

LUI

School code

School name

Given name/s

Family name

Attach your barcode ID label here

Book of books used

External assessment 2025

Question and response book

General Mathematics

Paper 1

(unofficial)
Sample Solutions

- alternate methods are possible
- Solutions may contain errors.

Notes not making up part of the Solution in PINK

Notes on use of Casio fx-8200 AU in Green

Time allowed

- Perusal time — 5 minutes
- Working time — 90 minutes

General instructions

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

Section 1 (15 marks)

- 15 multiple choice questions

Section 2 (42 marks)

- 10 short response questions

Recommended Setting:

- Math I / Decimal 0
- In Calculate APP
- Press SETTINGS
- in Calc Settings Input / Output
- choose this option (Second option)

- angle in Degrees
- in Calc Settings Angle Unit
- choose this option (first option)

Clear zone — margin trimmed off after completion of assessment

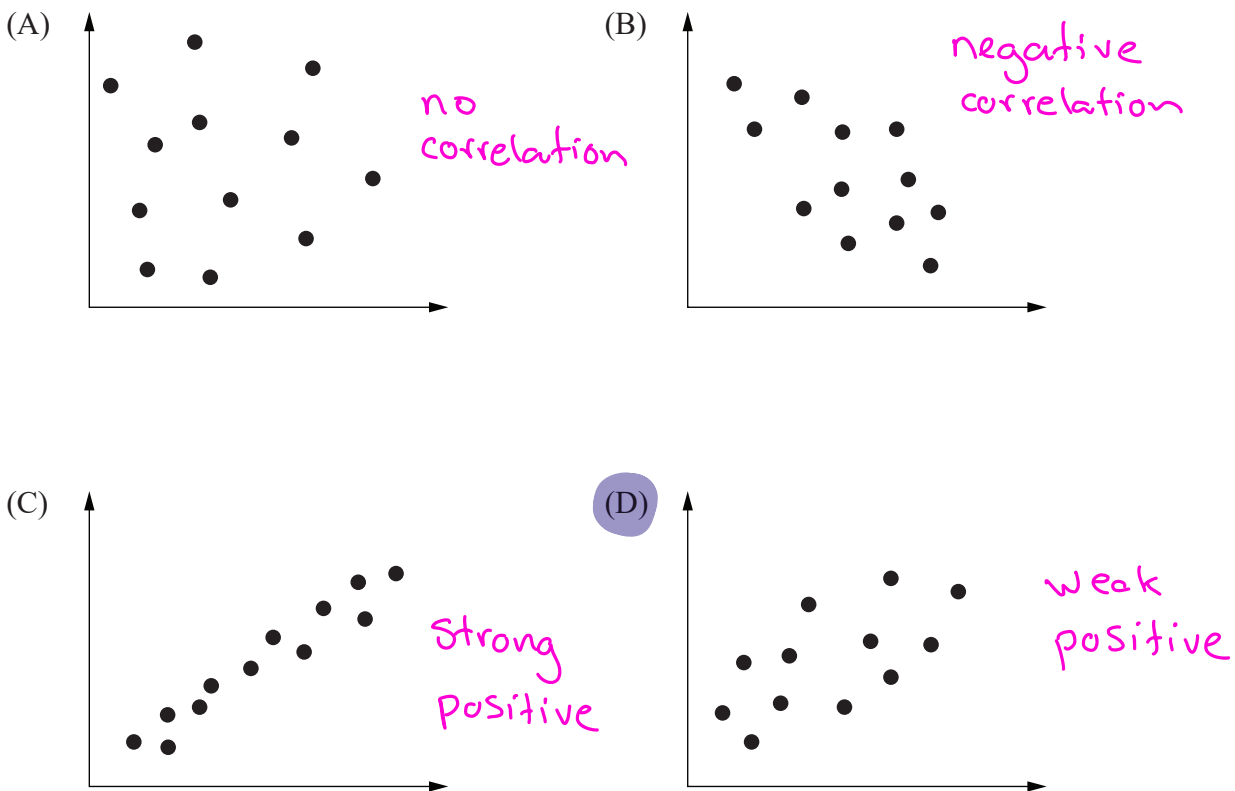
Section 1

Instruction

- Respond to these questions in the question and response book.

QUESTION 1

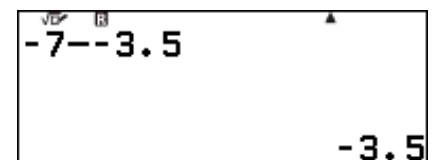
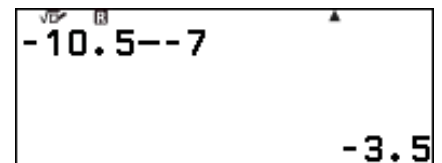
Which scatterplot best depicts a weak positive relationship?



QUESTION 2

Which option shows three consecutive terms for an arithmetic sequence?

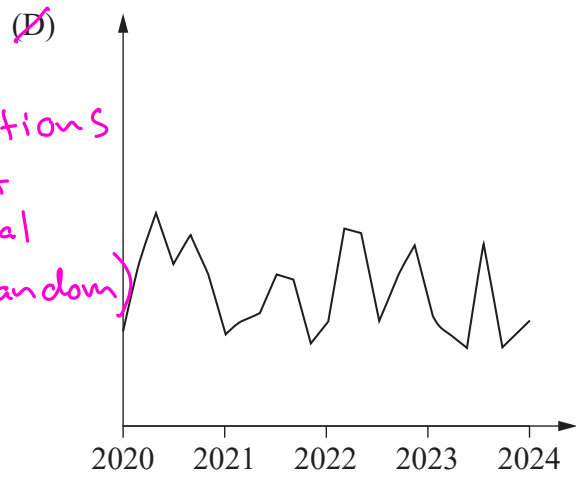
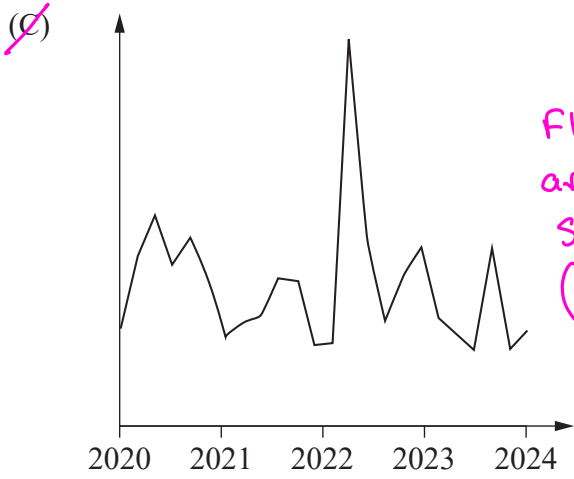
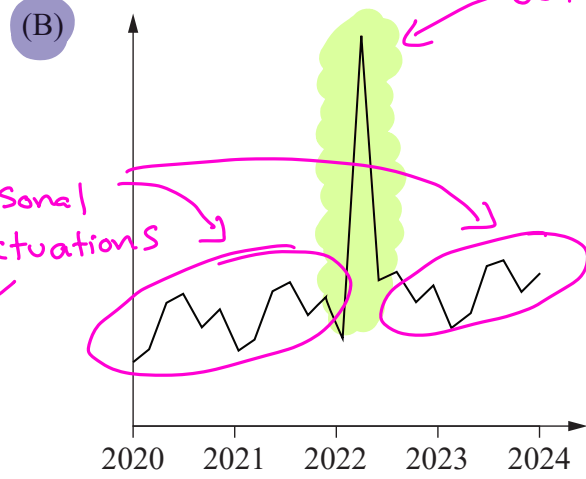
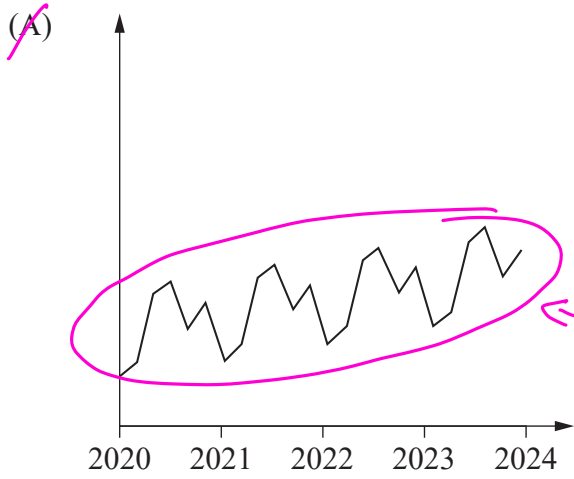
- (A) $-3.5, -7.0, -10.5$ ← decreases by 3.5
- (B) $-3.5, 7.0, -14.0$ ← inc. then decrease
- (C) $3.5, -7.0, 10.5$ ← dec. the increase
- (D) $3.5, 7.0, 14.0$ ← increases by a factor of 2



The common difference can be checked by subtracting successive terms

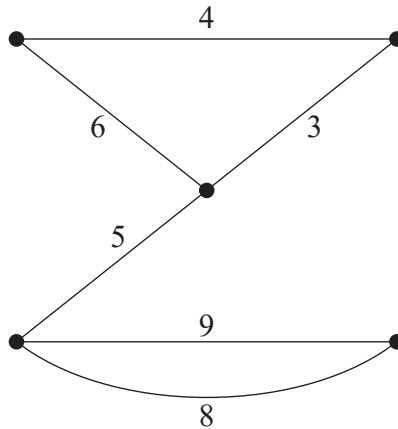
QUESTION 3

Which time series plot shows seasonal fluctuations with one outlier?



QUESTION 4

A network graph is shown.



The network graph could be described as

- (A) connected and weighted.
- (B) directed and connected. ← no arrow heads (not directed)
- (C) simple and connected. ← weights included ∴ not simple
- (D) weighted and simple. ← can't be weighted and simple

QUESTION 5

Identify the number of faces for a planar graph that has 5 edges and 3 vertices.

- (A) 8
 - (B) 6
 - (C) 4
 - (D) 2
- $$v + f - e = 2$$

$$\therefore 3 + f - 5 = 2$$

$$\therefore f = 2 + 5 - 3$$

$$= 4$$

QUESTION 6

A ball is dropped from a height of 25.6 m. After each bounce, the ball rebounds to 75% of its previous height.

Which option shows the ball's height after the third bounce?

- (A) 8.1 m
- (B) 10.8 m
- (C) 14.4 m
- (D) 19.2 m

Doing repeated calcs using 'Ans'

- Enter initial height and press EXE (or ok)
- Enter 'x 0.75' and EXE. The 'Ans' will appear
- Press EXE again
- Press EXE again

Using the Table app:

- Press Function (F(x))
- Define f(x)

f(x) = 25.6 × 0.75^x

← use the α^{\square} key
 ← this is the function for height after x bounces

Table Range
 End : 5
 Step : 1
 Execute

- Press Tools (T)
- Open Table Range (no change needed)
- Arrow down and ok

x	f(x)	g(x)
1	19.2	
2	14.4	
3	10.8	
4	8.1	

← look for height (f(x)) when bounce (x) = 3

* Table method better for large x *

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QUESTION 7

The association between two numerical variables is modelled by the equation $y = 4.6x - 35$, with a correlation coefficient of 0.92.

The association is best described as

- (A) weak and linear.
- (B) strong and linear. *$r^2 = 0.92 \Rightarrow$ 'strong', equation type is 'linear'*
- (C) weak and non-linear.
- (D) strong and non-linear.

QUESTION 8

Which statement is correct?

- (A) The mean solar time at the equator is called UTC. *"Coordinated Universal Time"*
- (B) UTC is a system of time measurement used around the world. *TRUE!*
- (C) The International Date Line passes through the prime meridian. *IDL is 180° meridian*
- (D) Each time zone that borders the International Date Line is ~~ahead~~ of GMT. *one side is ahead one side is behind*

QUESTION 9

The table shows the school start-time preferences of students in different year levels.

	8 am	9 am
Years 7–9	124	74
Years 10–12	82	120

What percentage of students in Years 10–12 prefer a start time of 8 am?

- (A) 20.5%
 - (B) 39.8%
 - (C) 40.6%
 - (D) 66.1%
- ← be careful to divide the '82' by the sum of the "Years 10-12" row not the "8am" column*

$$\frac{82}{82+120} \times 100 = 40.59405941$$

QUESTION 10

The table shows the average times (minutes) for three athletes to complete each stage of a triathlon relay.

	Athlete 1	Athlete 2	Athlete 3
Swim	50	30	40
Bike	70	90	80
Run	60	70	50

Which athlete should complete each stage of a future triathlon relay to **minimise** the total completion time?

	Athlete 1	Athlete 2	Athlete 3
(A)	run 60	swim 30	bike 80
(B)	swim 50	bike 90	run 50
(C)	bike 70	swim 30	run 50
(D)	swim 50	run 70	bike 80

Sum
 170
 190
 150 ←
 200

Smallest Sum = "minimise"

* The Hungarian Algorithm is the 'proper' way to answer this question BUT direct evaluation of options is quicker (and possible) in this multiple choice question *

QUESTION 11

In summer, **New Zealand (GMT +12)** uses daylight saving time, which is one hour ahead of New Zealand standard time. **Western Australia (GMT +8)** does not use daylight saving time.

When it is midday in summer in New Zealand, what is the time in Western Australia?

- (A) 7 am
- (B) 9 am
- (C) 3 pm
- (D) 5 pm

WA is 5 hours behind NZ
 $\therefore 12 \text{ noon} - 5 \text{ hours} = 7 \text{ am}$

QUESTION 12

Determine the distance between the two locations: X (18.7° N 15.3° W) and Y (12.4° S 15.3° W).

- (A) 676 km
- (B) 701 km
- (C) 3336 km
- (D) 3458 km**

$$\sqrt{(18.7+12.4)^2 \times 111.2^2}$$

$$3458.32$$

(Same longitude)
 $\therefore D = 111.2 \times \text{ang. dist}$
 Note: angular distance is 18.7 + 12.4 as the locations are north and south of equator.

QUESTION 13

Determine the effective annual rate of interest for a two-year investment, for which the interest compounds quarterly at 3.64% p.a.

- (A) 3.67%
- (B) 3.69%**
- (C) 7.28%
- (D) 7.52%

$$\left(1 + \frac{0.0364}{4}\right)^4 - 1 = 0.03689988114$$

Use the formula from the Formula Book
 * use the rate as a decimal (or divide by 100)
 * divide the p.a. rate by 4 to get the quarterly rate

QUESTION 14

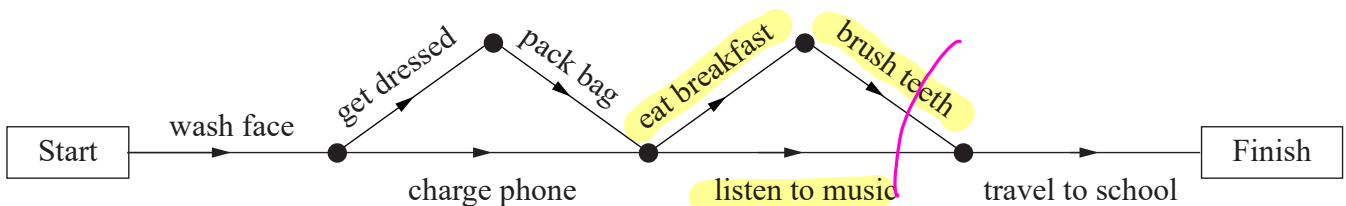
A non-causal explanation is most likely for a strong association between which pair of variables?

- (A) a town's child population and its number of schools
- (B) a phone's hours of use and its remaining battery percentage
- (C) the amount of bread sold by a bakery and its number of customers
- (D) the number of cars at a petrol station and the height of the car drivers**

These are situations where a causal connection is likely

QUESTION 15

The project network diagram shows a student's morning activities.



Which statement is correct?

- ~~(A)~~ Only activities on the critical path are completed.
- ~~(B)~~ No activity is completed while completing another activity.
- ~~(C)~~ Less than half of the activities are completed before listening to music. *exactly half*
- (D)** Three activities are completed after packing their bag and before travelling to school.

all activities are

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 book.
 - 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 42 marks.

QUESTION 16 (3 marks)

Determine the time and day in Santa Cruz (GMT -8) when it is 2:00 pm Monday in Nagano (GMT $+9$).

Santa Cruz is $8+9 = 17$ hours behind Nagano.

2 pm $\xrightarrow{-2}$ 12 pm $\xrightarrow{-12}$ 12 am $\xrightarrow{-3}$ 9 pm
mon mon Tues Tues

This is subtracting
17 hours

\therefore It is 9:00 pm on Sunday

Do not write outside this box.

QUESTION 17 (4 marks)

Students responded to a survey about their travel time to school.

	Travel less than 15 minutes	Travel 15 minutes or more
Year 6 students	11	6
Year 10 students	3	9

- a) Determine the total number of students in each year level who responded to the survey. [1 mark]

Total number of Year 6 students: 17

Total number of Year 10 students: 12

The survey results suggest there is an association between a student's year level and their travel time.

- b) Justify the suggested association by comparing the percentages of Year 6 and Year 10 students who travel less than 15 minutes. [3 marks]

64.7% of Year 6 students travel less than 15 mins whereas

$$\frac{11}{17} \times 100 = 64.70588235$$

25% of Year 10 students travel less than 15 mins to school.

$$\frac{3}{12} \times 100 = 25$$

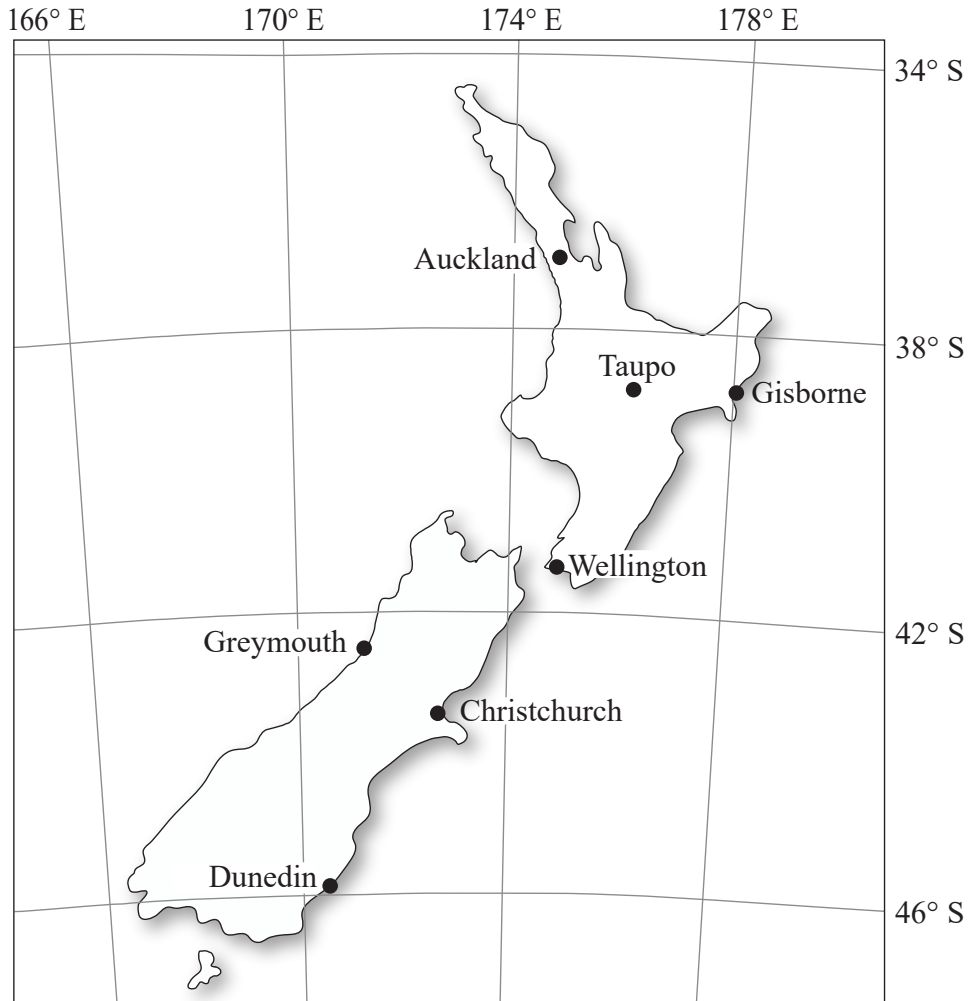
This significant difference in percentage (Year 10 % is less than half the Year 6 %)

suggests an association between year level and travel time.

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QUESTION 18 (4 marks)

A map of New Zealand is shown.



- a) Name the location with coordinates (43.5° S 172.5° E).

[1 mark]

Christchurch

- b) Calculate the distance between Taupo (38.7° S 176° E) and Gisborne (38.7° S 178° E), rounded to the nearest kilometre.

[3 marks]

Angular distance is $178 - 176 = 2^\circ$

$$\text{Distance} = 111.2 \times \cos 38.7^\circ \times 2$$

$$= 173.56\dots$$

$$= 174 \text{ km (to nearest km)}$$

$111.2 \times \cos(38.7) \times 2$
173.5677226

* Make SURE that your calculator is in DEGREES *

Do not write outside this box.

QUESTION 19 (4 marks)

The table shows a store's actual sales each quarter for two years.

Quarter	1	2	3	4
2023 sales (\$)	8000	18 000	94 000	10 000
2024 sales (\$)	7500	23 500	82 000	12 500

The average quarterly sales for 2023 is \$32 500.

- a) Calculate the average quarterly sales for 2024. [1 mark]

Ave. quarterly sale is \$31 375

Using $\frac{\square}{\square}$ replaces the need for brackets [1 mark]

$7500+23500+82000+$
4
31375

- b) Use your result from Question 19a) to calculate the seasonal index for the third quarter. [3 marks]

Ratio of Q3 to AQS in 2023 = 2.89

$94000 \div 32500$
2.892307692

" " " " " " 2024 = 2.61

$82000 \div 31375$
2.613545817

\therefore Seasonal index is

$$\frac{2.89 + 2.61}{2} = 2.75$$

$\text{Ans} + \text{PreAns}$
2
2.752926755

Ans and PreAns
(Shift + Ans)

are an easy way to use the two previous results without round-off error

Do not write outside this box.

QUESTION 20 (4 marks)

To repay a \$24 000 reducing balance loan at 5.4% p.a. compounding monthly, a person makes a \$557 payment at the end of every month for four years.

- a) Write a recurrence relation for the amount owing, where n is the number of months. [1 mark]

$$A_{n+1} = A_n \times \left(1 + \frac{5.4}{12 \times 100}\right) - 557$$

$$A_0 = 24000$$

- b) Use your result from Question 20a) to calculate the amount owing after two months. [2 marks]

$$A_1 = 23551$$

24000
24000

$$A_2 = 23099.9795$$

- Enter A_0 , the present value, and press EXE

\therefore amount owing after two months

- Enter the recurrence relation using Ans as A_n and press EXE to find A_1

$\left(1 + \frac{5.4}{1200}\right) \times \text{Ans} - 557$
23551

is \$23 099.98

- Press EXE once more to find A_2

$\left(1 + \frac{5.4}{1200}\right) \times \text{Ans} - 557$
23099.9795

- c) Use your result from Question 20b) to determine the reduction in the initial loan balance after two months. [1 mark]

\therefore reduction in balance is \$900.02

$24000 - \text{Ans}$
900.0205

Ans comes in handy once again!

QUESTION 21 (4 marks)

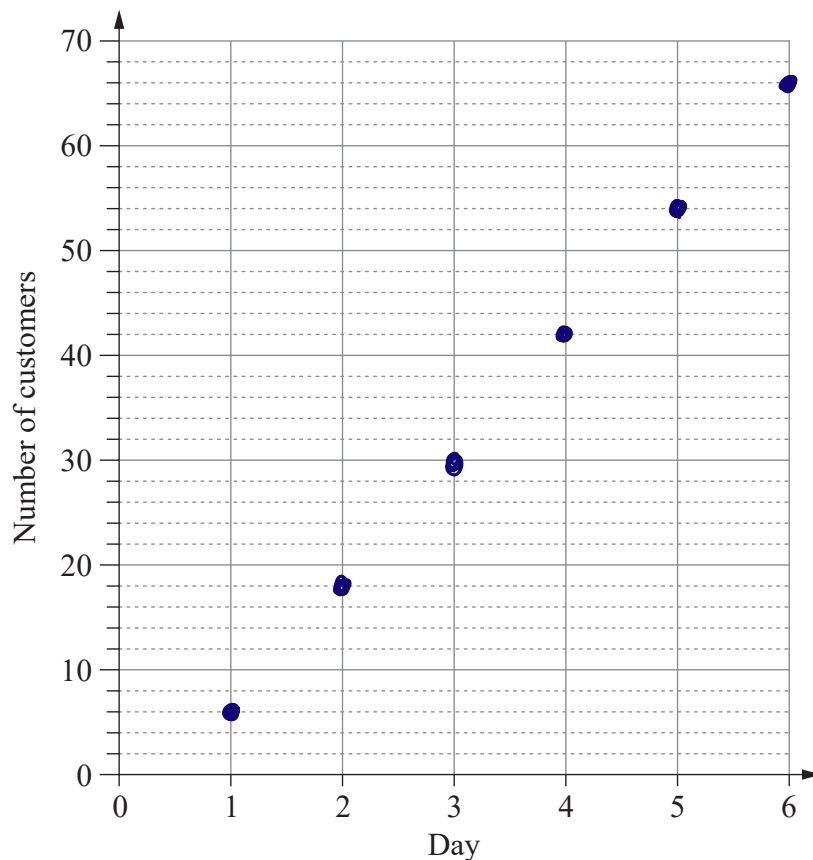
The number of customers for a new gym's first four days of operation is shown.

Day	1	2	3	4
Customers	6	18	30	42

- a) Provide a justified decision for whether the number of customers forms an arithmetic sequence or a geometric sequence. [2 marks]

The customer numbers have a common difference of 12, so they form an arithmetic sequence.

- b) Assuming the sequence continues, display the number of customers for the gym's first six days of operation in a scatterplot on the grid provided. [2 marks]



Note: If you make a mistake, cancel it by ruling a single diagonal line through your work and use the additional response space at the back of this book.

Do not write outside this box.

QUESTION 22 (4 marks)

A \$50 000 perpetuity earning fortnightly interest at 4.94% p.a. provides a regular fortnightly payment.

a) Calculate the fortnightly payment.

[2 marks]

fortnightly payment

$$= 50000 \times \frac{4.94}{100 \times 26}$$

$$= \$95$$

$50000 \times \frac{4.94}{100 \times 26}$
95

if you use the p.a. interest rate as a decimal, you won't need to divide by 100

b) Calculate the perpetuity's effective annual rate of interest as a percentage.

[2 marks]

$$i_{\text{eff}} = \left(1 + \frac{4.94}{100 \times 26}\right)^{26} - 1$$

$$= 0.05059 \dots$$

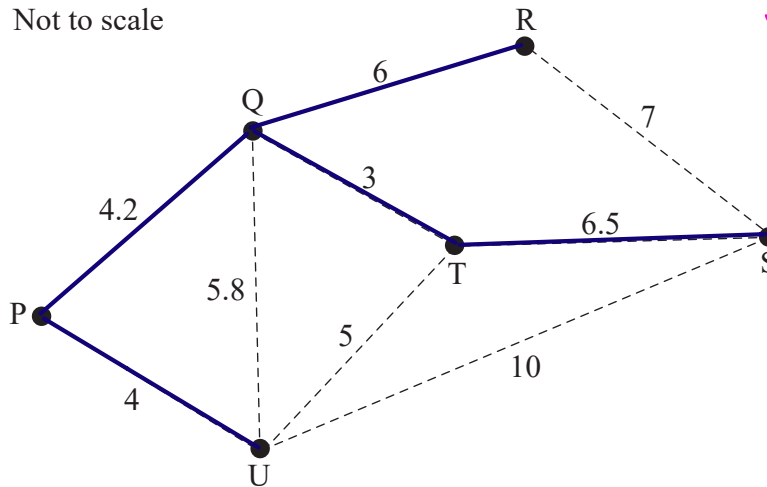
$$= 5.06\%$$

$\left(1 + \frac{4.94}{100 \times 26}\right)^{26} - 1$
0.05059127987

Do not write outside this box.

QUESTION 23 (5 marks)

The diagram represents a network of six electrical outlets (P–U) and possible locations for connecting cables. Cable lengths are in metres.



Using Prim's Algorithm:
 • Starting with QT
 • add in minimum edge weights
 QP, PU, QR, RT

- a) Justify why a subgraph of the network that contains outlets P, Q and U and connecting cables with lengths 4 m, 4.2 m and 5.8 m is not a tree. [2 marks]

These outlets and cables form a cycle.

A tree does not contain cycles.

- b) An electrician claims that all outlets can be connected using less than 25 m of cables. Identify a minimum spanning tree to evaluate the reasonableness of the claim. [3 marks]

Note: If you make a mistake, cancel it by ruling a single diagonal line through your work and use the additional response space at the back of this book.

The minimum spanning tree shown above has length

$$4 + 4.2 + 3 + 6 + 6.5 = 23.7 \text{ m}$$

AS 23.7 is less than 25, the claim is reasonable.

Do not write outside this box.

QUESTION 24 (5 marks)

The average weekly earnings for Australian workers from 2013 to 2023 are modelled by the least-squares line equation $y = 49x - 97\,140$, where x is the year and y is average weekly earnings (\$).

The coefficient of determination, R^2 , is 0.997.

- a) State the percentage of the variation in y that is explained by the linear relationship. [1 mark]

99.7 %

- b) Identify and interpret the slope of the least-squares line. [2 marks]

Slope = 49

Australia's average weekly earning increased by (approximately) \$49 per year between 2013 and 2023.

- c) Use the equation of the least-squares line to predict the average weekly earnings in 2035. [2 marks]

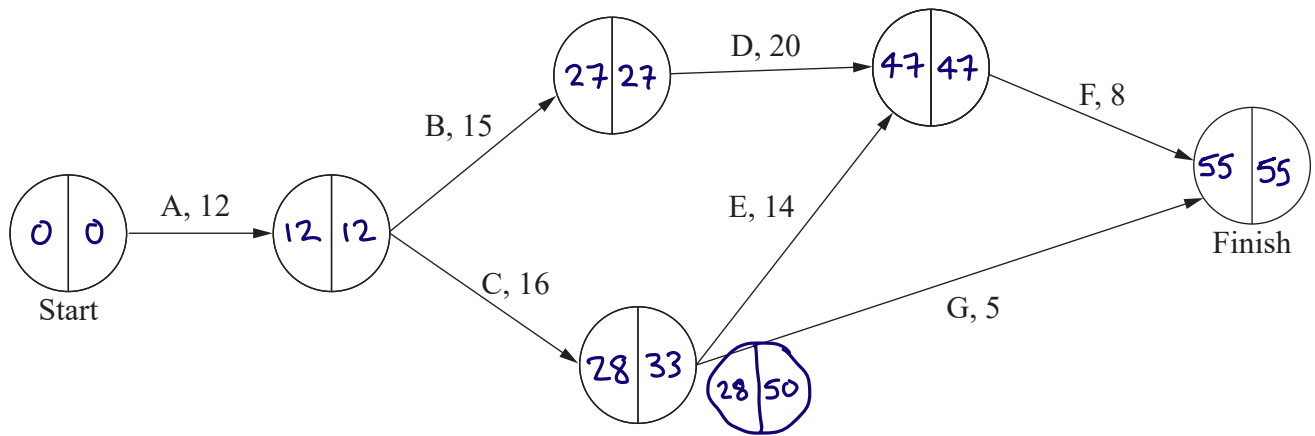
$$y = 49 \times 2035 - 97140$$
$$= \$ 2575$$

$49 \times 2035 - 97140$
2575

\therefore The model predicts an average weekly salary of \$2575 in 2035

QUESTION 25 (5 marks)

The network diagram shows the time (minutes) to complete each of seven activities in a project.



a) State the earliest starting time (EST) for activity D. [1 mark]

27 mins

b) Determine the minimum time to complete the project. [1 mark]

Note: If you make a mistake, cancel it by ruling a single diagonal line through your work and use the additional response space at the back of this book.

55 mins

c) State the latest starting time (LST) for activity E. [1 mark]

LST of E = $47 - 14 = 33$ mins

d) Calculate the float time for activity G. [2 marks]

Float time = $LFT - EST - AT$

\therefore Float time for G = $55 - 28 - 5$

= 22 mins

END OF PAPER

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LUI

School code

School name

Given name/s

Family name

Attach your
barcode ID label here

Book of books used

External assessment 2025

Question and response book

General Mathematics

Paper 2

Time allowed

- Perusal time — 5 minutes
- Working time — 90 minutes

General instructions

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Section 1 (38 marks)

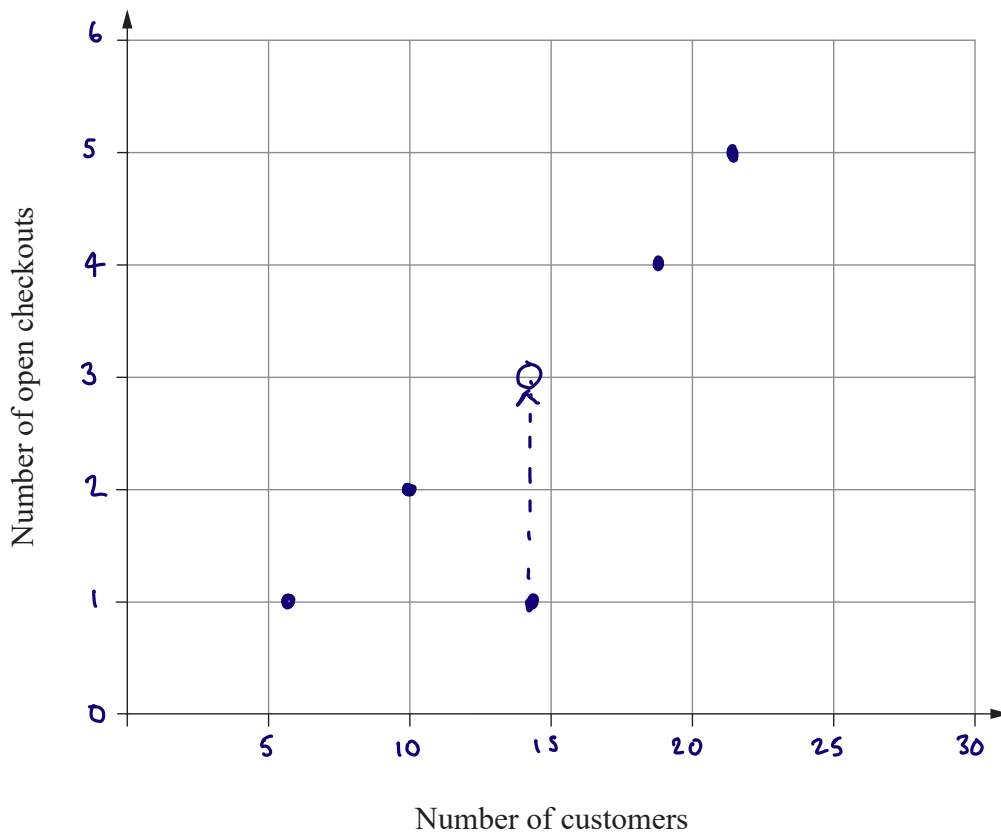
- 7 short response questions

QUESTION 1 (4 marks)

At various times of the day, a store manager recorded the number of customers in the store and the number of open checkouts.

	Time of the day				
	8 am	10 am	12 pm	2 pm	4 pm
Number of customers	6	10	22	18	14
Number of open checkouts	1	2	5	4	1

Use a scatterplot display of the data to explain how many additional checkouts should have been open at 4 pm to be consistent with the data.



Note: If you make a mistake, cancel it by ruling a single diagonal line through your work and use the additional response space at the back of this book.

At 4 pm there were 14 customers and 1 checkout open.
This datapoint would have more consistent with
the other data if 3 checkouts had been open.
As such, 2 additional checkouts should have opened.

Do not write outside this box.

QUESTION 2 (5 marks)

A vehicle's value (\$) depreciates geometrically each year. The table shows the value, t_n , where n is the number of years since the end of 2020.

n	1	2	3
t_n	83 600	71 060	60 401

Determine if the value at the end of 2028 will be lower than one third of the value at the end of 2021.

$$t_1 = 83600$$

$$r = \frac{71060}{83600} = 0.85$$

$\frac{71060}{83600}$
0.85

$$\therefore t_n = 83600 \times 0.85^{n-1}$$

The end of 2028 $\Rightarrow n = 8$

$$t_8 = 83600 \times 0.85^7$$

$$= 26800.24$$

83600×0.85^7
26 800.24458

one third of the 2021 value is

$$\frac{83600}{3} = 27866.67$$

$83600 \div 3$
27 866.66667

as $26800.24 < 27866.67$

The value at the end of 2028

is less than one third of

the value at the end of 2021

Do not write outside this box.

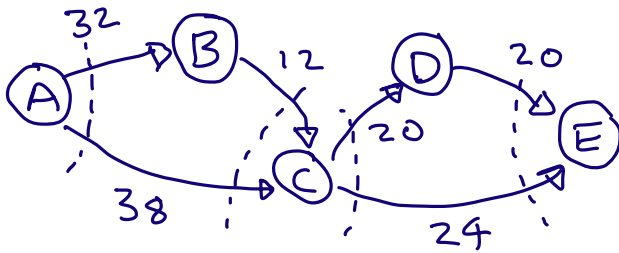
QUESTION 3 (5 marks)

Stormwater flows through a network of pipes from a source (A) to a river (E). The table shows the maximum flow rate (L/sec) through each pipe connecting different parts of the network.

		To			
		B	C	D	E
From	A	32	38	—	—
	B	—	12	—	—
	C	—	—	20	24
	D	—	—	—	20

An engineer will upgrade only one pipe to change the maximum flow from A to E to 45 L/sec.

Use a flow network diagram to determine the new maximum flow rate for the upgraded pipe.



$$\text{Flow out of A : } 32 + 38 = 70$$

$$\text{" into C : } 38 + 12 = 50$$

$$\text{Flow out of C : } 20 + 24 = 44$$

$$\text{Flow into E : } 20 + 24 = 44$$

Note: If you make a mistake, cancel it by ruling a single diagonal line through your work and use the additional response space at the back of this book.

current max. flow from A to E is 44

To increase flow, the capacity both out of C and into E must be increased, so CE must be upgraded.

As an increase of 1 L/s is needed C needs to be upgraded from 24 L/s to 25 L/s

Do not write outside this box.

QUESTION 4 (5 marks)

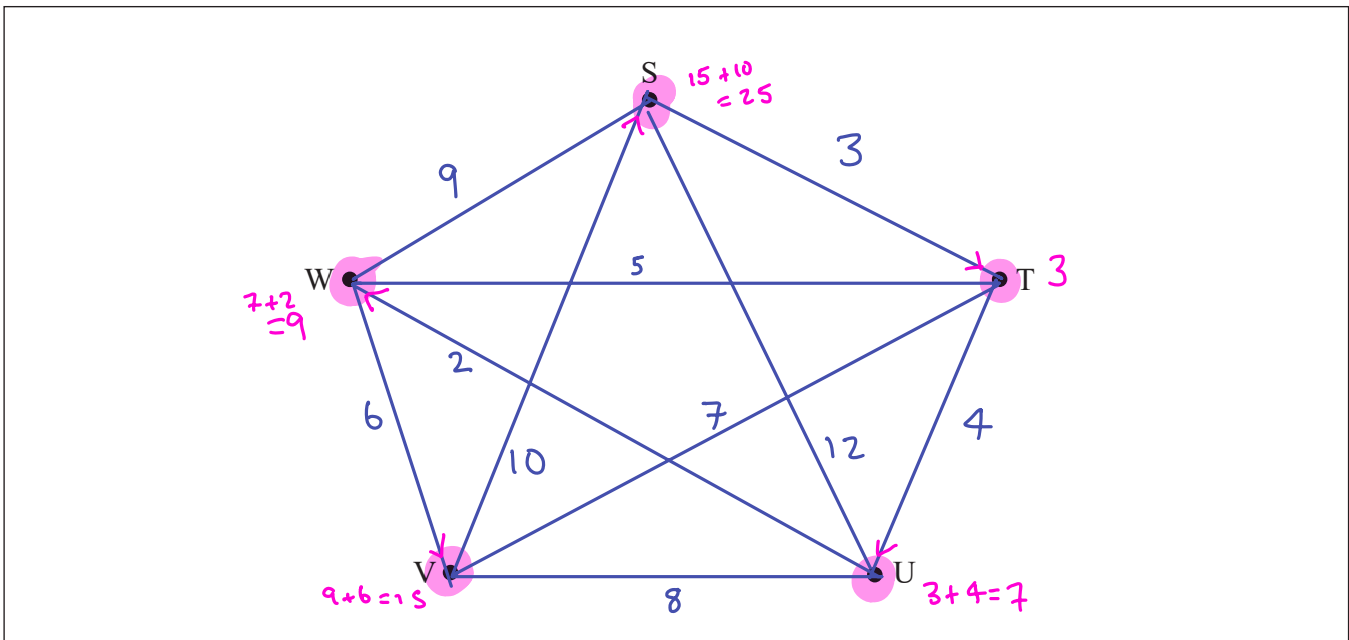
Marli drives a round trip in which she leaves a storage warehouse, S, refills vending machines at four venues, T, U, V and W, and returns to the storage warehouse. The tables show the distance (km) between the locations and the number of vending machines at each venue.

Road connecting locations	S-T	S-U	S-V	S-W	T-U	T-V	T-W	U-V	U-W	V-W
Distance (km)	3	12	10	9	4	7	5	8	2	6

Venue	T	U	V	W
Number of vending machines	2	3	4	3

Marli is paid \$25 per vending machine and a driving allowance of 80 cents per kilometre based on the minimum total distance for a round trip.

Use a weighted graph representing the road network to calculate Marli's total payment.



Note: If you make a mistake, cancel it by ruling a single diagonal line through your work and use the additional response space at the back of this book.

Do not write outside this box.

Shortest closed walk is STUWVS

its length is $3+4+2+6+10=25$ km

\therefore Marli is paid $25 \times \$0.80 = \20 travel

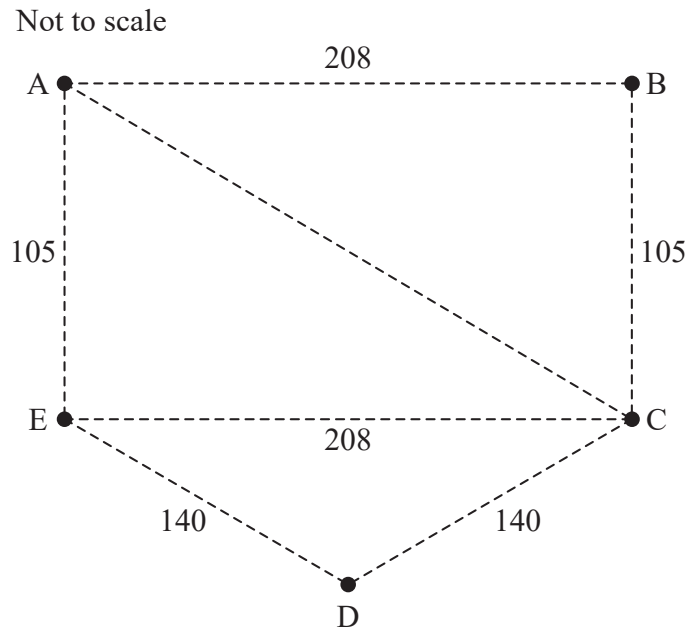
plus $\$25 \times (2+3+4+3) = \300 refilling

\therefore paid $\$320$ in total

Do not write outside this box.

QUESTION 5 (7 marks)

The diagram represents seven walkways joining five benches (A–E) in a park. Walkway distances are shown in metres. The walkway between A and B is perpendicular to the walkway between B and C.



Helen’s usual daily walk involves completing an open Eulerian trail beginning at A. On Tuesday, when one walkway could not be used, Helen used the available walkways to complete a closed Eulerian trail starting at A.

If Helen’s usual daily walk takes 17 minutes, justify whether she completed her walk on Tuesday in under 15 minutes. Assume Helen’s walking speed doesn’t change.

Using Pythagoras theorem:

$$AC^2 = 105^2 + 208^2$$

$\sqrt{105^2 + 208^2}$
233

$$\therefore AC = 233 \text{ m}$$

As vertices A and E are odd,

her open trail from A will end

at E. A possible path is

ABC A E C D E

with total distance 1139 m.

$233 + 140 + 140 + 208 + 105$
1139

Do not write outside this box.

On Tues, a closed trail is possible

So AE must be closed, making

A and E even. This shortens

her walk by 105 m, making

it 1034 m.

Ans-105
1 034

On her usual walk, her Speed

is $\frac{1139}{17} = 67$ m/min.

PreAns÷17
67

To do Tuesday's walk in 15 min

a speed of $\frac{1034}{15} = 68.93$ m/min

is required.

PreAns÷15
68.93333333

As we are told Helen's walking
Speed does not change, so

She cannot complete it in
15 mins or less.

Using PreAns
Saves us
reentering
the previously
found values

QUESTION 6 (6 marks)

Fiore (F) and Goran (G) each hike for n hours along a track that joins a car park and a lookout. They both start their hike at 10 am, but from opposite ends of the track.

- Fiore's distance (km) from the car park, F_n , is modelled by $F_n = 2n$
- Goran's distance (km) from the car park, G_n , is modelled by $G_n = 12 - 3(n - 1)$

When Fiore and Goran meet on the track, they both take a 30-minute break. They then hike together to the car park, arriving at 4 pm.

Determine their hiking speed (km/h) from when Fiore and Goran finish their break to when they arrive at the car park.

TABLE App

n	0	1	2	3					
F_n	0	2	4	6					
G_n	15	12	9	6					

- Tools ☺☺☺
Define $f(x)/g(x)$

	Define $f(x)$
	Define $g(x)$

- Enter $f(x)$
(use \oplus key)

	$f(x) = 2x$
--	-------------

- Repeat for $g(x)$

	$g(x) = 12 - 3(x - 1)$
--	------------------------

\therefore meet when $n = 3$, at 1 pm

they are 6 km from the carpark

\therefore Between 1:30 & 4:00 they hike 6 km.

\therefore Their speed is $\frac{6}{2.5} = 2.4$ km/h

	Define $f(x)$
	Define $g(x)$

	$f(x) = 2x$
--	-------------

	$g(x) = 12 - 3(x - 1)$
--	------------------------

	Table Range
	Start: 0
	End : 5
	Step : 1

	x	$f(x)$	$g(x)$
1	0	0	15
2	1	2	12
3	2	4	9
4	3	6	6

	6
	2.5

2.4

QUESTION 7 (6 marks)

Two businesses, B₁ and B₂, report their annual profit (\$) at the end of each year.

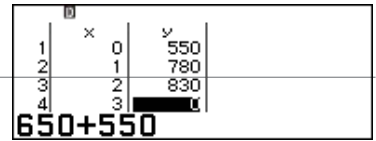
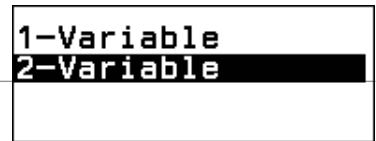
	Annual profit (\$)		Sum
	B ₁	B ₂	
2022	300 000	250 000	550 000
2023	500 000	280 000	780 000
2024	400 000	430 000	830 000
2025	650 000	550 000	1200 000

At the end of 2025, the two businesses merged into one company, C, and appointed a new director. The director used the B₁ and B₂ data up until that time to predict that C's annual profit reported at the end of 2040 would be more than \$4 million.

Evaluate the reasonableness of the director's prediction.

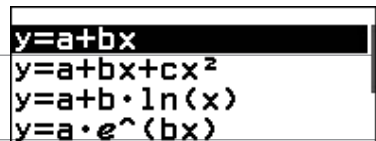
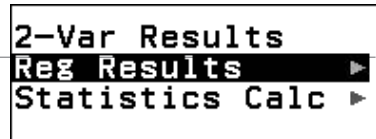
Statistics app

If x is years since 2022
 and y is combined profit in \$1000s
 then a regression model for y is
 $y = 540 + 200x$

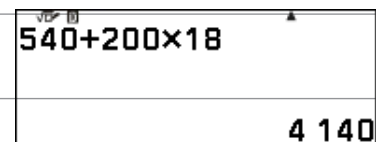
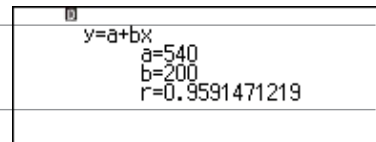


can sum within the Stats app.

Using this model, at the end of 2040, $x = 18$ and
 $y = 540 + 200 \times 18 = 4140$



\therefore The model predicts that C's annual profit is \$4140 000 which is more than \$4 million
 \therefore the prediction is reasonable.



Do not write outside this box.



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