Neap

Trial Examination 2022

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

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.

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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.

DO NOT WRITE ON THIS PAGE

THIS PAGE WILL NOT BE MARKED

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QUESTION 1 (3 marks)

A farmer wants to prepare a paddock for growing vegetables by covering the paddock in fertiliser. The paddock is in the shape of an equilateral triangle with side lengths of 25 metres. The cost of fertiliser was $8.50 per square metre of paddock in 2015 and, each year, the cost increases by 2.8%.

Determine the cost of preparing the farmer's paddock in 2022.

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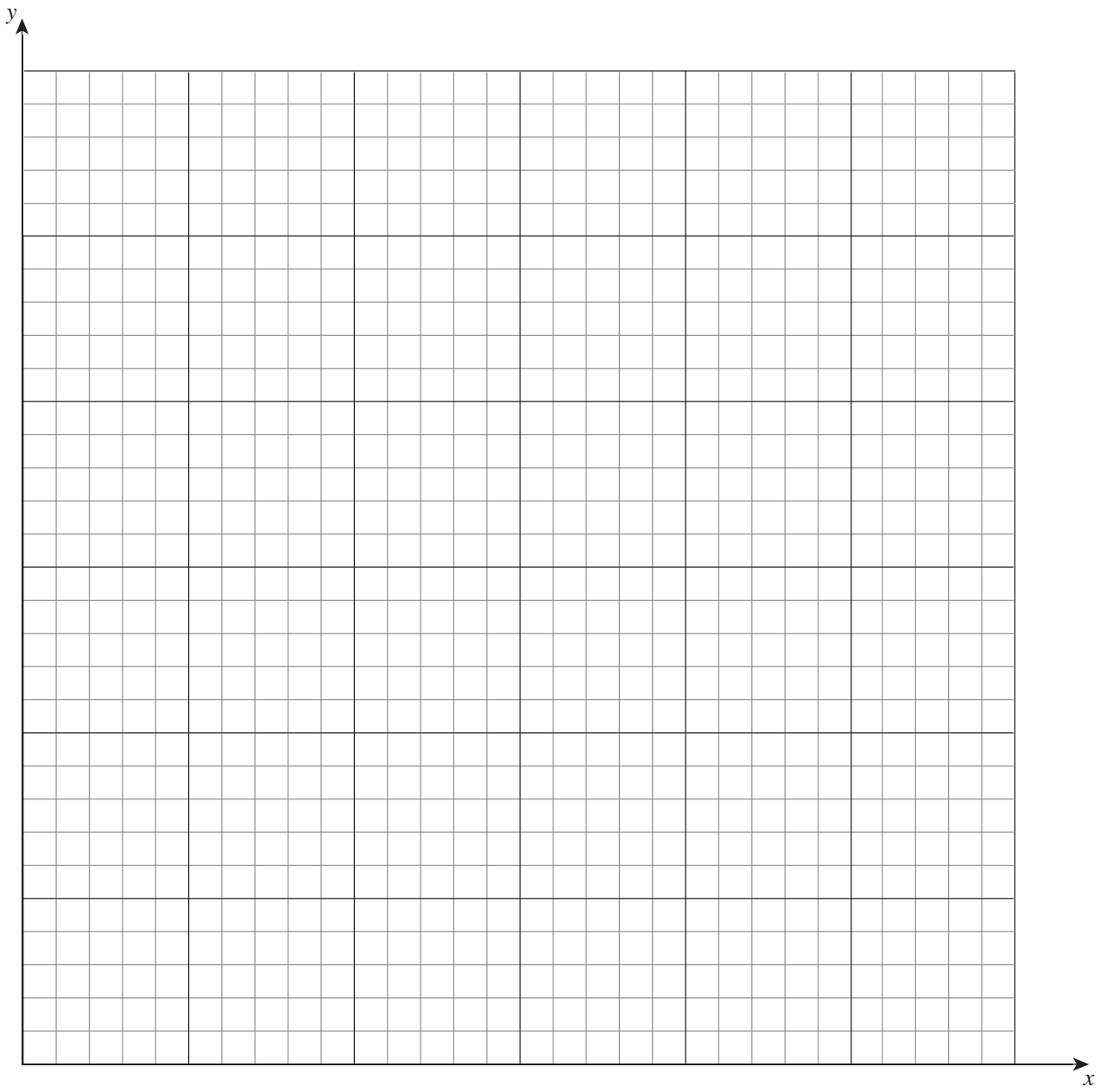
QUESTION 2 (6 marks)

A relationship exists between two variables, x and y, as shown in the table below.

x	5	8	13	18	22	25	27
y	5	6	8	11	15	20	26

Draw a scatterplot of the data on the axes below and assess the linearity of the association between the variables. Evaluate the reasonableness of your solution using mathematical justification.



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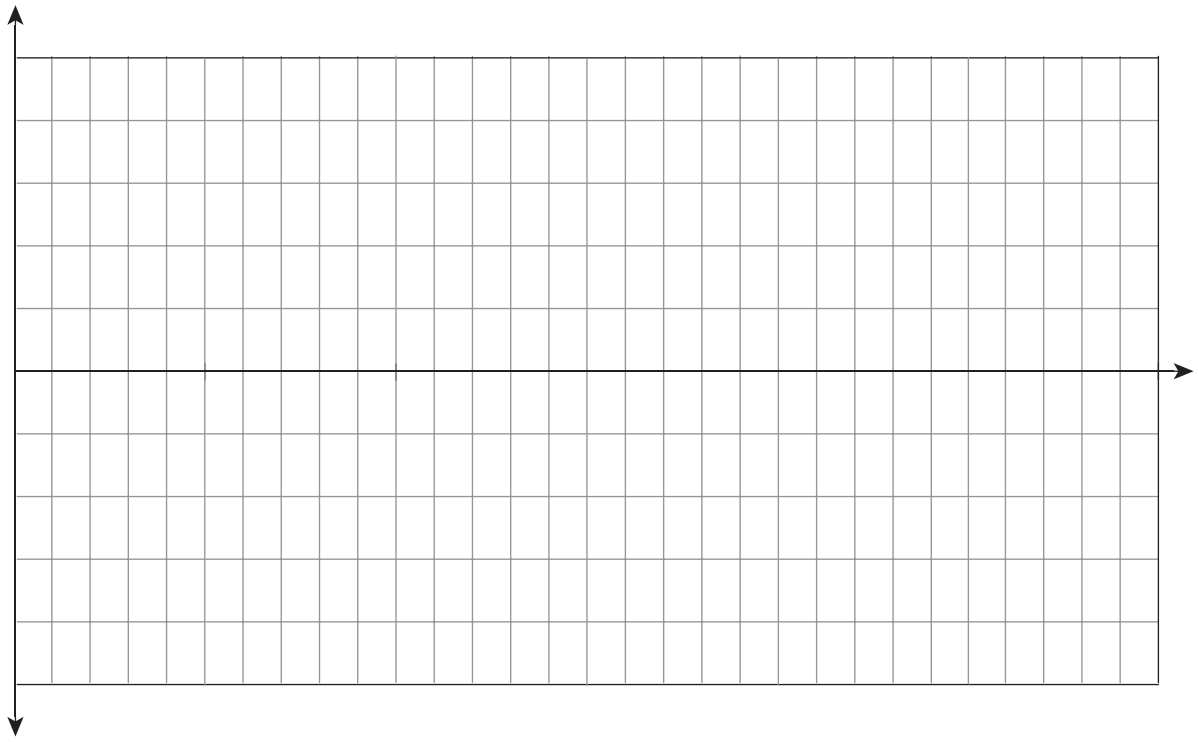

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QUESTION 3 (6 marks)

A linear association exists between a photocopier's age, in years, and its value, in dollars.

The following information about the association between the variables is known.

- The equation of the least-squares line for the data is $y = 94.6 - 10x$.
- The standard deviation of x is 1.5811.
- The standard deviation of y is 16.2727.

Determine the coefficient of determination (R^2) and interpret this in terms of the variables.

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QUESTION 4 (7 marks)

A pilot starts flying at (21°34′ S, 68°23′ E). They want to fly for 18 743 kilometres due east along the same parallel of latitude, then fly due north along the same meridian for another 6358 kilometres.

Determine the coordinates of the pilot's final position.

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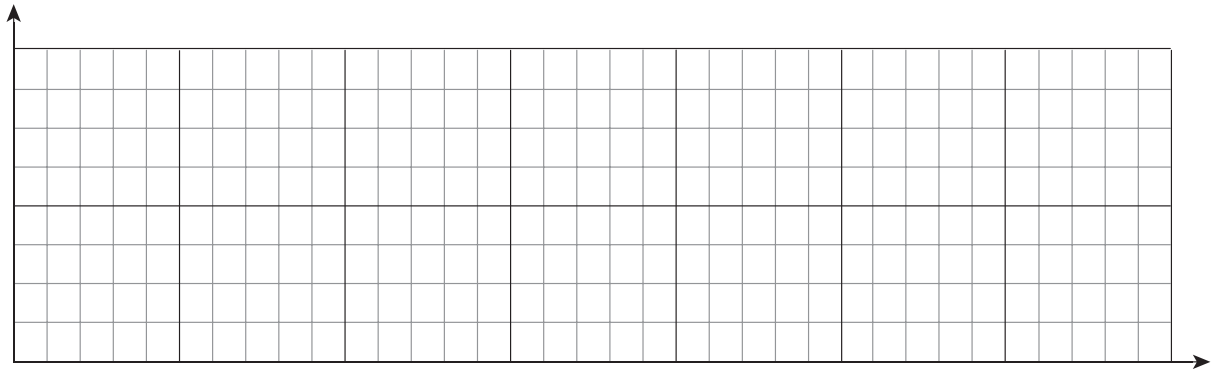
QUESTION 5 (6 marks)

The following raw data shows the number of soft drinks sold by a company each month.

Month	January	February	March	April	May	June
Sales	257	384	126	282	400	135

Determine the least-squares equation of the deseasonalised data and create a time series plot on the axes below to describe the trend of the deseasonalised data.



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QUESTION 6 (7 marks)

A scholarship for a disadvantaged student is created by investing $150 000 into a perpetuity with an interest rate of 3.86% p.a. compounding monthly. While they are studying at university, the student decides to invest the payments from the perpetuity into an annuity compounding monthly at 2.57% p.a. over five years.

Determine the value of the annuity after five years. Evaluate the reasonableness of your solution using an alternative mathematical method.

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QUESTION 7 (5 marks)

A gym has three trainers. Each trainer charges a different amount, in dollars, to run a gym class for weights, cardio or stretching.

Gym class	Weights	Cardio	Stretching
Trainer A	18	78	97
Trainer B	22	12	48
Trainer C	20	64	99

Use a matrix method to determine the optimal allocation of trainer to gym class and the minimum cost of the allocation.

END OF PAPER

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ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

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Neap

Trial Examination 2022

Formula Booklet

QCE General Mathematics Units 3&4

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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	$v + f - e = 2$

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

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