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NAME: _____

VCE® General Mathematics

Unit 3 & 4 Examination 1

Reading time: 10 minutes
Writing time: 90 minutes

QUESTION AND ANSWER BOOK

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	16	16	16
B	8	8	8
C	8	8	8
D	8	8	8
		Total	40

This exam will be marked **out of 40.**

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, and rulers.
- Students are permitted to bring into the examination room: Bound reference notebook, 1 CAS calculator, 1 Scientific calculator.

Materials supplied
- Question and Answer Book of 22 pages.
- Answer sheet for Multiple-Choice Questions.

Instructions
- Write your **student name** in the space provided above on this page.
- Check that your **student name** is printed on your answer sheet for multiple-choice.
- All written responses must be in English.

At the end of the examination
- Place the answer sheet for multiple-choice questions inside the front cover of this book.

Your teacher will advise you of the contribution of this exam to your School-Assessed Coursework.

Students are NOT permitted to bring into the examination room mobile phones and/or any other unauthorised electronic devices.

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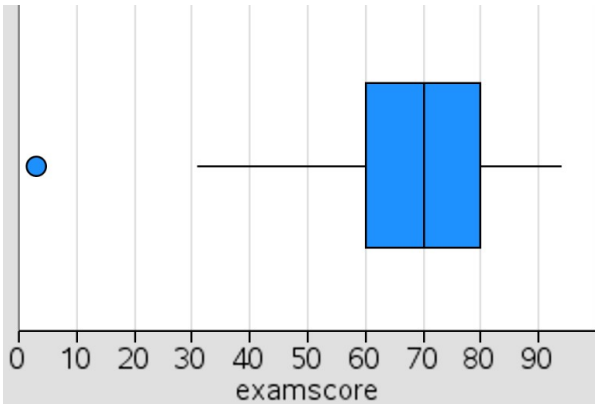
Section A – Data Analysis Suggested time: 36 minutes

The following information is to be used for Questions 1, 2 & 3

The box plot below contains the results of 32 students doing a General Maths Examination



Question 1

What is the approximate range of the plot?

A. 62

B. 20

C. 10

D. 91

E. 100

Question 2

The upper and lower fences of the plot respectfully are

A. 60 & 80

B. 3 & 94

C. 30 & 110

D. 58.5 & 81.5

E. 31 & 94

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Question 3

The number of students that achieved results below 60 on the exam is

A. 25

B. 50

C. 75

D. 16

E. 8

The following information is to be used for Questions 4, 5, 6 & 7

Stem	Leaf
4	5 6 7 7 8 8
5	2 4 6 8 8
6	5 8 9
7	4 5
8	7
9	9

Question 4

The Shape of the Stem and Leaf plot is

A. Symmetric

B. Positive

C. Negative

D. Square

E. Random

Question 5

The Median of the Stem and Leaf plot is

A. 57

B. 58

C. 68

D. 69

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E. 47

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Question 6

95% of the data in the Stem and Leaf plot is approximately between

A. 14.87 & 106.91

B. 30.21 & 76.23

C. 45.55 & 91.57

D. 30.21 & 91.57

E. 45.55 & 76.23

Question 7

A Z-Score of 2.36 would result in a value of approximately

A. 24.7

B. 97

C. 96

D. -3.84

E. 92

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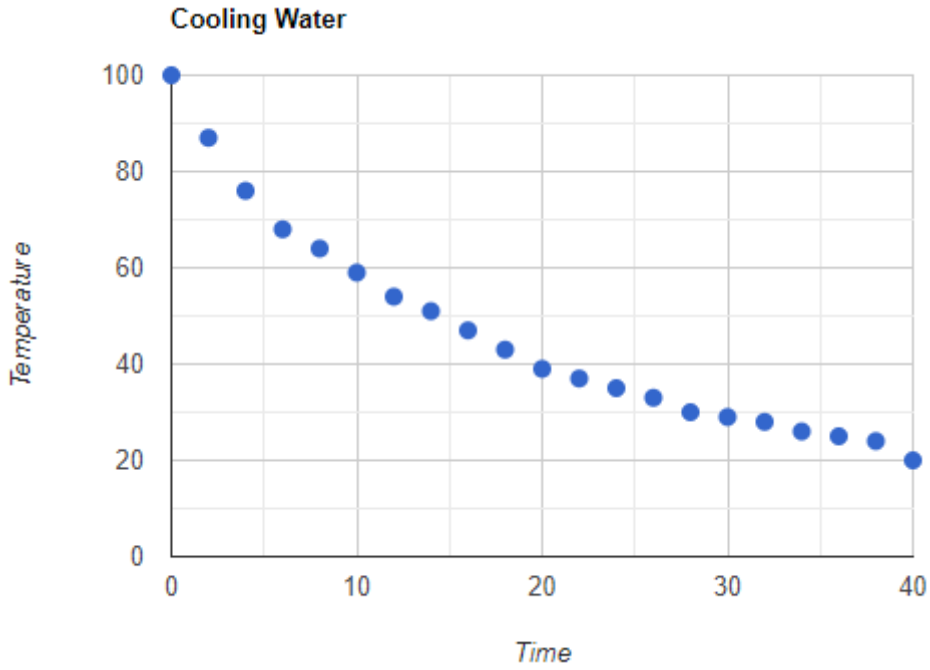
The following information is to be used for Questions 8, 9, 10 and 11.



Question 8

The direction and form of the scatter plot is

A. Positive Linear

B. Positive Non-Linear

C. Negative Linear

D. Negative Non-Linear

E. Strong Negative

Question 9

Which transformation would be best used to linearise the data?

A. Log(Temperature)

B. Time^2

C. Temp^2

D. Time^3

E. $\text{Log}(\text{Time}^2)$

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Question 10

If the linearised data results in the following values, the gradient and intercept would be

r	S_y	S_x	$\overline{x}$	$\overline{y}$
-0.995	0.18	11.83	21	1.6

A. 1.6 & 21

B. -0.015 & 1.92

C. -0.995 & 0.18

D. 11.83 & -0.015

E. 1.92 & -0.995

Question 11

The transformation provides a predicted value of 20.61 for a time of 40 minutes. The resultant residual value is

A. -19.39

B. -0.61

C. 0.61

D. 19.39

E. Not enough information

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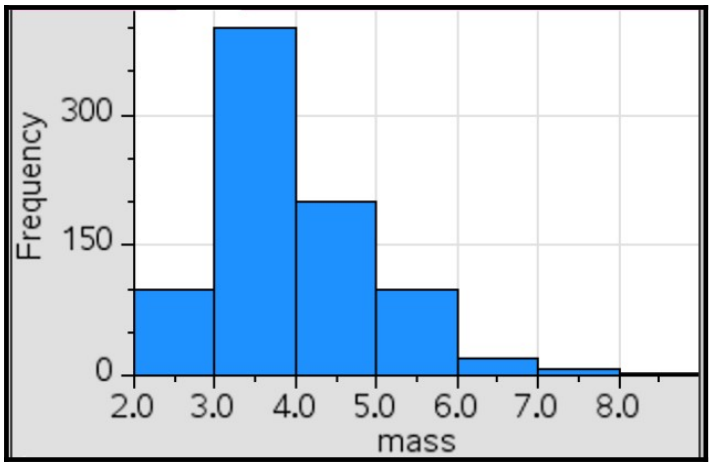
Question 12

The graph below shows the log(mass) of animals against the frequency of them.



How many animals had a mass between 100000 and 1000000 grams?

A. 100

B. 400

C. 200

D. 20

E. 8

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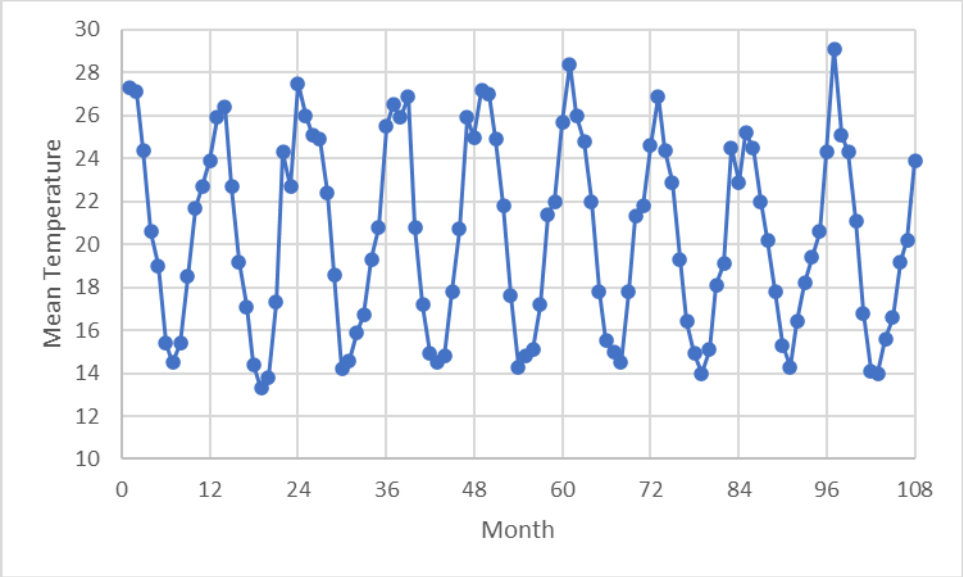
Question 13

The following plot shows the Mean temperature in Melbourne over 9 years:



The plot can be best described as

A. Cyclic

B. Increasing trend

C. Decreasing trend

D. Seasonal

E. Random

Question 14

In the table below, what is the missing Seasonal Index value?

	Winter	**Spring**	**Summer**	**Autumn**
Seasonal Index	1.28	1.02		0.96

A. 0.98

B. 1.04

C. 0.80

D. 1.42

E. 0.74

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Question 15

To correct for seasonality, the 5 point smoothed value for week 7 is

Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Rainfall (mm)	32	18	15	17	48	9	12	23	22

A. 22.8

B. 21.8

C. 20.2

D. 21.4

E. 26

Question 16

The seasonal index of ice cream sales in December is 1.8. To correct for seasonality, the actual value in December needs to be

A. Increased by 55.6%

B. Increased by 80%

C. Stay the same

D. Decreased by 55.6%

E. Decreased by 80%

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Section B - Recursion and Financial Modelling Suggested time: 18 minutes

Question 17

For the following sequence of terms, the relevant Recurrence relation is

450, 900, 1350, 1800, 2250, 2700…

A. $V_0 = 450,\ V_{n+1} = V_n - 450$

B. $V_0 = 450,\ V_{n+1} = V_n + 450$

C. $V_0 = 450,\ V_{n+1} = V_0 - 450$

D. $V_0 = 450,\ V_{n+1} = V_0 + 450$

E. $V_{n+1} = V_0 + 450$

Question 18

A car is purchased for $74 999. After it has driven for 5 years it now has a value of $42 599. On average the car is driven for 24000 km a year.

The unit rate that the car depreciates per km is

A. $0.27

B. $2.70

C. $27

D. $32400

E. $0.35

Question 19

Dana has invested their life savings into a bank account that pays 6.4% p/a simple interest. They deposited $12400. After 3 years the value of their account is

A. $793.60

B. $79360

C. $2380.80

D. $14780.80

E. $13987.20

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Question 20

If the investment from question 19 was instead a compound investment, the difference in account balance after 3 years, compounding 6 monthly, would be

A. $14979.59

B. $2579.59

C. $198.79

D. $3210.87

E. $14936.40

The following information is for Questions 21 and 22

Payment Number	Payment	Interest	Principal reduction	Balance
0	0	0	0	35000
1	4825	1295	3530	31470
2	4825	1164.39	3660.61	27809.39
3	4825		3796.05	24013.34

Question 21

The missing value in the reducing balance amortisation table is

A. $4825

B. $35000

C. $1028.95

D. $3.7

E. $3796.05

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Question 22

The value of the final payment would be

A. $2793.60

B. $2819.40

C. $4825

D. $2923.72

E. $1901.28

Question 23

A company wishes to start a yearly prize. They intend to invest $325000 into an account and each year have $12000 to award. What is the annual interest rate the account would need to be invested at, to one decimal place?

A. 3.7%

B. 3.6%

C. 96.3%

D. 96.4%

E. 1.03%

Question 24

Using the recurrence relation below, the value of the account after 5 years is closest to

$$V_0 = 37000,\ V_{n+1} = 1.0034V_n + 600$$

A. $37632.92

B. $37932.92

C. $38233.29

D. $40633.33

E. $40653.76

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Section C – Matrices Suggested time: 18 minutes

The following information is to be used for Questions 25 and 26

$$A = \begin{bmatrix} 12 & 13 & 19 & 22 \\ 7 & 12 & 31 & 44 \\ 54 & 23 & 3 & 46 \\ 16 & 12 & 4 & 27 \end{bmatrix}$$

Question 25

The element in position $A_{31,}$ if matrix A is transposed, is

A. 12

B. 13

C. 19

D. 22

E. 54.

Question 26

To the nearest value, what is the determinant of matrix A?

A. 116719

B. 116720

C. 911

D. 1418

E. 18188

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Question 27

If a matrix follows the rule 3i – 2j what is the missing value in the matrix below?

$$\begin{bmatrix} 1 & -1 & -3 \\ 4 & 2 & 0 \\ 7 & 5 & \end{bmatrix}$$

A. 1

B. 2

C. 3

D. 4

E. 5

Question 28

Why does a Leslie matrix only use the females of a sample?

A. You only need to use 50% of data.

B. Male animals have a shorter life expectancy.

C. Only female animals give birth.

D. Female animals have a longer life expectancy.

E. You don't have to use only Females.

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Question 29

The matrix product $\begin{bmatrix} 0&1&0&0&0&0&0 \\ 0&0&1&0&0&0&0 \\ 0&0&0&0&0&0&1 \\ 0&0&0&0&0&1&0 \\ 0&0&0&0&1&0&0 \\ 1&0&0&0&0&0&0 \\ 0&0&0&1&0&0&0 \end{bmatrix} \times \begin{bmatrix} G \\ E \\ N \\ E \\ R \\ A \\ L \end{bmatrix}$ is equal to

A. $\begin{bmatrix} G \\ L \\ E \\ A \\ N \\ E \\ R \end{bmatrix}$

B. $\begin{bmatrix} E \\ N \\ L \\ A \\ R \\ G \\ E \end{bmatrix}$

C. $\begin{bmatrix} A \\ N \\ G \\ L \\ E \\ R \\ E \end{bmatrix}$

D. $\begin{bmatrix} E \\ N \\ L \\ A \\ G \\ R \\ E \end{bmatrix}$

E. $\begin{bmatrix} E \\ G \\ R \\ A \\ L \\ N \\ E \end{bmatrix}$

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Question 30

The steady state of the matrix equation below is found after how many iterations?

$$T=\begin{bmatrix} 0.7 & 0.3 & 0.1 \\ 0.1 & 0.3 & 0.4 \\ 0.2 & 0.4 & 0.5 \end{bmatrix} \text{ and } S_0=\begin{bmatrix} 2400 \\ 1200 \\ 9000 \end{bmatrix}$$

A. 50

B. 12

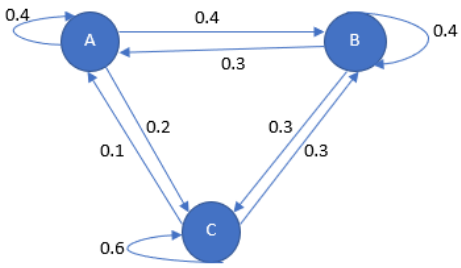
C. 13

D. 20

E. 99

Question 31

The graph below results in which transition matrix?



A.
$$\begin{array}{c} \\ A \\ B \\ C \end{array}\begin{bmatrix} 0.4 & 0.4 & 0.2 \\ 0.4 & 0.3 & 0.1 \\ 0.2 & 0.3 & 0.6 \end{bmatrix}$$

B.
$$\begin{array}{c} \\ A \\ B \\ C \end{array}\begin{bmatrix} 0.4 & 0.3 & 0.1 \\ 0.4 & 0.4 & 0.3 \\ 0.2 & 0.3 & 0.6 \end{bmatrix}$$

C.
$$\begin{array}{c} \\ A \\ B \\ C \end{array}\begin{bmatrix} 0.4 & 0.4 & 0.1 \\ 0.4 & 0.3 & 0.3 \\ 0.2 & 0.3 & 0.6 \end{bmatrix}$$

D.
$$\begin{array}{c} \\ A \\ B \\ C \end{array}\begin{bmatrix} 0.4 & 0.4 & 0.2 \\ 0.3 & 0.4 & 0.3 \\ 0.1 & 0.3 & 0.6 \end{bmatrix}$$

E.
$$\begin{array}{c} \\ A \\ B \\ C \end{array}\begin{bmatrix} 0.6 & 0.3 & 0.2 \\ 0.3 & 0.4 & 0.4 \\ 0.1 & 0.3 & 0.4 \end{bmatrix}$$

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Question 32

To find the value of S_{n+1} the rule $S_{n+1} = TS_n + D$ is used, where the values of T, S_0 and D are:

$$T = \begin{bmatrix} .6 & .5 \\ .4 & .5 \end{bmatrix},\ S_0 = \begin{bmatrix} 320 \\ 580 \end{bmatrix} \text{ and } D = \begin{bmatrix} -12 \\ 27 \end{bmatrix}$$

The value of S_4 to 2 decimal places is

A. $\begin{bmatrix} 470 \\ 445 \end{bmatrix}$

B. $\begin{bmatrix} 492.5 \\ 437.5 \end{bmatrix}$

C. $\begin{bmatrix} 510.73 \\ 449.28 \end{bmatrix}$

D. $\begin{bmatrix} 487.98 \\ 427.02 \end{bmatrix}$

E. $\begin{bmatrix} 502 \\ 442 \end{bmatrix}$

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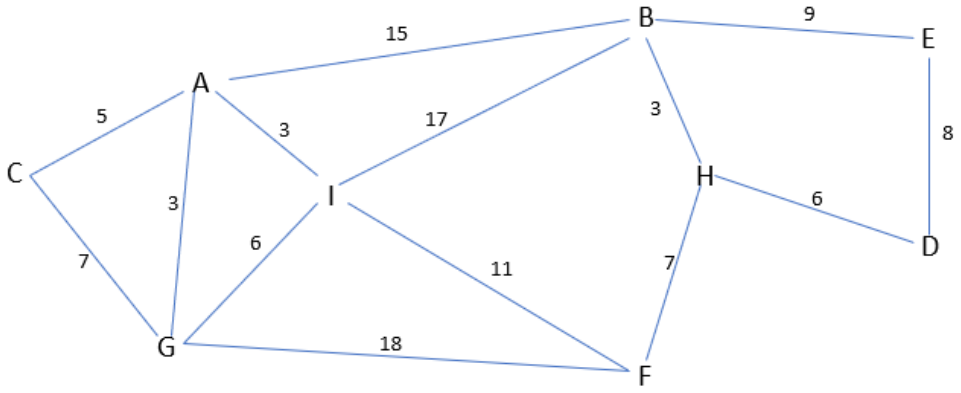
Section D – Networks Suggested time: 18 minutes

The following graph is to be used for Questions 33, 34 and 35



Question 33

The number of faces in the graph is

A. 7

B. 6

C. 5

D. 9

E. 8

Question 34

A Eulerian Trail of the graph is

A. H-D-E-B-F-G-C-A-G-I-A-B-I-F

B. H-D-E-B-H-F-G-C-A-G-I-A-B-I-F

C. H-F-G-C-A-G-I-A-B-I-F

D. H-D-E-B-H-F-G-C-A-G-I-A-B

E. H-D-E-B-H-F-G-C- A-B-I-F

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Question 35

The length of the minimum spanning tree of the graph is

A. 26

B. 36

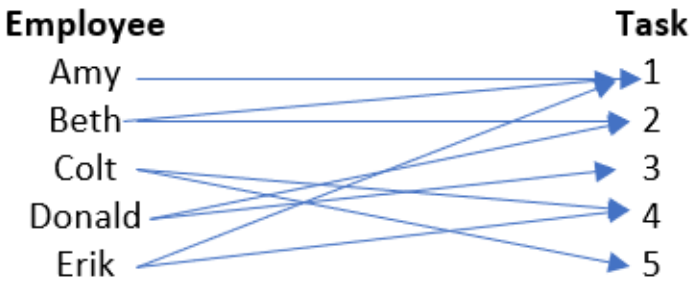
C. 46

D. 56

E. 66

Question 36

By using the bipartite graph below, who will be doing task 4?



A. Amy

B. Beth

C. Colt

D. Donald

E. Erik

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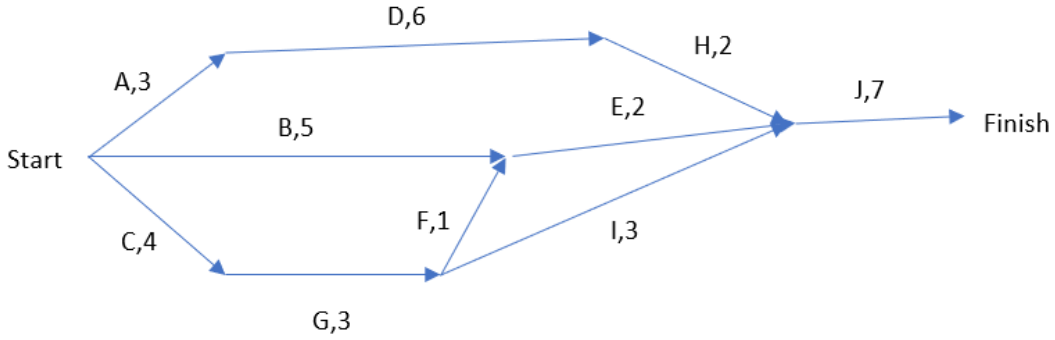
Question 37

In the graph below, the LST of activity C is



A. 0

B. 1

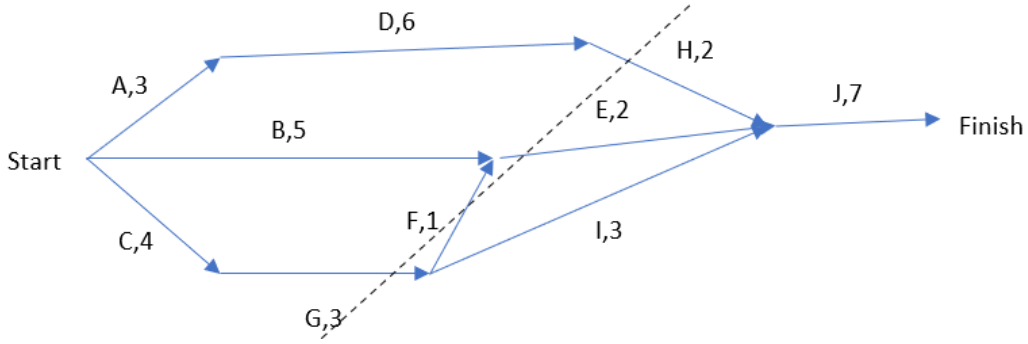
C. 2

D. 3

E. 4

Question 38

The size of the cut in the graph below is



A. 6

B. 7

C. 8

D. 9

E. 10

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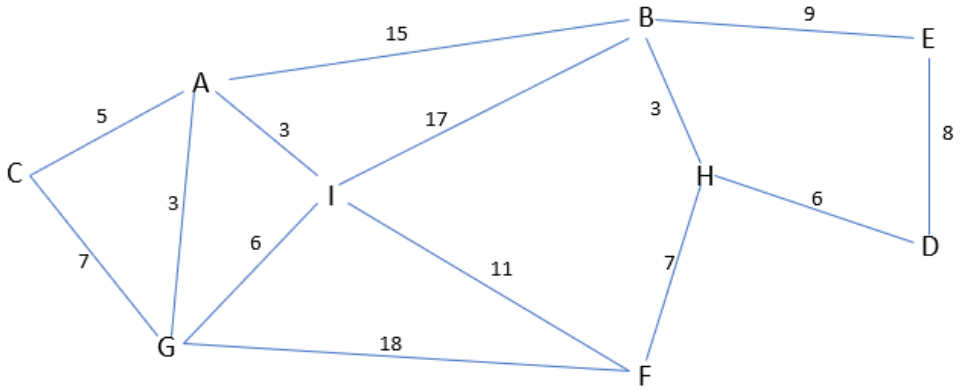
Question 39

What is the shortest path from A to H in the graph below?



A. 15

B. 16

C. 17

D. 18

E. 20

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Question 40

What is the critical path for the activity table below?

Activity	Predecessor	Duration
A	-	3
B	A	4
C	A	2
D	B	5
E	C	1
F	C	2
G	D, E	4
H	F, G	3

A. A-B-C-D-E-F-G-E

B. A-B-D-G-H

C. A-B-C-G-H

D. A-B-D-F-H

E. A-C-E-G-H

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Multiple-Choice Answer Sheet **Name:** _____

INSTRUCTIONS FOR MULTIPLE-CHOICE ANSWER SHEET

Use a **PENCIL** for **ALL** entries. For each question, shade the box which indicates your answer.
Marks will **NOT** be deducted for incorrect answers.
NO mark will be given if more than **one** answer is completed for any question.
If you make a mistake, **ERASE** the incorrect answer - **DO NOT** cross it out.

1	**A**	**B**	**C**	**D**	**E**
2	**A**	**B**	**C**	**D**	**E**
3	**A**	**B**	**C**	**D**	**E**
4	**A**	**B**	**C**	**D**	**E**
5	**A**	**B**	**C**	**D**	**E**
6	**A**	**B**	**C**	**D**	**E**
7	**A**	**B**	**C**	**D**	**E**
8	**A**	**B**	**C**	**D**	**E**
9	**A**	**B**	**C**	**D**	**E**
10	**A**	**B**	**C**	**D**	**E**
11	**A**	**B**	**C**	**D**	**E**
12	**A**	**B**	**C**	**D**	**E**
13	**A**	**B**	**C**	**D**	**E**
14	**A**	**B**	**C**	**D**	**E**
15	**A**	**B**	**C**	**D**	**E**
16	**A**	**B**	**C**	**D**	**E**
17	**A**	**B**	**C**	**D**	**E**
18	**A**	**B**	**C**	**D**	**E**
19	**A**	**B**	**C**	**D**	**E**
20	**A**	**B**	**C**	**D**	**E**

21	**A**	**B**	**C**	**D**	**E**
22	**A**	**B**	**C**	**D**	**E**
23	**A**	**B**	**C**	**D**	**E**
24	**A**	**B**	**C**	**D**	**E**
25	**A**	**B**	**C**	**D**	**E**
26	**A**	**B**	**C**	**D**	**E**
27	**A**	**B**	**C**	**D**	**E**
28	**A**	**B**	**C**	**D**	**E**
29	**A**	**B**	**C**	**D**	**E**
30	**A**	**B**	**C**	**D**	**E**
31	**A**	**B**	**C**	**D**	**E**
32	**A**	**B**	**C**	**D**	**E**
33	**A**	**B**	**C**	**D**	**E**
34	**A**	**B**	**C**	**D**	**E**
35	**A**	**B**	**C**	**D**	**E**
36	**A**	**B**	**C**	**D**	**E**
37	**A**	**B**	**C**	**D**	**E**
38	**A**	**B**	**C**	**D**	**E**
39	**A**	**B**	**C**	**D**	**E**
40	**A**	**B**	**C**	**D**	**E**

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VCE® General Mathematics

Unit 3 & 4 Examination 1

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Solution Pathway

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

1	A	B	C	**D**	E
2	A	B	**C**	D	E
3	A	B	C	D	**E**
4	A	**B**	C	D	E
5	**A**	B	C	D	E
6	A	B	C	**D**	E
7	A	**B**	C	D	E
8	A	B	C	**D**	E
9	**A**	B	C	D	E
10	A	**B**	C	D	E
11	A	**B**	C	D	E
12	**A**	B	C	D	E
13	A	B	C	**D**	E
14	A	B	C	D	**E**
15	**A**	B	C	D	E
16	A	B	C	**D**	E
17	A	**B**	C	D	E
18	**A**	B	C	D	E
19	A	B	C	**D**	E
20	A	B	**C**	D	E

21	A	B	**C**	D	E
22	A	B	C	**D**	E
23	**A**	B	C	D	E
24	A	B	C	D	**E**
25	A	B	**C**	D	E
26	A	**B**	C	D	E
27	A	B	**C**	D	E
28	A	B	**C**	D	E
29	A	**B**	C	D	E
30	A	B	**C**	D	E
31	A	B	C	**D**	E
32	A	B	**C**	D	E
33	**A**	B	C	D	E
34	A	**B**	C	D	E
35	A	B	**C**	D	E
36	A	B	C	D	**E**
37	A	**B**	C	D	E
38	A	**B**	C	D	E
39	A	B	C	**D**	E
40	A	**B**	C	D	E

Question 1: D

Top whisker is approximately 94, lower outlier is at approximately 3.

Question 2: C

Q1 is 60 and Q3 is 80.

$upper\ fence: 80 + 1.5 \times 20 = 110$

$lower\ fence: 60 - 1.5 \times 20 = 30$.

Question 3: E

60 is the Q1, below this is 25% of the data. 25% of 32 is 8.

Question 4: B

The data is bunched more towards the start of the graph.

Question 5: A

Median is between 56 and 58.

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Question 6: D

95% of the data is 2 standard deviations, the mean is 60.89.

Question 7: B

Using the z-score formula $2.36 = \frac{x - 60.89}{15.34}$.

Question 8: D

The data is decreasing and clearly shows a curve.

Question 9: A

The possible transformations are Log and reciprocal.

Question 10: B

$gradient = r\frac{s_y}{s_x} = -0.995\frac{.18}{11.83} = -0.015$

$Intercept = 1.6 - -0.015 \times 21 = 1.92$.

Question 11: B

Reading the graph shows 40min is 20. 20-20.61 = -0.61.

Question 12: A

Log(100000) is 5, log(1000000) is 6, from the graph between 5 and 6 is 100.

Question 13: D

The graph repeats with every 7th value of the year being a minimum.

Question 14: E

The index values need to total 4.

Question 15: A

$\frac{48 + 9 + 12 + 23 + 22}{5} = 22.8$.

Question 16: D

$\frac{1}{1.8} = 0.556$. This is a reduction of 55.6%.

Question 17: B

The first value is 450 and increases by 450 each time.

Question 18: A

The change in value is $32400. This divided by 5 years of 24000km is 0.27.

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Question 19: D

The interest over the 3 years amounts to $2380.80. Adding this to the initial amount results in a balance of $14780.80.

Question 20: C

The value after 3 years is $14979.60. This results in a difference of $198.79.

Question 21: C

By using the values in payment 1 or 2, it can be determined that the interest is 3.7%. 3.7% of $27809.39 is $1028.95.

Question 22: D

After 8 full payments there is still $2819.40. 3.7% on top of this results in a payment of $2923.72.

Question 23: A

This is a perpetuity, to maintain the balance an interest level of 3.69223% is needed, thus 3.7%.

Question 24: E

By completing the formula 5 times, the value $40653.76 is found.

Question 25: C

When the matrix is transposed the third row starts with 19.

Question 26: B

The determinant is 116720.

Question 27: C

Using the formula shows that $3(3) - 2(3) = 3$.

Question 28: C

Leslie matrices only take into consideration the females as they are the ones that give birth, given Leslie matrices are looking at birth and survival rates.

Question 29: B

The permutation is asking for the 2nd letter, then the 3rd, last, 6th, 5th, 1st and finally 4th.

Question 30: C

The 13th state rounds to the result that is equal to the steady state.

Question 31: D

Only D has all the correct values.

Question 32: C

By completing the relation 4 times results in option C.

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Question 33: A

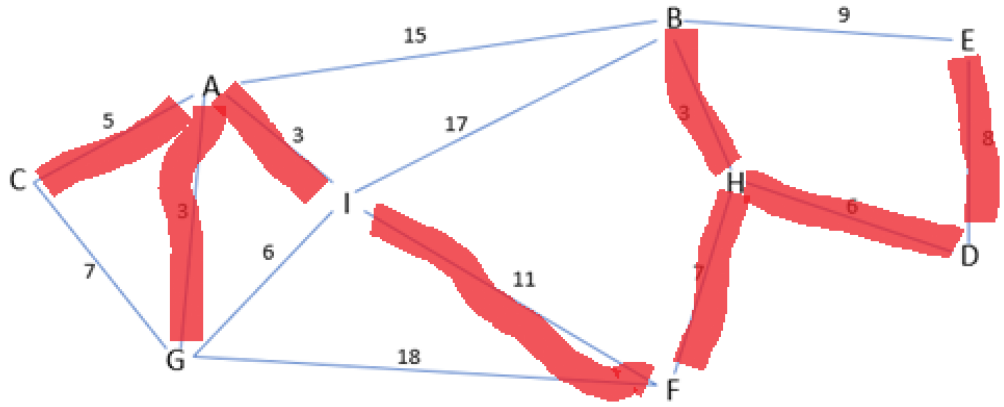
There are 7 faces in the graph.

Question 34: B

Only option B shows a complete Eulerian Trail.

Question 35: C

The minimum spanning tree is as below and is 46 long.



Question 36: E

Only Erik and Colt can do task 4, Colt is the only person who can do task 5, thus Erik has to do 4.

Question 37: B

The critical path is 18 long. The longest path including C is 17, thus its latest start time is 1.

Question 38: B

The cut goes over 4 lines, however the path F is going into the back of the cut and not counted.

Question 39: D

The shortest path is A-B-H which is 18 long.

Question 40: B

The critical path is A-B-D-G-H.

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