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VCE[®] General Mathematics

Unit 3 and 4 Practice Written Examination 2

SOLUTIONS

Solution Pathway

Below are sample answers. Please consider the merit of alternative responses.

Question 1 (9 marks)

a.

1 mark

Variable	Type	Sub Type
Lane	Categorical	Nominal
Nation	Categorical	Nominal
Time	Numerical	Continuous
Event	Categorical	Ordinal

- Mark only if all 4 values are correct. Lane is a marker not a measure and Time is a measure (continuous)

b.

1 mark

Time	Frequency	Percentage Frequency
$9.80 < 9.9$	5	21.74
$9.9 < 10.00$	7	30.43
$10.00 < 10.10$	9	39.13
$10.10 < 10.20$	1	4.35
$10.20 < 10.30$	1	4.35
Total	23	100

- Mark only if all values are correct to 2 decimal places.

$$\text{lower fence: } Q_1 - 1.5(IQR) = 9.91 - 1.5(0.13) = 9.715$$

$$\text{Upper fence: } Q_3 + 1.5(IQR) = 10.04 + 1.5(0.13) = 10.235,$$

as 10.24 is larger than this value it is an outlier

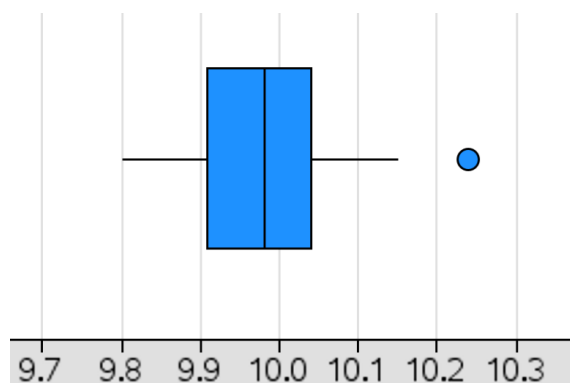
c.

2 marks

- 1 mark for both the upper and lower fence values correct.
- 1 mark for the explanation as to why 10.24 is an outlier.

d.

1 mark



Must include the outlier and have the upper whisker finish at 10.15

e.

$$\bar{x} = 9.984$$

$$s_x = 0.1049$$

2 marks

- 1 mark for each correct value

f. $z = \frac{9.58 - 9.98}{0.1049} = -3.81$

1 mark

g. 9.8751 is 1 deviation below, 10.2987 is 3 deviations above, thus 83.85%

1 mark

Question 2 (9 marks)

a. *Number of steps is the explanatory variable*

1 mark

b. *When the number of steps is 0, the Race Time is predicted to be 6.81 seconds.* 1 mark

Similar responses can be accepted.

c. *Strong Positive* is the strength and direction

1 mark

d. 0.8084

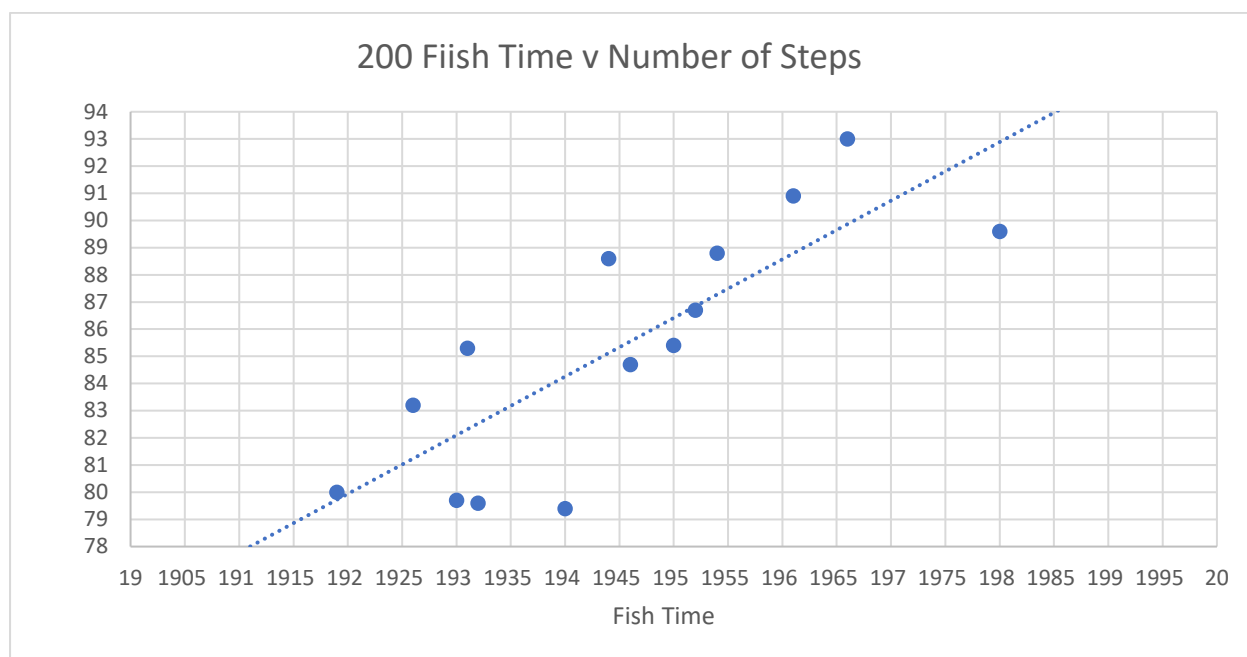
1 mark

e. 65.35%

1 mark

f. Graph as below, or very similar

1 mark



g. 2013 sec

1 mark

$$100 = -334.3 + 21.58(\text{Time})$$

$$\text{Time} = 20.13$$

h. Not accurate as the result is extrapolated outside the data set

1 mark

Question 3 (7 marks)a. The graph shows a *decreasing trend* only.

1 mark

b. Show that question, must show the steps.

$$\frac{10.14 + 10.06 + 10.25 + 9.99 + 9.92}{5} = 10.072 \approx 10.07$$

1 mark

c. $\text{Time} = 31.929 - 0.011(\text{Year})$

1 mark

d. 9.665 seconds.

$$\text{Time} = 31.929 - 0.011(2024) = 9.665$$

Answer may be slightly different if different equation was formed in Part c. Award consequential marks for this.

1 mark

e. *0.871 means 12.9% below average.*

1.132 means 13.2% above average

2 marks

- **1 mark** for each correct statement.

f. *15.28km/h*

$$de - seasonalised = \frac{17.3}{1.132} = 15.28$$

1 mark

Question 4 (3 marks)

$$V_0 = 2899$$

$$V_1 = 2464.15$$

$$V_2 = 2029.30$$

a.

1 mark

b. *15%*

$$\frac{434.85}{2899} 100 = 15$$

1 mark

c. *660 years*

$$30 = 2899 - 434.85n$$

$$n = 6.59768 \approx 6.60$$

1 mark

Question 5 (5 marks)

a. **“Show that” question: Students must show all working.**

$$\frac{27980 \times \frac{5.8}{12}}{100} = 135.2366 \cong 135.24$$

1 mark

b. $V_0 = 27980, V_{n+1} = 1.0048V_n$

$$1.0048 \text{ is from } \frac{5.8}{\frac{12}{100}} + 1 = 1.0048$$

1 mark

c. *\$3051689*

$$18 \text{ months is a year and a half, thus } 1.0048^{18}(27980) = 30516.89$$

1 mark

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- d. 5.96% and 5.61%

1 mark

First method: $\left[\left(1 + \frac{5.8}{100(12)} \right)^{12} - 1 \right] \times 100 = 5.956694 \cong 5.96$

Second method: $\left[\left(1 + \frac{5.5}{100(4)} \right)^4 - 1 \right] \times 100 = 5.61448 \cong 5.61$

- e. 169 months and 60 quarters

1 mark

Using finance solving, method 1 is 169 months, or 14 years 1 month.

Method 2 will be 60 quarters or 15 years

Question 6 (4 marks)

- a. 6.4%

1 mark

$$\frac{1550.77 \times 26}{100} = 6.4$$

- b. $V_0 = 630000$, $V_{n+1} = 1.00246V_n - 1817.92$

1 mark

1.00246 is from $\frac{1550.77}{630000} + 1 = 1.00246$

- c. Table as below

1 mark

3	181792	154945	26847	62919657
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- d. Final payment is \$1813.71

1 mark

Use finance solver to find 779 normal payments. Final payment will require \$1809.26 before interest. Once interest is added increases to 1813.71356

Question 7 (2 marks)**a.** 2×2 **1 mark**

2 rows and 2 columns

b. *Can be in equivalent form,* $\begin{bmatrix} \frac{5}{7} & -\frac{2}{7} \\ -\frac{4}{7} & \frac{3}{7} \end{bmatrix}$ *or* $\frac{1}{7} \begin{bmatrix} 5 & -2 \\ -4 & 3 \end{bmatrix}$ *or* $\begin{bmatrix} 0.71 & -0.29 \\ -0.57 & 0.43 \end{bmatrix}$ **1 mark**

Question 8 (3 marks)

a. $\begin{bmatrix} 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix},$ **1 mark**

*loss**A B C D*

b. $\begin{matrix} A \\ B \\ C \\ D \end{matrix} \begin{bmatrix} 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix},$ **1 mark**

c. *A, B, C, D* **1 mark**

$$\begin{bmatrix} 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} + \begin{bmatrix} 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}^2 = \begin{bmatrix} 0 & 1 & 2 & 2 \\ 1 & 0 & 2 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}, \text{ summed} = \begin{bmatrix} 5 \\ 4 \\ 3 \\ 2 \end{bmatrix}$$

Question 9 (4 marks)

- a. 10% of baby trout die
 5% of young die
 20% of adults die
 100% of dead fish remain dead

1 mark**Similar wording can be used.**

- b. 85.5%

$$T^2 \times \begin{bmatrix} 500 \\ 0 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0 \\ 135 \\ 292.5 \\ 72.5 \end{bmatrix} \text{ so } 427.5 \text{ remain } \frac{427.5}{500} = 85.5\%$$

1 mark

- c. All the fish will die.

Similar wording can be accepted.**1 mark**

$$d. S_0 = \begin{bmatrix} 300 \\ 1000 \\ 3000 \\ 0 \end{bmatrix}, S_{n+1} = T \times S_n + \begin{bmatrix} 300 \\ 430 \\ -50 \\ 0 \end{bmatrix}$$

1 mark**Question 10 (3 marks)**

$$a. L = \begin{bmatrix} 0 & 1.6 & 2.4 & 4.9 & 4.3 & 0.2 \\ 0.91 & 0 & 0 & 0 & 0 & 0 \\ 0 & .88 & 0 & 0 & 0 & 0 \\ 0 & 0 & .73 & 0 & 0 & 0 \\ 0 & 0 & 0 & .65 & 0 & 0 \\ 0 & 0 & 0 & 0 & .62 & 0 \end{bmatrix}$$

1 mark

- b. 8642

1 mark

$$L^2 \times \begin{bmatrix} 2014 \\ 345 \\ 194 \\ 131 \\ 104 \\ 62 \end{bmatrix} = \begin{bmatrix} 4734 \\ 1928.38 \\ 1612.81 \\ 221.63 \\ 92.05 \\ 52.79 \end{bmatrix} \text{ which sums to } 8642$$

c. 764284

1 mark

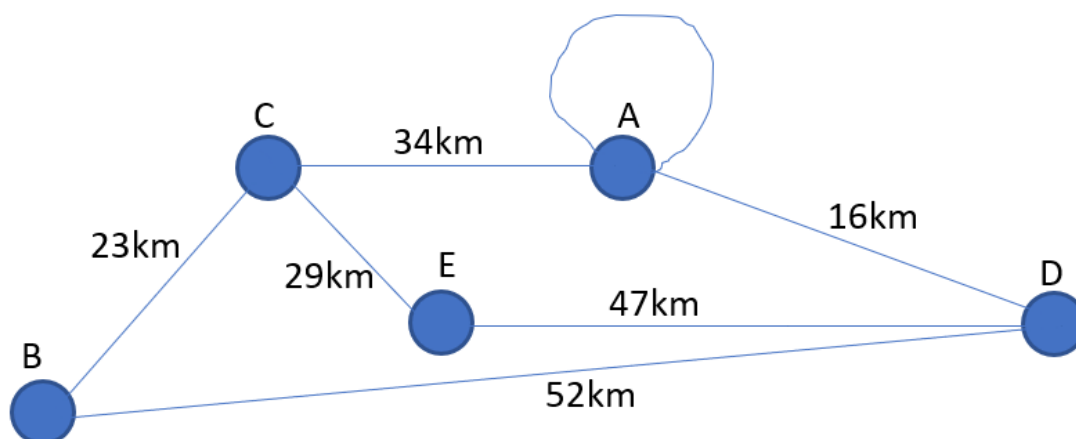
$$L^8 \times \begin{bmatrix} 2014 \\ 345 \\ 194 \\ 131 \\ 104 \\ 62 \end{bmatrix} = \begin{bmatrix} 208300.91 \\ 100302.85 \\ 46958.11 \\ 17992.36 \\ 6598.47 \\ 1990.36 \end{bmatrix}$$

the result is then summed and doubled to get total population and not just females.

Question 11 (4 marks)

- a. Graph can be drawn many ways. As long as all correct data is included mark should be awarded. 1 mark

For example:



- b. $V - E + f = 2$ 1 mark
 $5 - 7 + 4 = 2$ as required
- c. Minimum spanning tree 1 mark
- d. 102 km 1 mark
16+34+23+29

Question 12 (2 marks)

a. *Ace = Replace, Best = Finish, Con's = Remove, Dodgy = Excavate*

2 marks

1 mark for correct allocation.

1 mark for correct reduction to produce bipartite graph.

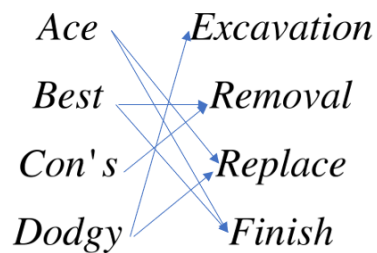
$$\begin{bmatrix} 22500 & 8000 & 7000 & 11200 \\ 19200 & 6250 & 7300 & 11000 \\ 23000 & 6000 & 7220 & 12000 \\ 19250 & 6900 & 7000 & 15000 \end{bmatrix} \quad \text{column and row reduction}$$

$$\begin{bmatrix} 3150 & 1000 & 0 & 0 \\ 600 & 0 & 1050 & 550 \\ 4650 & 0 & 1220 & 1800 \\ 0 & 0 & 100 & 3900 \end{bmatrix} \quad \text{cover 0's, add min to double covered, subtract from non covered}$$

$$\begin{bmatrix} 3250 & 1100 & 0 & 0 \\ 600 & 0 & 950 & 450 \\ 4650 & 0 & 1120 & 1700 \\ 0 & 0 & 0 & 3900 \end{bmatrix} \quad \text{repeat}$$

$$\begin{bmatrix} 3250 & 1550 & 0 & 0 \\ 150 & 0 & 500 & 0 \\ 4200 & 0 & 670 & 1250 \\ 0 & 450 & 0 & 3900 \end{bmatrix} \quad \text{final}$$

Allocation



Question 13 (3 marks)

a. 58 1 mark

20+12+9+6+11 be aware of arrow direction

b. *Cut 1=45, Cut 2 =46* 1 mark

c. 37 1 mark

Cut across 25, 8 and 12. 8 is flowing into the back of the cut, thus not counted.

Question 14 (3 marks)

a. *Est = 8, Duration = 3, Predecessor = B* 1 mark

b. *A-C-F-H-F* 1 mark

c. *B=1, D=1, E=4, G=1* 1 mark