}+\dfrac{77.2+80.0+\cdots+97.3}{6}\right)\approx 81.3$ C

Q19 A

Q20 $\dfrac{2160000}{5}=432000$ D

Recursion and financial modelling

Q21 $T_1=T_0+3=10+3=13$ A

Q22 $V_{n+1}=2480+45(n+1)=2480+45n+45=V_n+45$ C

Q23 2nd and 3rd C

Q24 Interest $=1.0048^5\times 3000-3000\approx 72.69$ dollars D

Q25 B

Q26 E

Q27 $10000\times 1.055^{13}\approx 20057.74$ B

Q28 $\left[\left(1+\dfrac{8}{100\times 26}\right)^{26}-1\right]\times 100\%\approx 8.3154\%\approx 8.32\%$ C

Q29 $45000\times\left(1-\dfrac{k}{100}\right)^3-30000\times 0.15=26166.24$

$k=12$ B

Q30 $\left(A\left(1+\dfrac{3.2}{100\times 12}\right)^{120}+10000\right)\left(1+\dfrac{2.8}{100\times 12}\right)^{120}=686904.09$

$A=\$370000$ B

SECTION B

Module 1: Matrices

Q1 A

Q2 $q_{41} = 4\times 2 + 5\times 4$ E

Q3 $P^4 = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$ D

Q4 C

Q5 D

Q6 B

Q7 $\begin{bmatrix} 0.85 & 0.35 \\ 0.15 & 0.65 \end{bmatrix}^4 \begin{bmatrix} 0.40 \\ 0.60 \end{bmatrix} \approx \begin{bmatrix} 0.68 \\ 0.32 \end{bmatrix}$ B

Q8 C^T is 4×3; $\left(A^T \times B\right)^T$ is 3×4 $\therefore$ $C^T \times \left(A^T \times B\right)^T$ is 4×4 E

Q9 For Brie winning, the sum of one-step and two-step dominances is 9, it is the highest. B

Q10 $j = 0.4$, $m = 0.5$, $l = 0.6$, $n = 0.1$ $\therefore$ $l = m + n$ E

Module 2: Networks and decision mathematics

Q1 $7 + f = 9 + 2$ D

Q2 D

Q3 B

Q4 C

Q5 $x = 53 - (7+6+5+8+7+5+6) = 9$ D

Q6 $7+4+3+3+5 = 22$ E

Q7 Bipartite and planar C

Q8 E

Q9 Cuts B, C and D have a capacity equal to the maximum flow of 33.
Cut E has a capacity of 38 but maximum flow of 33. C

Q10 A

Module 3: Geometry and measurement

Q1 E

Q2 $\frac{1}{2}\times 2\times 1.5 = 1.5$ B

Q3 $\sqrt{25^2 - 15^2} = 20$ C

Q4 B

Q5 $80\% \times \pi \times 16^2 \approx 643$ D

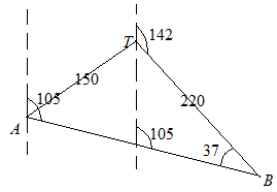
Q6 C

Q7 $\frac{34+59}{360}\times 2\pi \times 6400 \approx 10388$ E

Q8 $6\times 6 + 6\times 8 + 2\left(\frac{1}{2}\times 6\times 8\right) + 6\times\sqrt{6^2+8^2} = 192$ C

Q9 Diameter: $w : m = 1 : 1.25 = 4 : 5$
Total surface area: $w : m = 4^2 : 5^2 = 16 : 25$ E

Q10 $TA = \sqrt{170^2 - 80^2} = 150$; $TB = \sqrt{234^2 - 80^2} \approx 220$



$\angle TBA = 142 - 105 = 37°$. Let $x = AB$
$150^2 = x^2 + 220^2 - 2(220)x\cos 37°$, $x \approx 246$ C

Module 4: Graphs and relations

Q1 C

Q2 D

Q3 E

Q4 $\frac{x}{10} + \frac{y}{8} = 1$ $\therefore$ $4x + 5y = 40$ B

Q5 $n = 2$, $30 = k4^2$, $k = \frac{15}{8}$ B

Q6 $200\times 27 - (420 + 200\times 15) = 1980$ A

Q7 $38.70 + 0.025n = 169.90$, $n = 5248$, $\frac{5248}{30} \approx 175$ C

Q8 $\frac{x}{y} \le \frac{2}{5}$, $y \ge \frac{5}{2}x$ A

Q9 $80 - \left(20 + \frac{1100 - 300}{32}\right) = 35$ C

Q10 Line BC: $y = -2x + 14$

$Z = bx + 4.5y$, $y = -\frac{b}{4.5}x + \frac{Z}{4.5}$, $-\frac{b}{4.5} < -2$, $\therefore$ $b > 9$ E

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