NAME: _____

VCE® General Mathematics

UNITS 3 & 4 Practice Written Examination 1

Reading time: 15 minutes
Writing time: 1 hour 30 minutes

MULTIPLE-CHOICE QUESTION BOOK

Structure of book

Number of Questions	*Number of questions to be answered*	*Number of marks*
40	**40**	**40**
		Total 40

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, one bound reference, one approved technology (calculator or software) and, if desired, one scientific calculator. Calculator memory DOES NOT need to be cleared. For approved CAS, full functionality may be used.
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or correction fluid/tape.

Materials supplied

- Question and answer book of 22 pages
- Answer sheet for multiple-choice questions
- Additional space is available at the end of the book if you need extra paper to complete an answer.

Instructions

- Write your **student name** in the space provided above on this page.
- Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

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

Instructions

Answer **all** questions in pencil on the answer sheet provided for Multiple-Choice Questions.
Choose the response that is **correct** for the question.
A correct answer scores 1; an incorrect answer scores 0.
Marks will **not** be deducted for incorrect answers.
No marks will be given if more than one answer is completed for any question.
Unless otherwise indicated, the diagrams are **not** drawn to scale.

Data Analysis

Use the following information to answer Questions 1, 2, and 3.

The mass of **15** puppies were recorded in grams after 3 weeks from birth as shown in the table below.

154	182	196	252	280
308	350	378	406	448
588	700	812	924	1036

Question 1

The mean mass of the data set, in grams, is

A. 378

B. 467.6

C. 438.38

D. 501

E. 6047.07

Question 2

If another puppy was born, what mass would it need to be for the group to have a mean mass of 470 g?

A. 16

B. 470

C. 501

D. 506

E. 7520

Question 3

A measure of spread of the data, in grams, is

A. 212

B. 448

C. 880

D. 501

E. 1036

Use the following information to answer Questions 4, 5, and 6.

The mass of the puppies for a specific breeder is approximately normally distributed with a mean of 1.67 kg and a standard deviation of 0.27 kg.

Question 4

Over decades of breeding, this breeder has produced 372 puppies. Using the 68-95-99.7 rule, the number of puppies that are within 1.13 kg and 1.94 kg is

A. 186

B. 253

C. 303

D. 353

E. 371

Question 5

The Z-score of a puppy with a mass of 2.13 kg is

A. 2.25

B. 1.70

C. -1.70

D. 7.8

E. 0.57

Question 6

What percentage of the puppies would lie between 1.40 kg and 2.21 kg?

A. 68

B. 95

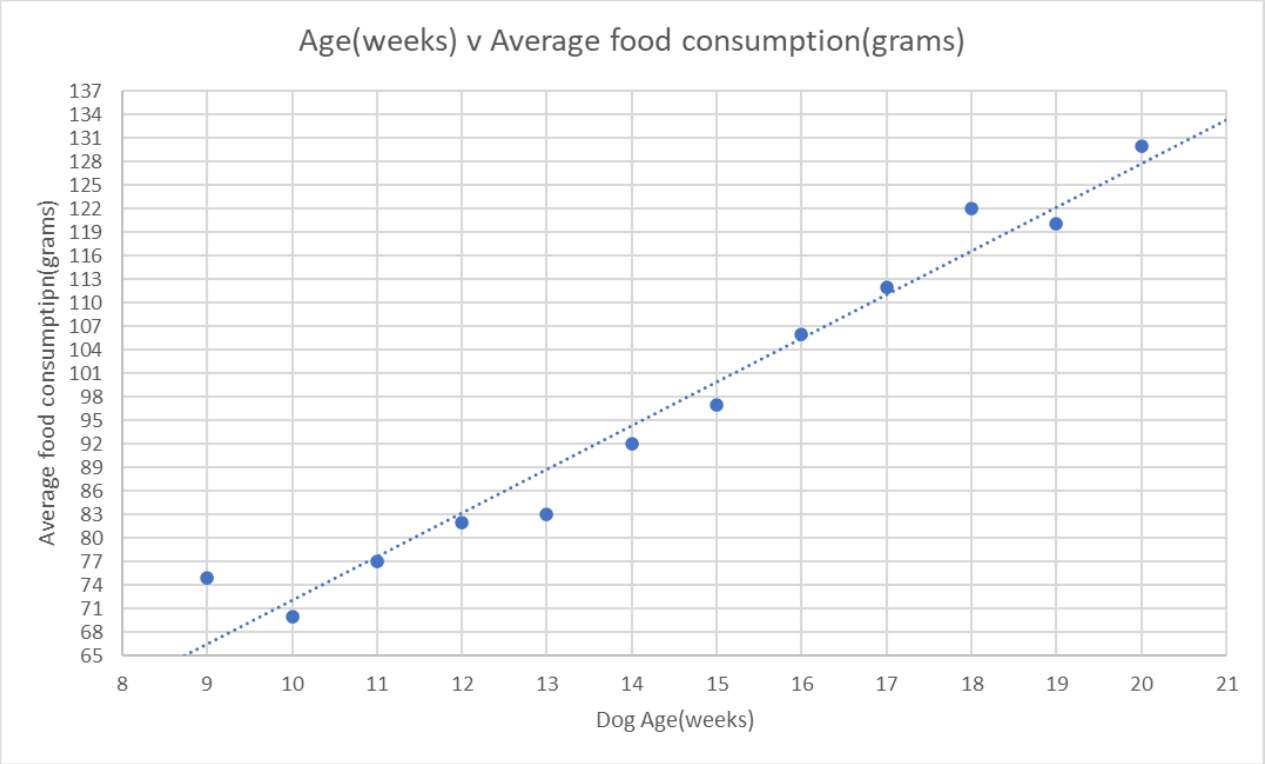
C. 99.7

D. 50

E. 81.5

Use the following information to answer Questions 7-10

A graph of the average food consumption (grams) v puppy age (weeks) is shown below.



Question 7

The median amount of food consumption for the puppies is closest to

A. 92

B. 94.5

C. 97

D. 97.17

E. 104

Question 8

The equation of the Regression line is closest to

A. $food = 5.5(Age) - 17.5$

B. $food = 5.5(Age) + 17.5$

C. $Age = 5.5(food) - 17.5$

D. $Age = 5.5(food) + 17.5$

E. $food = 5.5(Age) + 8.7$

Question 9

Given that the actual amount of food eaten in week 18 was 122 grams, what is the value of the residual?

A. 6

B. -6

C. 0

D. 116

E. 18

Question 10

From the graph it can be concluded that

A. as age increases the food consumption likely increases.

B. as age increases the food consumption likely decreases.

C. there is an increase in food consumption as time decreases.

D. there is a decrease in food consumption as time increases.

E. there is no relation between the 2 variables.

Use the following information to answer Questions 11 and 12.

A y^2 transformation can be applied to the following set of data to help linearise the data set.

X	1	2	3	4	5	6	7	8	9	10	11
Y	15.6	15.7	15.4	15.16	15.2	14.38	14.2	14.3	13.1	11.63	11.2

Question 11

The equation of the transformed data set is

A. $y = 16.78 - 0.44x$

B. $y^2 = 16.78 - 0.45x$

C. $x = 16.78y - 0.45$

D. $x = 16.78y^2 - 0.45$

E. $y^2 = 274.53 - 11.92x$

Question 12

The strength of the transformed data set can be best described as

A. Strong Positive

B. Moderate Positive

C. Strong Negative

D. Moderate Negative

E. Weak relationship

Use the following information to answer Questions 13 and 14.

The average monthly spend of a family was tracked over two years and shown below.

2015

	1	2	3	4	5	6	7	8	9	10	11	12
	141.16	120.75	118	116.50	80.75	62.15	75.16	88.75	121.74	124.20	208.05	232.67

2016

	1	2	3	4	5	6	7	8	9	10	11	12
	239.12	253	248.33	172.79	166.29	112.10	115.81	153.04	164.91	202.77	244.09	253.49

Question 13

The time series features that are evident in the data are

A. upward trend.

B. seasonality.

C. downward trend.

D. random fluctuations.

E. seasonality with upward trend.

Question 14

The value of the 2015 June spend with 5 median smoothing is

A. 62.15

B. 75.16

C. 80.75

D. 88.75

E. 116.50

Use the following information to answer Questions 15 and 16.

Quarter	**Q1**	**Q2**	**Q3**	**Q4**
Average Shopping Bill	**$262**	**$208**	**$114**	**$216**
Seasonl Index	**1.31**		**0.57**	**1.08**

Question 15

The seasonal index for quarter 2 is

A. 0.84

B. 1.04

C. 0.96

D. 4

E. 1.08

Question 16

The de-seasonalised value for quarter 4 is

A. 164.89

B. 200

C. 207.69

D. 216

E. 233.28

Recursion and Financial Modelling

Question 17

A sequence is defined by $U_0 = 12,\ U_{n+1} = 3U_n + 4$.

The value of U_7 is

A. 12

B. 40

C. 4804

D. 30616

E. 43252

Question 18

A car follows the rule of $T_0 = 37500.\ T_{n+1} = T_n - 7100$ per year, where T is the value of the car.

Over the span of 3 years the car travels 36000 km. How much does the car decrease in value per km of travel?

A. $0.59

B. $0.20

C. $3.13

D. $1.04

E. $7100

Use the following information to answer Questions 19 and 20.

Beth wants to invest $19 000 into a savings account for two years. Beth has two options she can choose from, *Simplebank and Complex Bank,* with the following details:

Simplebank: 6.3% simple interest p/a

Complex Bak: 5.7% p/a compounding monthly

Question 19

The balance of each option respectively after 2 years is

A. $21 394 & $21 288.54

B. $2394 & $2288.54

C. $21 394 & $20 111.75

D. $20 111.75 & $21 288.54

E. $2394 & $21 288.54

Question 20

The effective interest rate of *Complex Bank* is

A. 5.85

B. 5.7

C. 6.3

D. 6.49

E. 5.8

Use the following information to answer Questions 21 – 23.

To buy a house, Beth takes out a loan for $873 654. The loan charges interest monthly and follows the rule:

$$T_0 = 873654,\ T_{n+1} = 1.00525T_n - 5824.30$$

Question 21

The value of the annual interest rate per year is

A. 5.85

B. 5.7

C. 6.3

D. 6.49

E. 5.8

Question 22

The final payment will not be a normal payment, The amount that Beth will be required to pay is

A. $5824.30

B. $0

C. $1202.68

D. $4621.62

E. $4597.48

Question 23

The time it takes to pay off the loan will be

A. 24 years.

B. 24 years 7 months.

C. 24 years 8 months.

D. 288 years.

E. 296 years.

Question 24

A bank account that follows the rule $T_0 = 350000,\ T_{n+1} = 1.0047T_n - 1645$ is an example of which type of account?

A. Perpeuity

B. Annuity

C. Simple interest

D. Reducing balance loan

E. Unit cost

Matrices

Question 25

The inverse of the matrix $A=\begin{bmatrix} 7 & -3 & -3 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix}$ is the same as the transpose of which of the following matrices?

A. $\begin{bmatrix} 1 & 1 & 1 \\ 3 & 3 & 3 \\ 3 & 3 & 4 \end{bmatrix}$

B. $\begin{bmatrix} 1 & 3 & 3 \\ 1 & 4 & 3 \\ 1 & 3 & 4 \end{bmatrix}$

C. $\begin{bmatrix} 7 & -1 & -1 \\ -3 & 1 & 0 \\ -3 & 0 & 1 \end{bmatrix}$

D. $\begin{bmatrix} 1 & 1 & 1 \\ 3 & 4 & 3 \\ 3 & 3 & 4 \end{bmatrix}$

E. $\begin{bmatrix} -1 & -1 & -1 \\ -3 & 1 & 1 \\ -3 & 0 & 0 \end{bmatrix}$

Question 26

Let $K=\begin{bmatrix} 1 & -2 & -7 & -14 \\ 3 & 0 & -5 & -12 \end{bmatrix}$. The element in row *i* and column *j* is $\mathrm{K}_{\mathrm{ij.}}$ The rule for matrix K is

A. $k=i+j$

B. $k=i+2j$

C. $k=i-2j$

D. $k=i-j^2$

E. $K=2i-j^2$

Question 27

The product of the two matrices S and T shown below is

$$S=\begin{bmatrix}1&4&5&1\\1&2&2&1\\4&4&3&5\\1&3&1&4\end{bmatrix} \text{ and } T=\begin{bmatrix}12\\4\\2\\9\end{bmatrix}$$

A. undefined

B. $\begin{bmatrix}47\\33\\100\\62\end{bmatrix}$

C. $\begin{bmatrix}47\\33\\115\\62\end{bmatrix}$

D. $\begin{bmatrix}47&0&0&0\\0&35&0&0\\0&0&115&0\\0&0&0&62\end{bmatrix}$

E. $\begin{bmatrix}12\\4\\2\\9\end{bmatrix}$

Question 28

Below are the results of a school team round-robin sports event.

$$\begin{array}{cc} & \textit{Loss} \\ \textit{win} & \begin{array}{c} A \\ B \\ C \\ D \end{array} \begin{bmatrix} 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 1 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix} \end{array}$$

The winner was found via the sum of one and two step dominance. Which team finished second?

A. A

B. B

C. C

D. D

E. Second place was a tie

Question 29

The matrix below models the population change for a breed of cichlid over 5 years.

$$\begin{array}{c} 0-1 \quad 1-2 \quad 2-3 \quad 3-4 \quad 4-5 \\ \begin{bmatrix} 0 & 0 & 1.1 & 0.6 & 0.2 \\ .6 & 0 & 0 & 0 & 0 \\ 0 & .6 & 0 & 0 & 0 \\ 0 & 0 & .8 & 0 & 0 \\ 0 & 0 & 0 & .2 & 0 \end{bmatrix} \end{array}$$

Which of the following is **not** true?

A. 40% of the fish survive birth

B. 60% survive year 1-2

C. Birth rate of 2-3 year old fish is the highest

D. Most births are in 2-3 years old

E. No fish make it to 5 years

Use the following information to answer Questions 30 and 31.

An online gaming platform offers 4 different games to play in a competition. The games are ABA2K (A), BTA (B), COB (C) and Demons (D). The pattern of play for users follows the transition diagram below.

$$T = \begin{array}{c} \text{This time} \\ \begin{matrix} A & B & C & D \end{matrix} \\ \begin{bmatrix} .8 & .3 & .1 & .05 \\ .02 & .4 & .05 & .1 \\ .1 & .2 & .75 & .25 \\ .08 & .1 & .1 & .6 \end{bmatrix} \begin{matrix} A \\ B \\ C \\ D \end{matrix} \end{array} \text{next time}$$

Question 30

If 30 people were playing BTA, how many will play Demons next time?

A. 0.1

B. 3

C. 10

D. 12

E. 30

Question 31

In the long run, which game will have the most players?

A. A

B. B

C. C

D. D

E. A & D

Question 32

A farmer keeps track of his stock so that it follows the transition between fields A and B as shown below.

$$T = \begin{matrix} A & B \\ \end{matrix} \begin{bmatrix} .7 & .6 \\ .3 & .4 \end{bmatrix} \begin{matrix} A \\ B \end{matrix}$$

Due to selling and buying stock the recurrence relation for the farm is

$$S_0 = \begin{bmatrix} 1200 \\ 600 \end{bmatrix},\ S_{n+1} = T \times S_0 + \begin{bmatrix} -100 \\ 50 \end{bmatrix}$$

After three weeks, the population of field A is

A. 1200

B. 1100

C. 1060

D. 1026

E. 650

Networks

Question 33

To satisfy Euler's formula, a graph with six edges and three faces would need to have how many vertices?

A. 2

B. 3

C. 4

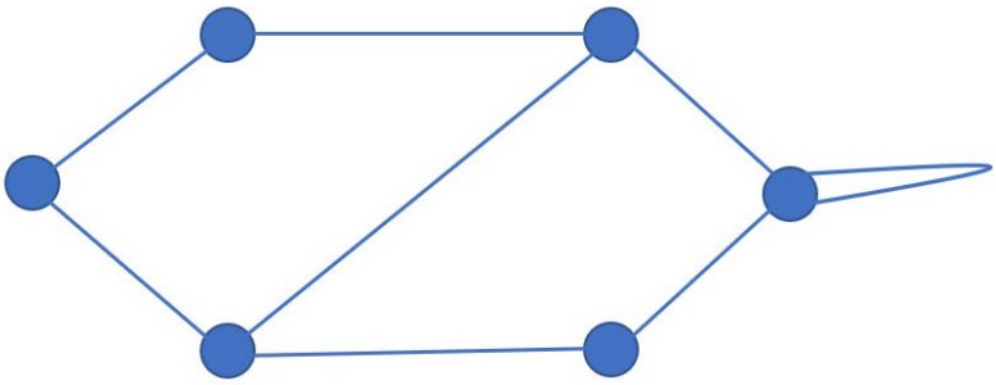
D. 5

E. 6

Question 34

The graph below has how many of the following types of routes:

An Eulerian Trail, An Eulerian Circuit, A Hamiltonian Path, A Hamiltonian Cycle



A. 0

B. 1

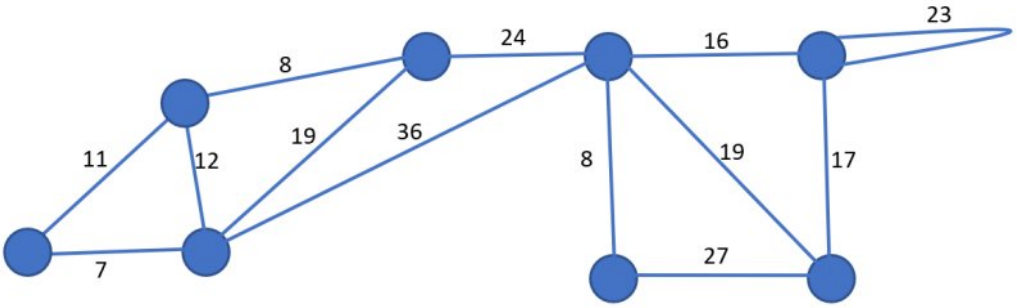
C. 2

D. 3

E. 4

Question 35

The minimum length needed to run services to each of the vertices in the map below is



A. 91

B. 93

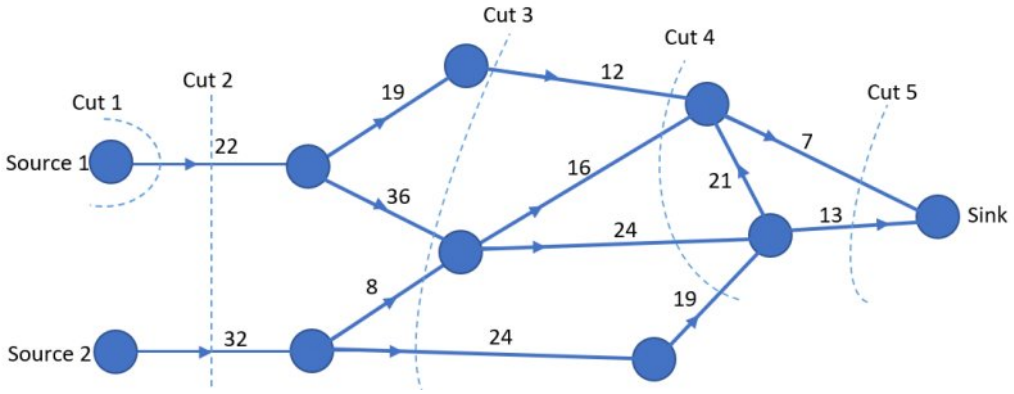
C. 114

D. 136

E. 227

Question 36

The max flow in the graph below is found using which cut?



A. 1

B. 2

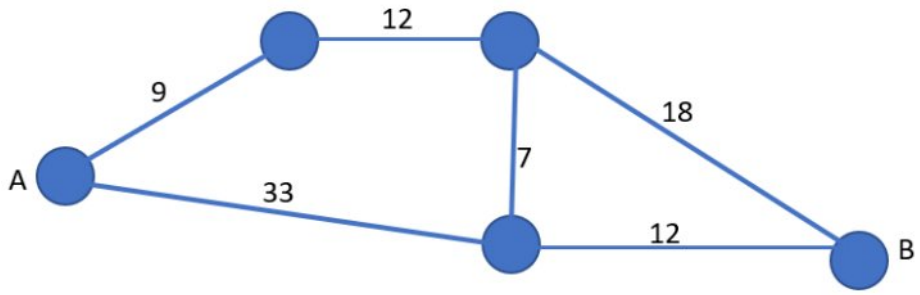
C. 3

D. 4

E. 5

Question 37

To get from A to B in the below graph, the shortest path length is



A. 37

B. 39

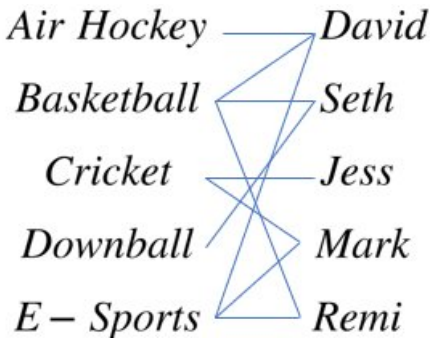
C. 40

D. 45

E. 58

Question 38

By solving the Bipartite graph below, determine the person who will be selected to play Basketball.



A. David

B. Seth

C. Jess

D. Mark

E. Remi

Use the following information to answer Questions 39 and 40

The activity table below is used to define a series of events that are all connected.

Activity	Predecessor	Time taken
A	-	3
B	-	4
C	A	10
D	C	15
E	C	10
F	B	12
G	E	12
H	D	8
I	F	16
J	F	13
K	G,H,I	9
L	J	5

Question 39

The earliest start time for activity I is

A. 16

B. 32

C. 10

D. 12

E. 20

Question 40

There is the ability to change the time of some of the events, but this would come at a cost as seen in the table below.

Activity	C	G	K
Max Days can be reduced	3	4	2
Cost per day	$500	$200	$300

Given these possibilities, the new completion time is now 40 days. How much will it cost to do this?

A. $1000

B. $1100

C. $2100

D. $2300

E. $2900

END OF EXAMINATION

VCE® General Mathematics

Unit 3 and 4 Practice Written Examination 1

ADVICE FOR TEACHERS

Solution Pathway

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

Question	Correct Answer	Explanation
1	B	$\frac{\sum x}{n} = \frac{7014}{15} = 467.6$
2	D	$470 = \frac{7014 + x}{16}$ *gives* $x = 506$
3	B	Range is 882, not an option. IQR is 488
4	C	1.13 and 1.94 is 81.5% of the data, thus 303 puppies
5	B	$Z = \frac{2.13 - 1.67}{0.27} = 1.7037$
6	E	2 above the mean, and 1 below is 81.5%
7	B	12 data points, between 6th and 7th is the median, 94.5
8	B	$y - 122 = 5.5(x - 19)$ *gives* $y = 5.5x + 17.5$
9	A	122-116 = 6
10	A	Positive graph, both variables increasing
11	E	After squaring the y values and doing a regression E is the answer
12	C	r value is -0.9370
13	E	At month 6 each year there is a minimum, and the data is on the increase
14	C	Median of 116.5, 80.75, 62.15, 75.16, and 88.75 is 80.75
15	B	4-(1.31+0.57+1.08) = 1.04
16	B	$deseasonalised = \frac{216}{1.08} = 200$
17	D	After 7 steps D is the answer
18	A	$\frac{36000}{3} = 12000, \frac{7100}{12000} = 0.59166$

19	**A**	$simple: 19000+\left(\frac{19000\times 6.3\times 2}{100}\right)=21394$ $complex: 19000\left(1+\frac{5.7}{\frac{12}{100}}\right)^{24}=21288.5439$
20	**A**	$\left[\left(1+\frac{5.7}{100(12)}\right)^{12}-1\right]100=5.8513$
21	**C**	$(1.00525-1)\cdot 12\cdot 100=6.3$
22	**D**	Setting interest as 6.3, payment as 5824.30, future value as 0 and initial as -873654 gives the amount owing before the last payment as 4597.48 Setting 4597.48 as the initial for 1 period gives a final payment of 4621.62
23	**C**	The setting from question 22, show 296 months, that is 24 years 8 months
24	**A**	1645 is the interest earnt of the initial value, thus perpetuity
25	**D**	Inverse of A is $\begin{bmatrix}1&3&3\\1&4&3\\1&3&4\end{bmatrix}$, the same as the transpose of D
26	**E**	Subbing in 1,1 into any position gives E as the only option
27	**C**	Product being multiplication gives C
28	**D**	When adding the 2-steps gives A=1, B=5, C=0 and D=2, second is D
29	**A**	60% survive birth not 40%
30	**B**	$30\times .1=3$
31	**A**	A has the highest total percentage
32	**D**	After 3 weeks S3 is, $s_3=\begin{bmatrix}1026\\624\end{bmatrix}$
33	**D**	Euler's formula is $v+f=e+2,\ v=6-3+2=5$
34	**D**	Graph has a Euler trail, Hamiltonian Path and Hamiltonian Cycle
35	**A**	Min spanning tree is 91

36	**E**	Min cut is cut 5, thus the max flow
37	**B**	Shortest path is 9+12+18
38	**E**	Solving results in David with Air Hockey, Seth with Downball, Jess with Cricket, Mark with E-Sports and Remi with basketball
39	**A**	I is preceded by F and B, which is 4+12=16
40	**C**	To get to 40, reducing C by 3, and k by 2 is 2100

Quick Marking Grid

Question						Question						Question						Question					
1	A	**B**	C	D	E	**17**	A	B	C	**D**	E	**25**	A	B	C	**D**	E	**33**	A	B	C	**D**	E
2	A	B	C	**D**	E	**18**	**A**	B	C	D	E	**26**	A	B	C	D	**E**	**34**	A	B	C	**D**	E
3	A	**B**	C	D	E	**19**	**A**	B	C	D	E	**27**	A	B	**C**	D	E	**35**	**A**	B	C	D	E
4	A	B	**C**	D	E	**20**	**A**	B	C	D	E	**28**	A	B	C	**D**	E	**36**	A	B	C	D	**E**
5	A	**B**	C	D	E	**21**	A	B	**C**	D	E	**29**	**A**	B	C	D	E	**37**	A	**B**	C	D	E
6	A	B	C	D	**E**	**22**	A	B	C	**D**	E	**30**	A	**B**	C	D	E	**38**	A	B	C	D	**E**
7	A	**B**	C	D	E	**23**	A	B	**C**	D	E	**31**	**A**	B	C	D	E	**39**	**A**	B	C	D	E
8	A	**B**	C	D	E	**24**	**A**	B	C	D	E	**32**	A	B	C	**D**	E	**40**	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																		