

Trial Examination 2021

Question and response booklet

QCE General Mathematics Units 3&4

Paper 2

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.
- Write using black or blue pen.
- QCAA-approved scientific calculator permitted.
- Formula sheet provided.
- Planning paper will not be marked.

Section 1 (40 marks)

7 short response questions

TEQGM34_QA_P2_2021

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.

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SECTION 1

Instructions

- 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 seven questions and is worth 40 marks.

DO NOT WRITE ON THIS PAGE

THIS PAGE WILL NOT BE MARKED

QUESTION 1 (4 marks)

The data below was collected relating a person's salary and how much they paid for their car. The equation of the least-squares regression line for the data was calculated to be y = -42.933 + 0.878x.

Salary (\$1000's)	Amount paid for car (\$1000's)
50	6
60	3
70	10
80	20
90	40
100	50
60	18
70	22
80	25
90	35

Create a residual plot of the data on the axes below and assess the linearity of the association between a person's salary and how much they paid for their car.



QUESTION 2 (7 marks)

The data below shows a farmer's profit for each quarter over three years.

	Quarter	Profit (\$)
	1	38540
2010	2	32470
2019	3	50490
	4	45 270
2020	1	41 320
	2	33 640
	3	52340
	4	46690
2021	1	43 800
	2	35680
	3	55270
	4	47 260

Deseasonalise the data and plot the original data and the deseasonalised data on the same set of axes on the next page. Determine if there is a long-term increasing or decreasing trend.



QUESTION 3 (5 marks)

Thomas is growing bacteria on a petri dish. He starts with 5 individual bacteria on the dish. At the end of every hour, the number of bacteria has increased by 15%.

Determine how long, to the nearest hour, it will take to grow over 250000 bacteria.

QUESTION 4 (6 marks)

Adam boards a plane. The plane leaves Melbourne (31°S, 145°E) at local time 3:30 pm on Friday. It takes 14 hours to fly to Dubai (25°N, 55°E). Adam needs to make an important phone call to his office in Canada (45°N, 80°W) when he gets off the plane in Dubai. His office closes at Canadian local time 4:00 pm on Friday.

Determine whether Adam can make the phone call to Canada before the office closes.

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QUESTION 5 (8 marks)

Anna wants to save for a holiday by investing in an annuity. She needs \$85000 by the end of 5 years.

She opens an annuity account. In the first year, she deposits \$285 weekly payments at 2.35% p.a. compounded weekly.

At end of the first year, Anna stops depositing the weekly payments and instead begins to deposit \$1386 monthly payments. The interest rate of the annuity account also changes to 2.21% p.a. compounded monthly for the remaining years.

Determine whether Anna will have saved enough in her annuity account after 5 years to go on her holiday.

QUESTION 6 (5 marks)

The network below shows a map of possible electrical wires from source to sink. Each value is recorded in metres.



The electrical wires cost \$215 per metre to install plus \$5380 for labour. An electrician gives a quote of \$15000 as the minimum cost of installing wires from source to sink.

Use the 'maximum flow, minimum cut' theorem to determine whether the electrician can complete the installation within the quoted amount.



QUESTION 7 (5 marks)

A company assigns tasks to staff members with the goal of minimising the time it takes to complete the overall project. The table below shows the time it takes, in hours, for three staff members to complete the tasks for a project.

	Task 1	Task 2	Task 3
Andrew	61	81	19
Boris	65	78	50
Christopher	66	82	34

Determine which staff member should be assigned to each task to minimise the time it takes to complete the overall project.

END OF PAPER











Trial Examination 2021

Formula sheet

QCE General Mathematics Units 3&4

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Manguration				
circumference of a circle	$C = 2\pi r$	area of a cir	cle	$A = \pi r^2$
area of a parallelogram	A = bh	area of a tra	pezium	$A = \frac{1}{2}(a+b)h$
area of a triangle	$A = \frac{1}{2}bh$	total surface of a cone	e area	$S = \pi r s + \pi r^2$
total surface area of a cylinder	$S = 2\pi r h + 2\pi r^2$	surface area of a sphere	1	$S = 4\pi r^2$
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	$A = \sqrt{s(s-a)(s-b)(s-c)}, \text{ where } s = \frac{a+b+c}{2}$			
Earth geometry	$D = 111.2 \times \text{angular distance}$ $D = 111.2 \cos\theta \times \text{angular distance}$			

Finance				
simple interest	I = Pin	compound i	nterest	$A = P(1 + i)^n$
effective annual rate of interest	$i_{\text{effective}} = \left(1 + \frac{i}{n}\right)^n - 1$	dividend yie	eld	$\frac{\text{dividend}}{\text{share price}} \times 100$
price to earnings ratio (of a share)	$P/E \text{ ratio} = \frac{\text{market price per share}}{\text{annual earnings per share}}$			
recurrence relation for reducing balance loans	$A_{n+1} = rA_n - R$	recurrence for compou interest	relation nd	$A_{n+1} = rA_n$
recurrence relation for annuities	$A_{n+1} = rA_n + d$			
annuities	$A = M\left(\frac{\left(1+i\right)^n - 1}{i}\right)$		$A = M\left(\frac{1-\alpha}{2}\right)$	$\frac{(1+i)^{-n}}{i} \bigg)$

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	area = $\frac{1}{2}bc\sin A$		

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