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# **VCE<sup>®</sup> 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

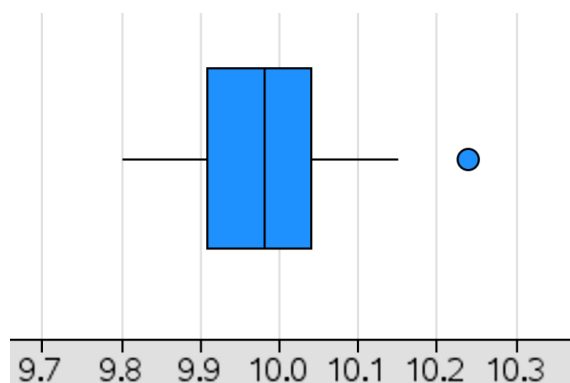
c.

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*

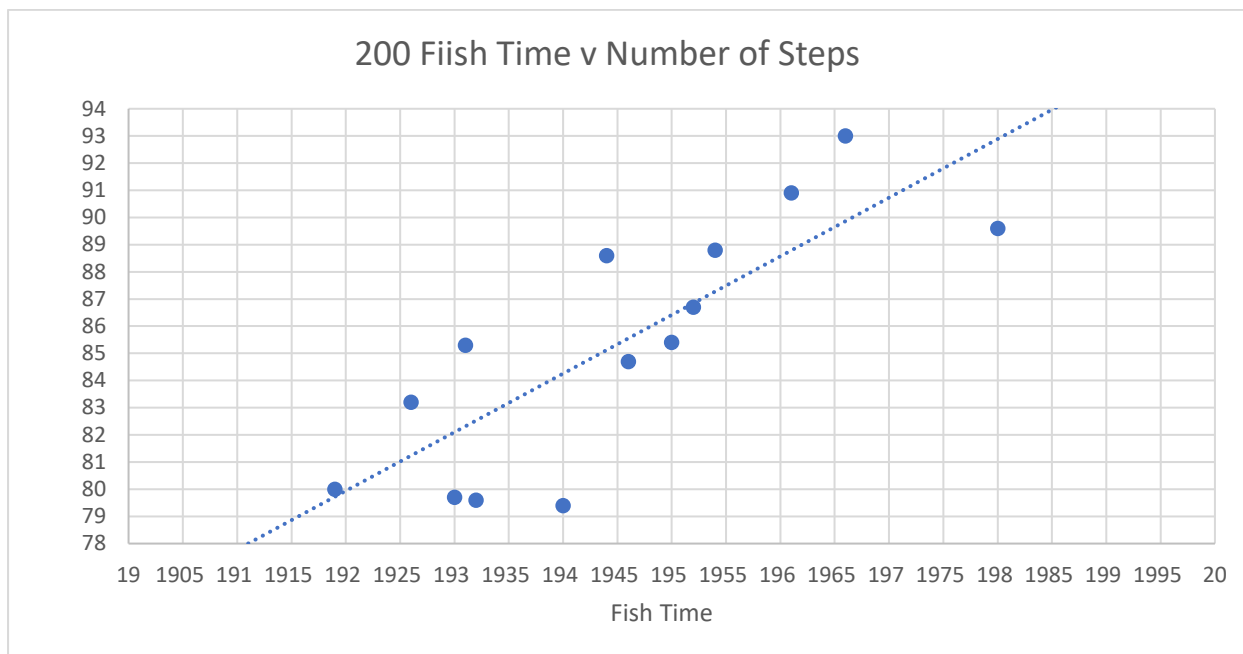
1 mark

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.

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

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.  $15.28\text{km/h}$

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

**1 mark**

#### Question 4 (3 marks)

$$V_0 = 2899$$

$$V_1 = 2464.15$$

$$V_2 = 2029.30$$

a.

**1 mark**

b.  $15\%$

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

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

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

**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**

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

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

- 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**

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

- c. Table as below

**1 mark**

<b>3</b>	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.**  $2 \times 2$ **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.**  $A \begin{bmatrix} 0 & 1 & 0 & 1 \end{bmatrix},$   
*win*  $B \begin{bmatrix} 0 & 0 & 1 & 1 \end{bmatrix},$   
 $C \begin{bmatrix} 1 & 0 & 0 & 0 \end{bmatrix}$   
 $D \begin{bmatrix} 0 & 0 & 1 & 0 \end{bmatrix}$

**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

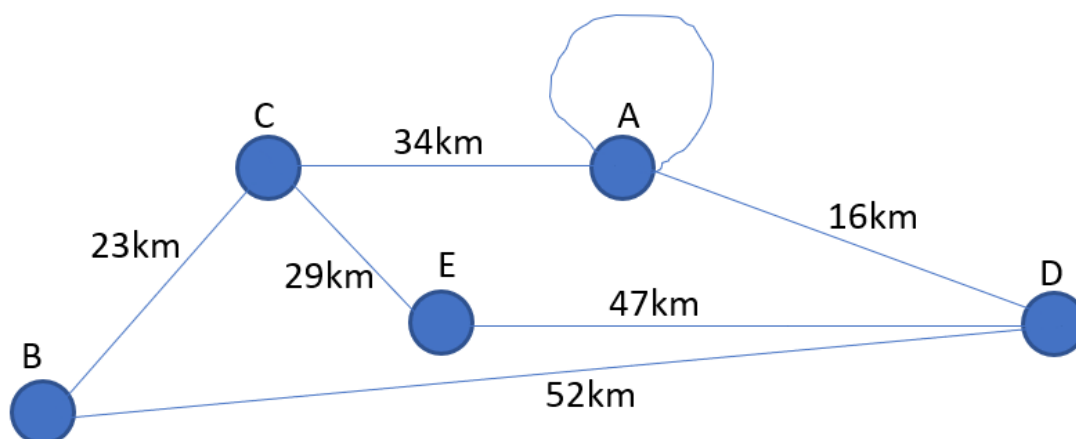
$$L^8 \times \begin{bmatrix} 2014 \\ 345 \\ 194 \\ 131 \\ 104 \\ 62 \end{bmatrix} = \begin{bmatrix} 208300.91 \\ 100302.85 \\ 46958.11 \\ 17992.36 \\ 6598.47 \\ 1990.36 \end{bmatrix}$$

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.

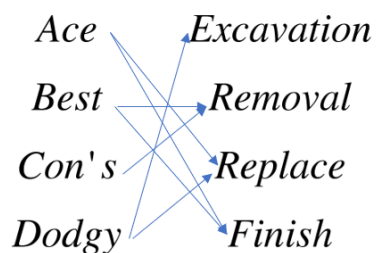
**1 mark** for correct reduction to produce bipartite graph.

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

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

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

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

**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