General Mathematics 2019 v1.2

IA2: Sample assessment instrument

This sample has been compiled by the QCAA to assist and support teachers in planning and developing assessment instruments for individual school settings.

Student name

Student number

Teacher

Exam date

Marking summary

Criterion	Marks allocated	Provisional marks
Foundational knowledge and problem-solving	15	
Overall	**15**	

Conditions

Technique	Examination
Unit	Unit 3: Bivariate data, sequences and change, and Earth geometry
Topic/s	Topic 1: Bivariate data analysis
	Topic 2: Time series analysis
	Topic 3: Growth and decay in sequences
	Topic 4: Earth geometry and time zones
Time	2 hours + 5 minutes perusal
Seen/Unseen	Unseen questions
Other	Only the QCAA formula sheet must be provided
	Notes are not permitted
	Use of technology is required; schools must specify the technology used

Instructions

- Show all working in the space provided.
- Use a black or blue pen.
- Use of a scientific calculator is permitted.

Summative internal assessment 2 (IA2): Examination

Question 1 (4 marks)

A market researcher interviewed 60 people about their preferred telecommunications provider. Of the 35 females interviewed, 12 said they preferred Fonestar, while 13 of the males preferred Telcall. Ten people preferred an alternative company, with four of those people being female.

Complete all entries for the two-way frequency table below using gender as the explanatory variable:

Question 2 (4.5 marks)

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a. Describe the associations shown in the scatter plots below in terms of direction and strength.

A   B   C
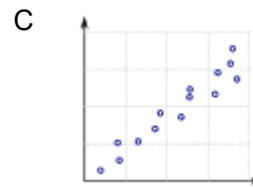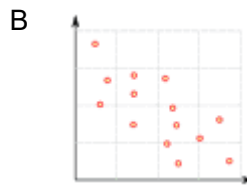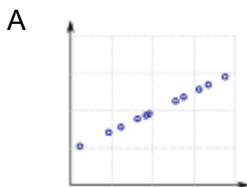
b. Select from the correlation coefficients listed below allocating an appropriate value to each graph.

1,	0.8,	0.3,	0,	-0.3,	-0.8,	-1

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Question 3 (4.5 marks)

Given the following data for the number of twin births in Queensland over a 11-year period:

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Number of twin births	828	802	893	943	1020	1014	988	977	1000	925	940

From: *Australian Bureau of Statistics*, 'Births, Australia, 2014', www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3301.02014?OpenDocument

    a.   construct a time series plot for the above data

    b.   describe the trend of the time series.

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Question 4 (4 marks)

Given the following table for the cost of a taxi ride:

Total distance, n (km)	1	2	3	4	5	6
Total fare, t_n ($)	6	8.5	11	13.5	…	…

    a.   demonstrate that the total fares form an arithmetic sequence

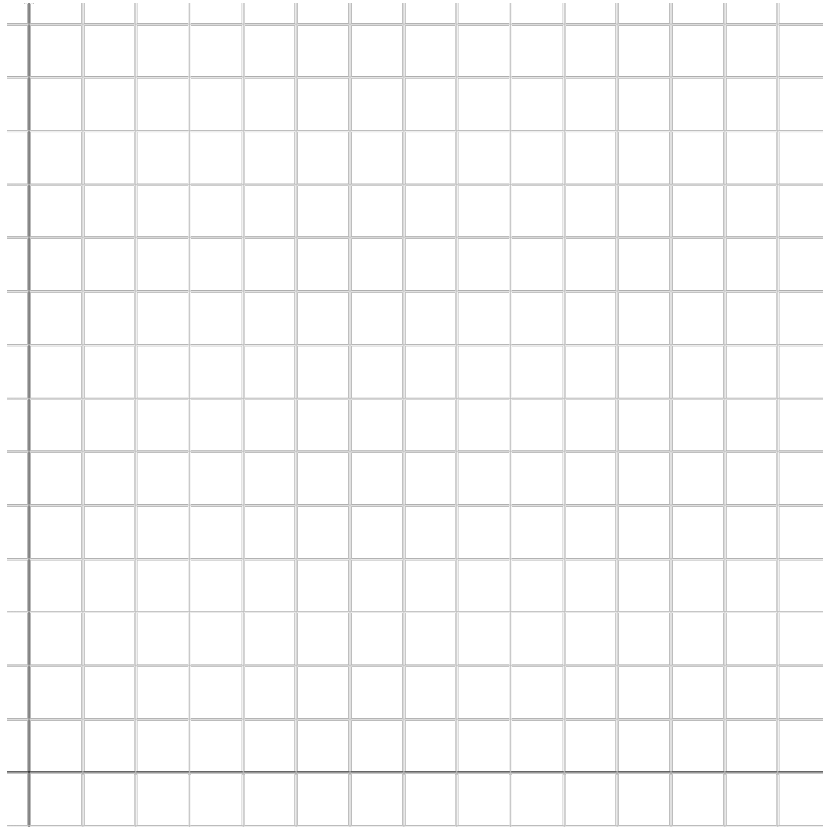   b.   use the rule $t_n = 6 + 2.5(n-1)$ to predict the total fare for a 35-kilometre taxi ride.

Question 5 (5 marks)

Given the recursive formula $a_1 = 4$; $a_n = 3a_{n-1}$ to model a bacterial population:

    a.   generate the next two terms in the sequence

    b.   graphically display the first five terms of the sequence on the grid below

    c.   state what type of model best describes the trend of the graph.

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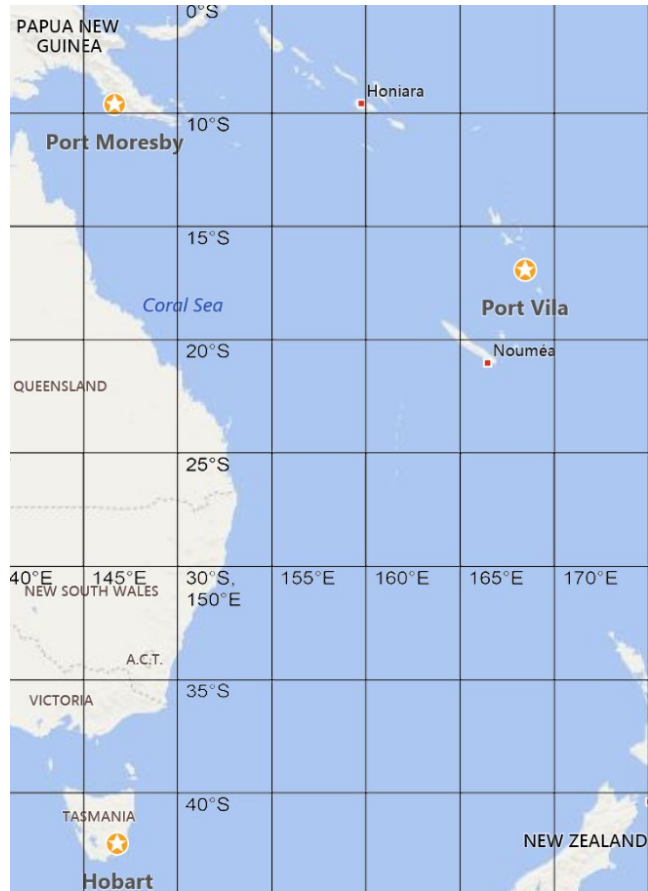
Question 6 (5 marks)

Given the following map:

    a.   state the latitude and longitude of Port Vila, Vanuatu

    b.   determine the angular distance between Port Moresby, Papua New Guinea (9°S, 147°13'E) and Hobart, Australia (42°S, 147°13'E)

    c.   calculate the distance, to the nearest kilometre, between Port Moresby and Hobart.

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Average (mean) unleaded petrol retail prices in Queensland were recorded over a 6-month period. Details are shown in the table below.

Time (months)	1	2	3	4	5	6
Price (cents)	132.4	129.5	130.4	124.6	128.7	130.7

a. Calculate the 3-point moving averages.

b. Plot the moving averages on the graph below.

c. Comment on the trend of the time series data.

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Question 8 (8 marks)

Eighty-five students from the same school were surveyed about their preferred sport — volleyball or cricket. The results are shown in a two-way frequency table below.

	Preferred sport		
	Cricket	**Volleyball**	**Total**
Junior school	24	21	45
Senior school	12	28	40
Total	36	49	85

a. Calculate the percentage of students in the Junior school who prefer volleyball.

b. Of the students who prefer cricket, calculate the percentage who are in the Senior school.

c. Determine whether there is an association between the variables. Explain your response in terms of percentages.

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Question 9 (6 marks)

A pump removes one-quarter of the contents of a 20 000-litre water tank every 15 minutes. Determine how long the pump needs to run to reduce the contents of a full tank to 500 litres.

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Question 10 (9 marks)

Twelve people of different ages ran around an athletics track for 30 minutes. The number of complete laps they ran was recorded and the results are shown below.

Age (in years)	20	40	33	12	18	70	51	25	55	14	16	30
Number of complete laps	7	6	5	12	10	3	4	8	4	11	9	7

a. Identify the response variable and the explanatory variable.

b. Use the statistics function on your scientific calculator to calculate the y-intercept and slope of the line of best fit.

c. Interpret appropriately the y-intercept and slope of the fitted line in the context of the data.

d. Given that the correlation coefficient is –0.91, explain what this means in terms of the strength of the association.

e. Interpret the value of the correlation coefficient in the context of the data.

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Question 11 (7 marks)

The approximate coordinates of two northern hemisphere cities are:

Deadhorse, Alaska — 70°N, 148°W

Tiksi, Russia — 70°N, 128°E

    a.   Calculate the shortest distance between the two cities along the parallel of latitude.

    b.   Determine the day and time (to the nearest hour) it will be in Deadhorse when it is 10 am in Tiksi on a Monday.

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Question 12 (9 marks)

The table below shows the quarterly newspaper sales of a convenience store in 2017. The long-term seasonal indices for newspaper sales for the first three quarters are also shown.

Use a valid mathematical model to predict the actual newspaper sales for the fourth quarter of 2018.

	Newspaper sales			
	Quarter 1	**Quarter 2**	**Quarter 3**	**Quarter 4**
2017	2245	2038	3110	2907
Seasonal index	0.86	0.79	1.21	

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Question 13 (7 marks)

When an empty garbage truck with a maximum carrying capacity of 1500 kilograms, starts its daily round, it stops at a school, where it collects 186 kilograms of garbage. It then travels along a suburban street, where the amount of rubbish collected from each house is the same. After the 10th house, the truck is carrying 546 kilograms of garbage.

Will the truck be able to collect garbage at the 35th house?

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Examination marks summary

Question number	Simple familiar (SF)	Complex familiar (CF)	Complex unfamiliar (CU)
1	4		
2	4.5		
3	4.5		
4	4		
5	5		
6	5		
7	6.5		
8	4	4	
9		6	
10	6	3	
11	4	3	
12			9
13			7
Totals	**47.5**	**16**	**16**

Instrument-specific marking guide (IA2): Examination (15%)

Criterion: Foundational knowledge and problem-solving

Assessment objectives

1. select, recall and use facts, rules, definitions and procedures drawn from all Unit 3 topics

2. comprehend mathematical concepts and techniques drawn from all Unit 3 topics

3. communicate using mathematical, statistical and everyday language and conventions

4. evaluate the reasonableness of solutions

5. justify procedures and decisions by explaining mathematical reasoning

6. solve problems by applying mathematical concepts and techniques drawn from all Unit 3 topics.

The student work has the following characteristics:	Cut-off	Marks
• consistently correct selection, recall and use of facts, rules, definitions and procedures; authoritative and accurate command of mathematical concepts and techniques; astute evaluation of the reasonableness of solutions and use of mathematical reasoning to correctly justify procedures and decisions; and fluent application of mathematical concepts and techniques to solve problems in a comprehensive range of simple familiar, complex familiar and complex unfamiliar situations.	> 93%	15
	> 87%	14
• correct selection, recall and use of facts, rules, definitions and procedures; comprehension and clear communication of mathematical concepts and techniques; considered evaluation of the reasonableness of solutions and use of mathematical reasoning to justify procedures and decisions; and proficient application of mathematical concepts and techniques to solve problems in simple familiar, complex familiar and complex unfamiliar situations.	> 80%	13
	> 73%	12
• thorough selection, recall and use of facts, rules, definitions and procedures; comprehension and communication of mathematical concepts and techniques; evaluation of the reasonableness of solutions and use of mathematical reasoning to justify procedures and decisions; and application of mathematical concepts and techniques to solve problems in simple familiar and complex familiar situations.	> 67%	11
	> 60%	10

• selection, recall and use of facts, rules, definitions and procedures; comprehension and communication of mathematical concepts and techniques; evaluation of the reasonableness of some solutions using mathematical reasoning; and application of mathematical concepts and techniques to solve problems in simple familiar situations.	> 53%	9
	> 47%	8
• some selection, recall and use of facts, rules, definitions and procedures; basic comprehension and communication of mathematical concepts and techniques; inconsistent evaluation of the reasonableness of solutions using mathematical reasoning; and inconsistent application of mathematical concepts and techniques.	> 40%	7
	> 33%	6
• infrequent selection, recall and use of facts, rules, definitions and procedures; basic comprehension and communication of some mathematical concepts and techniques; some description of the reasonableness of solutions; and infrequent application of mathematical concepts and techniques.	> 27%	5
	> 20%	4
• isolated selection, recall and use of facts, rules, definitions and procedures; partial comprehension and communication of rudimentary mathematical concepts and techniques; superficial description of the reasonableness of solutions; and disjointed application of mathematical concepts and techniques.	> 13%	3
	> 7%	2
• isolated and inaccurate selection, recall and use of facts, rules, definitions and procedures; disjointed and unclear communication of mathematical concepts and techniques; and illogical description of the reasonableness of solutions.	> 0%	1
• does not satisfy any of the descriptors above.		0