Neap

Trial Examination 2021

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)

- 8 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 2021 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

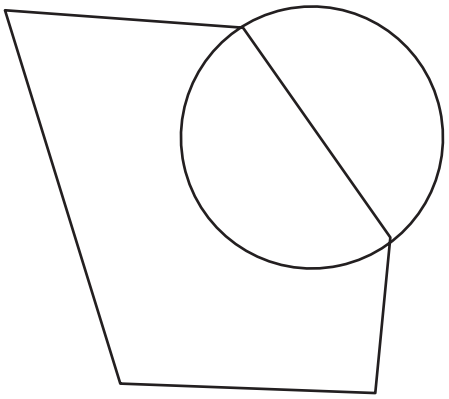
- Write using black or blue pen.
- Questions worth more than one mark require mathematical reasoning and/or working to be shown to support answers.
- If you need more space for a response, use the additional pages at the back of this booklet.
  - On the additional pages, write the question number you 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 eight questions and is worth 40 marks.

DO NOTE WRITE ON THIS PAGE

THIS PAGE WILL NOT BE MARKED

QUESTION 21 (3 marks)

A planar graph is shown below.



a) Identify the number of faces in the planar graph. *[1 mark]*

b) Use Euler's formula to evaluate the reasonableness of your solution to 21a). *[2 marks]*

QUESTION 22 (7 marks)

A doctor wants to open an annuity account with a lump sum of $57 000 and deposit monthly payments of $2400 for 6 years. The account has a fixed interest rate of 3.62% p.a.

a) Calculate the future value of the lump sum after 6 years. *[3 marks]*

b) Calculate the future value of the monthly deposit payments after 6 years. *[2 marks]*

c) Calculate the total amount the doctor will have accumulated in the annuity account after 6 years. Express your answers correct to two decimal places. *[2 marks]*

QUESTION 23 (5 marks)

A survey was conducted on dogs of different sizes (small and large) and whether or not they barked.

The following information was taken from the survey.

- The total number of large dogs is 25.
- The number of small dogs that bark is 5.
- The total number of dogs that do not bark is 35.
- The number of small dogs that do not bark is 15.

a) Using the information above, complete the table below. *[4 marks]*

	Barks	**Does not bark**	**Total**
Small dogs			
Large dogs			
Total			

b) Calculate the percentage of large dogs that bark. *[1 mark]*

QUESTION 24 (5 marks)

The table below shows information collected regarding the length of time owning a car and the amount of money spent on the car.

Mean of length of time owning a car $(\bar{x})$	8.5 years
Mean of money spent on the car $(\bar{y})$	$12 300
Standard deviation of length of time owning a car (s_x)	2.37 years
Standard deviation of money spent on the car (s_y)	$1893
Correlation coefficient (r)	0.79

Using the information above, calculate the equation of the least-squares regression line $y = a + bx$.

QUESTION 25 (5 marks)

An electric car is purchased for $66 000 and depreciates in value by $1200 every year.

a) Write a recurrence relation to model this scenario. *[1 mark]*

b) Calculate the first 6 years of depreciation. *[2 marks]*

c) Draw a graph of the depreciation of the car's value over the first 6 years. Include an appropriate scale for each axis. *[2 marks]*

QUESTION 26 (6 marks)

The approximate coordinates of Perth, Australia, are $(31°57′\text{S}, 115°52′\text{E})$. The approximate coordinates of South Africa are $(31°57′\text{S}, 22°56′\text{E})$.

a) Calculate the distance between Perth and South Africa to the nearest kilometre. *[3 marks]*

b) The approximate coordinates of Greece are $(39°4′\text{N}, 22°56′\text{E})$.
Calculate the distance between South Africa and Greece to the nearest kilometre. *[3 marks]*

QUESTION 27 (6 marks)

A shop sells furniture over one week and records the number of items it sells per day as shown in the table below.

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Items sold	121	110	153	179	280	410	350

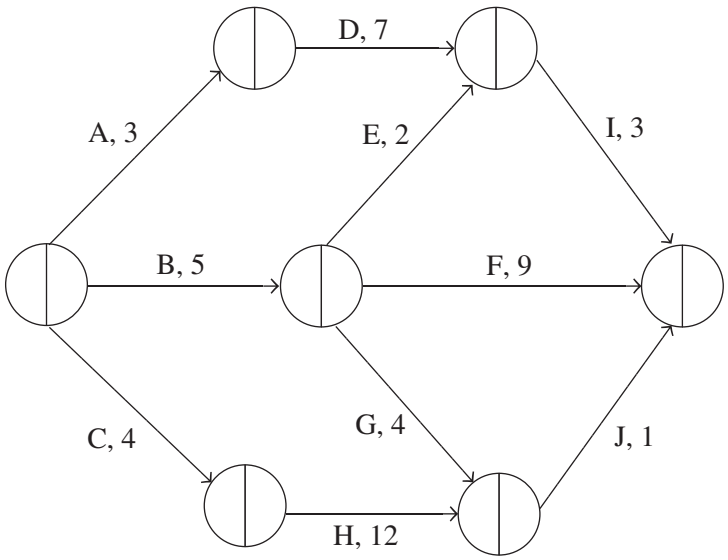
a) Calculate the weekly average. *[1 mark]*

b) Calculate the seasonal index for each day. Express your answers correct to three decimal places. *[3 marks]*

c) Evaluate the reasonableness of the seasonal indices that you have calculated in 27b). *[2 marks]*

QUESTION 28 (3 marks)

The network diagram below illustrates the time taken, in minutes, to complete 10 different steps, labelled A–J. These steps represent all the steps required to bake a cake.



a) Fill in the spaces in the network diagram above using forward and backward scanning. *[1 mark]*

b) Identify the critical path. *[1 mark]*

_____

c) Determine the minimum completion time to bake a cake. *[1 mark]*

_____

END OF PAPER

ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

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Write the question number you are responding to.

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Formula sheet

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)	$Q_1 - 1.5 \times \text{IQR} \leq x \leq Q_3 + 1.5 \times \text{IQR}$