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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.

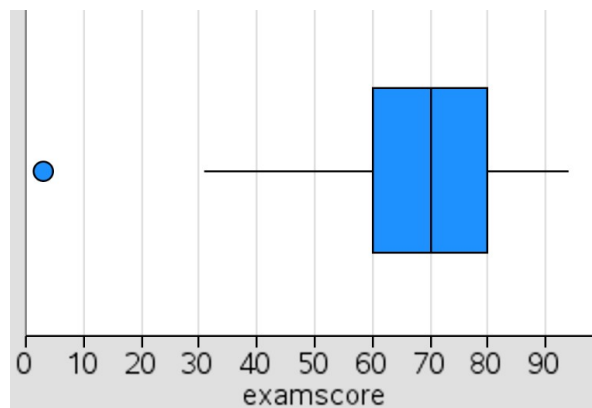
Your teacher will advise you of the contribution of this exam to your School-Assessed Coursework.

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

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

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

E. 47

Question 6

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

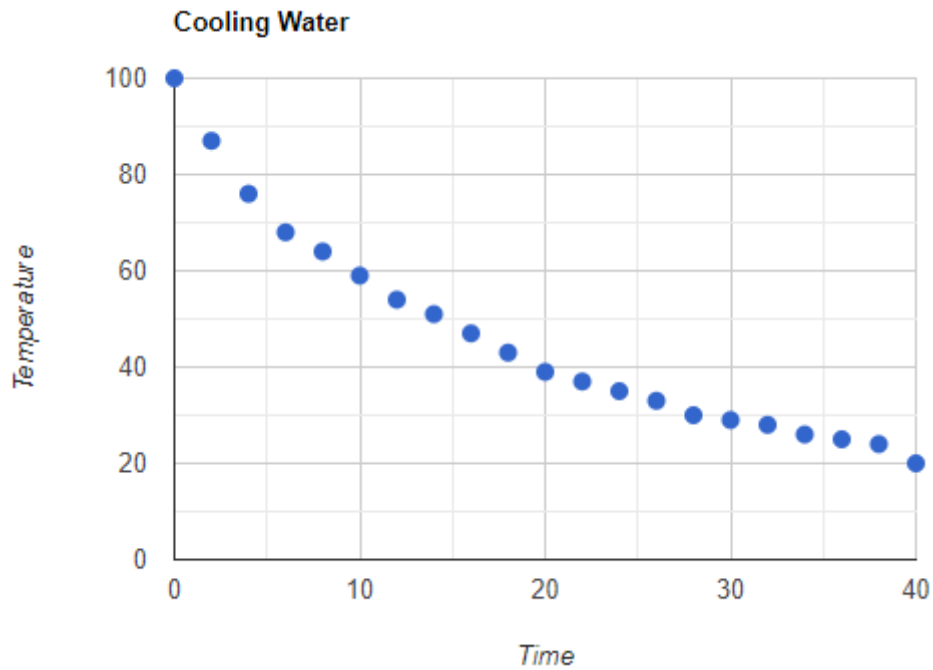
- A. 14.87 & 106.91
- B. 30.21 & 76.23
- C. 45.55 & 91.57
- D. 30.21 & 91.57
- E. 45.55 & 76.23

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

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. $\text{Log}(\text{Temperature})$
- B. Time^2
- C. Temp^2
- D. Time^3
- E. $\text{Log}(\text{Time}^2)$

Question 10

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

r	S_y	S_x	$\bar{x}$	$\bar{y}$
-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

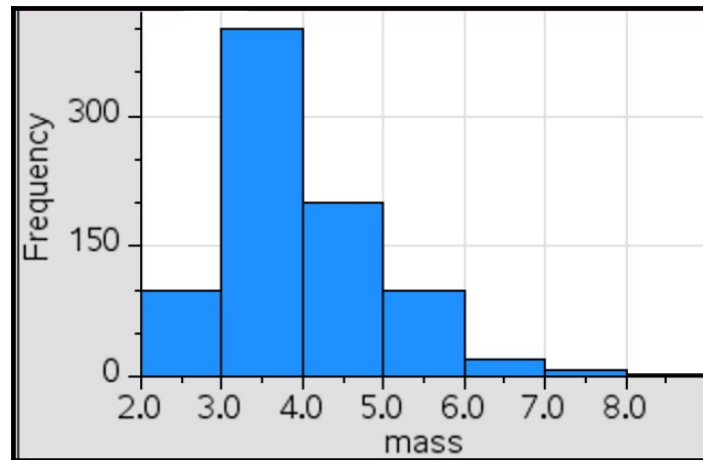
Question 11

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

Question 12

The graph below shows the $\log(\text{mass})$ of animals against the frequency of them.

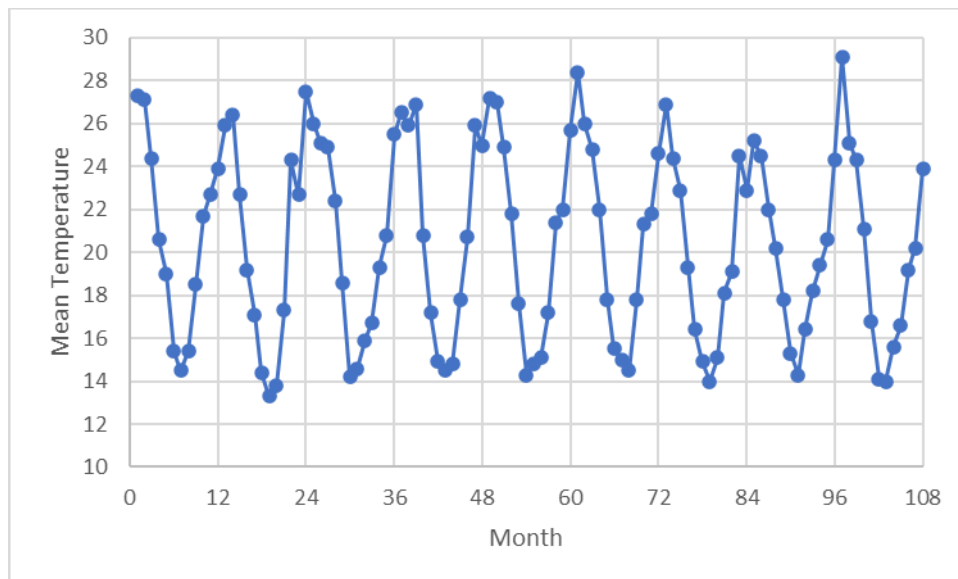


How many animals had a mass between 100000 and 1000000 grams?

- A. 100
- B. 400
- C. 200
- D. 20
- E. 8

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

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%

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

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

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

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

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.

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

Question 30

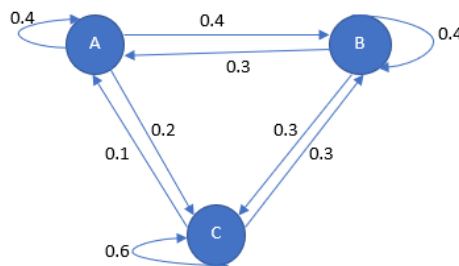
The steady state of the matrix equation below is found after how many iterations?

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

- A. 50
- B. 12
- C. 13
- D. 20
- E. 99

Question 31

The graph below results in which transition matrix?



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

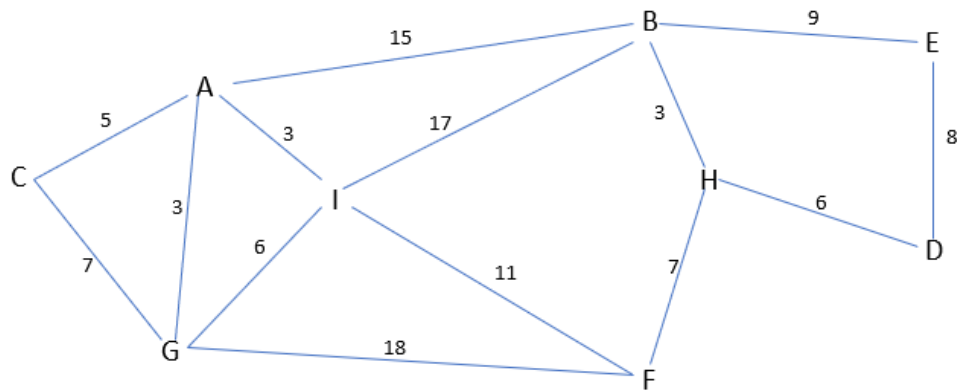
Question 32

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

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

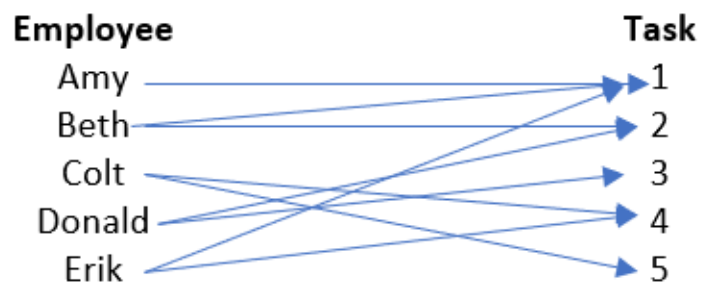
Question 35

The length of the minimum spanning tree of the graph is

- A. 26
- B. 36
- C. 46
- D. 56
- E. 66

Question 36

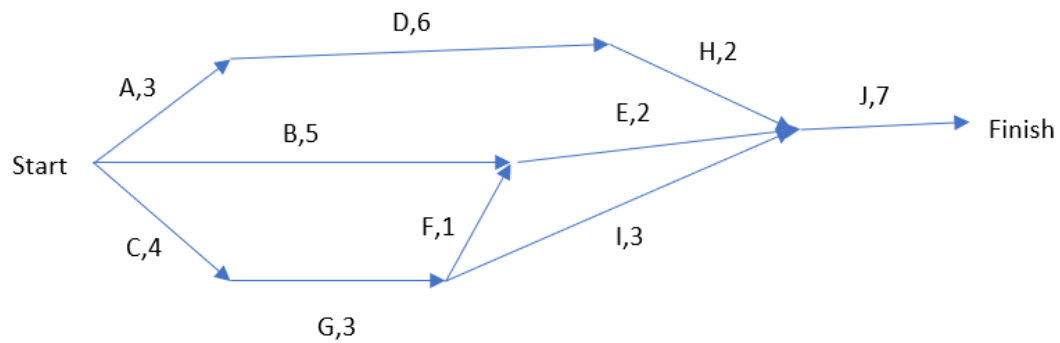
By using the bipartite graph below, who will be doing task 4?



- A. Amy
- B. Beth
- C. Colt
- D. Donald
- E. Erik

Question 37

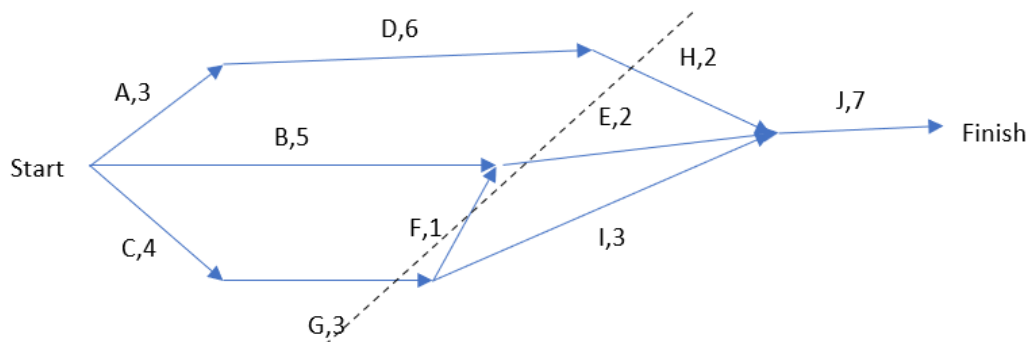
In the graph below, the LST of activity C is



- A. 0
- B. 1
- C. 2
- D. 3
- E. 4

Question 38

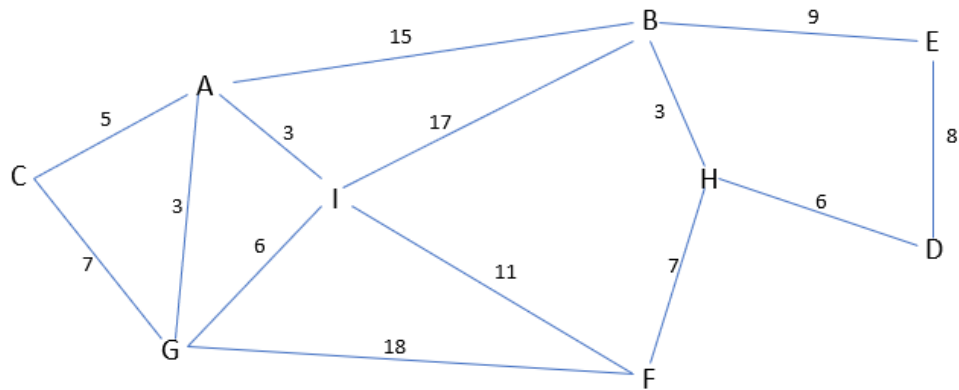
The size of the cut in the graph below is



- A. 6
- B. 7
- C. 8
- D. 9
- E. 10

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

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

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.

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

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

$$\text{Intercept} = 1.6 - (-0.015 \times 21) = 1.92$$

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.

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.

Question 33: A

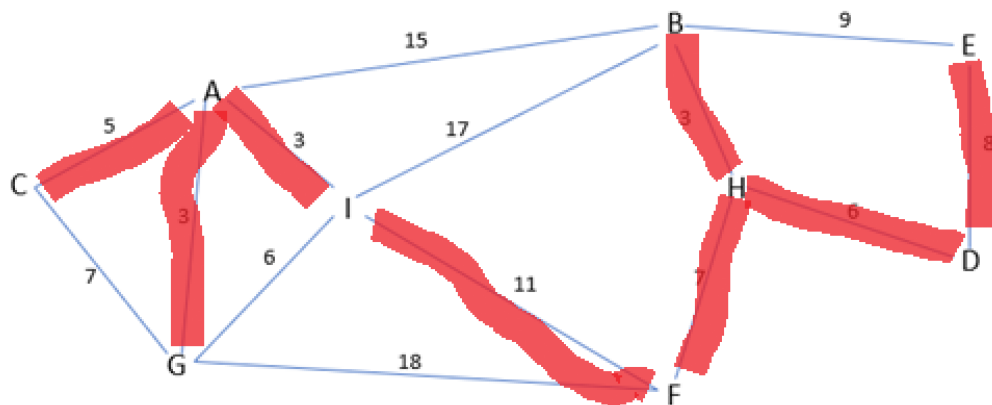
There are 7 faces in the graph.

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.