Neap

Trial Examination 2022

Question and Response Booklet

QCE General Mathematics Units 3&4

Paper 1

Student's Name: _____

Teacher's Name: _____

Time allowed

- Perusal time – 5 minutes
- Working time – 90 minutes

General instructions

- Answer all questions in this question and response booklet.
- QCAA-approved scientific calculator permitted.
- Formula sheet provided.
- Planning paper will not be marked.

Section 1 (20 marks)

- 20 multiple choice questions

Section 2 (40 marks)

- 10 short response questions

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2022 QCE General Mathematics Units 3&4 Written Examination.

SECTION 1

Instructions

- Choose the best answer for Questions 1–20.
- This section has 20 questions and is worth 20 marks.
- Use a 2B pencil to fill in the A, B, C or D answer bubble completely.
- If you change your mind or make a mistake, use an eraser to remove your response and fill in the new answer bubble completely.

	A	B	C	D
Example:	●	○	○	○

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

SECTION 2

Instructions

- Write using black or blue pen.
- Questions worth more than one mark require mathematical reasoning and/or working to be shown to support answers.
- If you need more space for a response, use the additional pages at the back of this booklet.
  - On the additional pages, write the question number you are responding to.
  - Cancel any incorrect response by ruling a single diagonal line through your work.
  - Write the page number of your alternative/additional response; i.e. See page …
  - If you do not do this, your original response will be marked.
- This section has 10 questions and is worth 40 marks.

DO NOT WRITE ON THIS PAGE

THIS PAGE WILL NOT BE MARKED

QUESTION 21 (4 marks)

Students at a primary school and high school were surveyed to find out whether they would support a change in their school tuckshop menus or prefer to keep the same menu.

The results are shown in the two-way frequency table.

	Primary school	High school	Total
Change tuckshop menu	39	92	131
Keep tuckshop menu	45	108	153
Total	84	200	284

a) Convert the raw data into a percentaged two-way frequency table using the column totals. *[2 marks]*

b) State whether there is an association between a student being in primary school or high school and wishing to change or keep the school tuckshop menu. Justify your answer with percentages. *[2 marks]*

QUESTION 22 (5 marks)

In a certain bivariate data set, the x variable is the height of a plant, in centimetres, and the y variable is the amount of plant hormone emitted, in micrograms. The following statistics have been calculated based on the bivariate data set.

$$\overline{x} = 28.1,\ \overline{y} = 254.6,\ s_x = 10.63,\ s_y = 29.99,\ r = 0.9176$$

a) Determine the linear equation of the relationship between plant height and hormones emitted. Give your answer correct to one decimal place. *[3 marks]*

b) i) Interpret the y-intercept in terms of the variables. *[1 mark]*

ii) Interpret the gradient/slope in terms of the variables. *[1 mark]*

QUESTION 23 (3 marks)

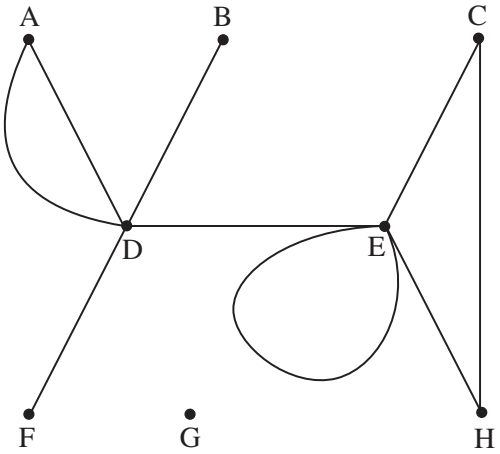
A group of five friends – Christie, Tamara, Mukul, Seydou and Felipa – make phone calls to each other to organise a party.

- Christie calls Felipa and Seydou.
- Tamara calls Mukul and Felipa.
- Mukul calls Felipa and Seydou.
- Seydou calls Mukul and Christie.
- Felipa doesn't call anyone.

Construct a directed graph (digraph) of the friends' phone calls to each other.

QUESTION 24 (3 marks)

The diagram below shows a network.



Use the letters A–H from the diagram to answer the following questions.

a) Identify the vertex that contains a loop. *[1 mark]*

b) Identify TWO vertices that have multiple edges. *[1 mark]*

c) Identify the isolated vertex. *[1 mark]*

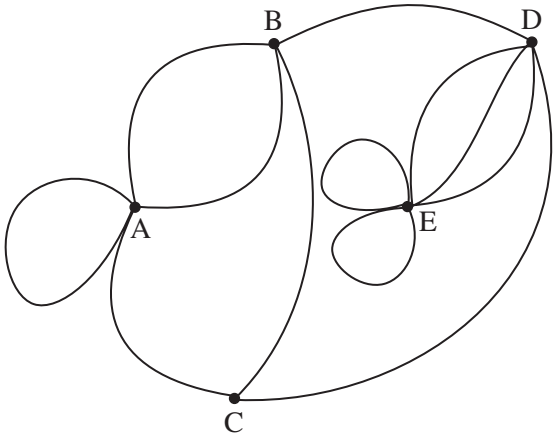
QUESTION 25 (4 marks)

A person wishes to put $2000 into a savings account to receive $600 of interest. The interest rate is 3.15% p.a. compounding monthly.

Calculate the number of years and months it will take the person to receive $600 of interest.

QUESTION 26 (5 marks)

The network diagram below shows the roads between five towns (A–E).



Construct an adjacency matrix to show the connections between the towns.

QUESTION 27 (4 marks)

Calculate the shortest distance between Sakhalin, Russia (50°05′ N, 142°25′ E) and Calgary, Canada (50°05′ N, 113°56′ W).

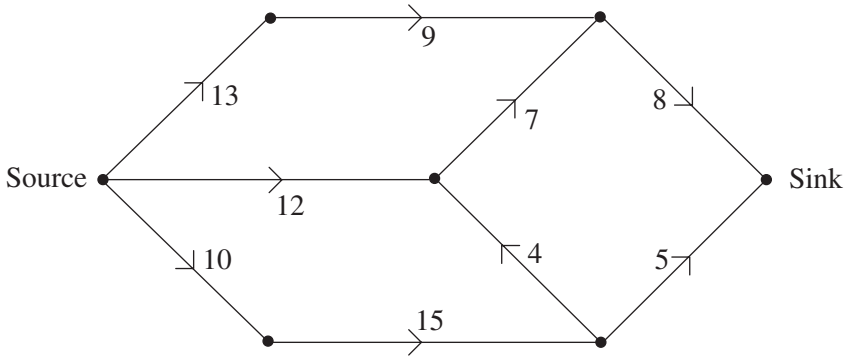
QUESTION 28 (2 marks)

A newly manufactured car is priced at $24 000. Each year, the car depreciates by 25%.

Write a recurrence relation to model this scenario.

QUESTION 29 (6 marks)

The flow network below shows the capacity of water pipes in litres from source to sink.



a) Identify how many cuts are possible on this flow network and calculate the value of each cut. *[4 marks]*

b) Calculate the minimum cut and state the maximum flow. *[2 marks]*

QUESTION 30 (4 marks)

Shiori, Murray, Zoe and Phan are starting a new band. They are trying to work out who should sing and who should play the guitar, drums and bass.

- Shiori can play guitar, drums or bass but cannot sing.
- Murray can play guitar or bass.
- Zoe cannot play guitar, drums or bass.
- Phan can play bass or sing.

Draw a bipartite graph using the information above and determine who should be allocated to each task.

END OF PAPER

ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

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Formula Booklet

QCE General Mathematics Units 3&4

Mensuration			
circumference of a circle	$C = 2\pi r$	**area of a circle**	$A = \pi r^2$
area of a parallelogram	$A = bh$	**area of a trapezium**	$A = \frac{1}{2}(a+b)h$
area of a triangle	$A = \frac{1}{2}bh$	**total surface area of a cone**	$S = \pi rs + \pi r^2$
total surface area of a cylinder	$S = 2\pi rh + 2\pi r^2$	**surface area of a sphere**	$S = 4\pi r^2$
volume of a cone	$V = \frac{1}{3}\pi r^2 h$	**volume of a cylinder**	$V = \pi r^2 h$
volume of a prism	$V = Ah$	**volume of a pyramid**	$V = \frac{1}{3}Ah$
volume of a sphere	$V = \frac{4}{3}\pi r^3$		
Heron's rule	$A = \sqrt{s(s-a)(s-b)(s-c)}$, where $s = \frac{a+b+c}{2}$		
Earth geometry	$D = 111.2 \times$ angular distance	$D = 111.2\cos\theta \times$ angular distance	

Finance			
simple interest	$I = Pin$	**compound interest**	$A = P(1+i)^n$
effective annual rate of interest	$i_{\text{effective}} = \left(1+\frac{i}{n}\right)^n - 1$	**dividend yield**	$\frac{\text{dividend}}{\text{share price}} \times 100$
price to earnings ratio (of a share)	$\text{P/E ratio} = \frac{\text{market price per share}}{\text{annual earnings per share}}$		
recurrence relation for reducing balance loans	$A_{n+1} = rA_n - R$	**recurrence relation for compound interest**	$A_{n+1} = rA_n$
recurrence relation for annuities	$A_{n+1} = rA_n + d$		
annuities	$A = M\left(\frac{(1+i)^n - 1}{i}\right)$	$A = M\left(\frac{1-(1+i)^{-n}}{i}\right)$	

Sequences	
arithmetic sequence	$t_n = t_1 + (n-1)d$
geometric sequence	$t_n = t_1 r^{(n-1)}$

Networks and matrices	
Euler's formula	$v + f - e = 2$

Trigonometry			
Pythagoras' theorem	$c^2 = a^2 + b^2$		
trigonometric ratios	$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$	$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$	$\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$
cosine rule	$c^2 = a^2 + b^2 - 2ab\cos C$		
sine rule	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$		
area of a triangle	$\text{area} = \frac{1}{2}bc\sin A$		

Statistics	
mean	$\bar{x} = \frac{\Sigma x_i}{n}$
median	$\left(\frac{n+1}{2}\right)^{\text{th}}$ data value
least-squares line (slope)	$b = \frac{\Sigma(x_i - \bar{x})(y_i - \bar{y})}{\Sigma(x_i - \bar{x})^2} = r\frac{s_y}{s_x}$
least-squares line (intercept)	$a = \bar{y} - b\bar{x}$
correlation coefficient (*r*)	$r = \frac{1}{n-1}\sum\left(\frac{x_i - \bar{x}}{s_x}\right)\left(\frac{y_i - \bar{y}}{s_y}\right)$
standard deviation	$s = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n-1}}$
outliers (identifying)	$Q_1 - 1.5 \times \text{IQR} \leq x \leq Q_3 + 1.5 \times \text{IQR}$