OXFORD Study Buddy

QCE GENERAL MATHEMATICS

UNITS 3 & 4

VOLUME 1

Revision and Exam Guide

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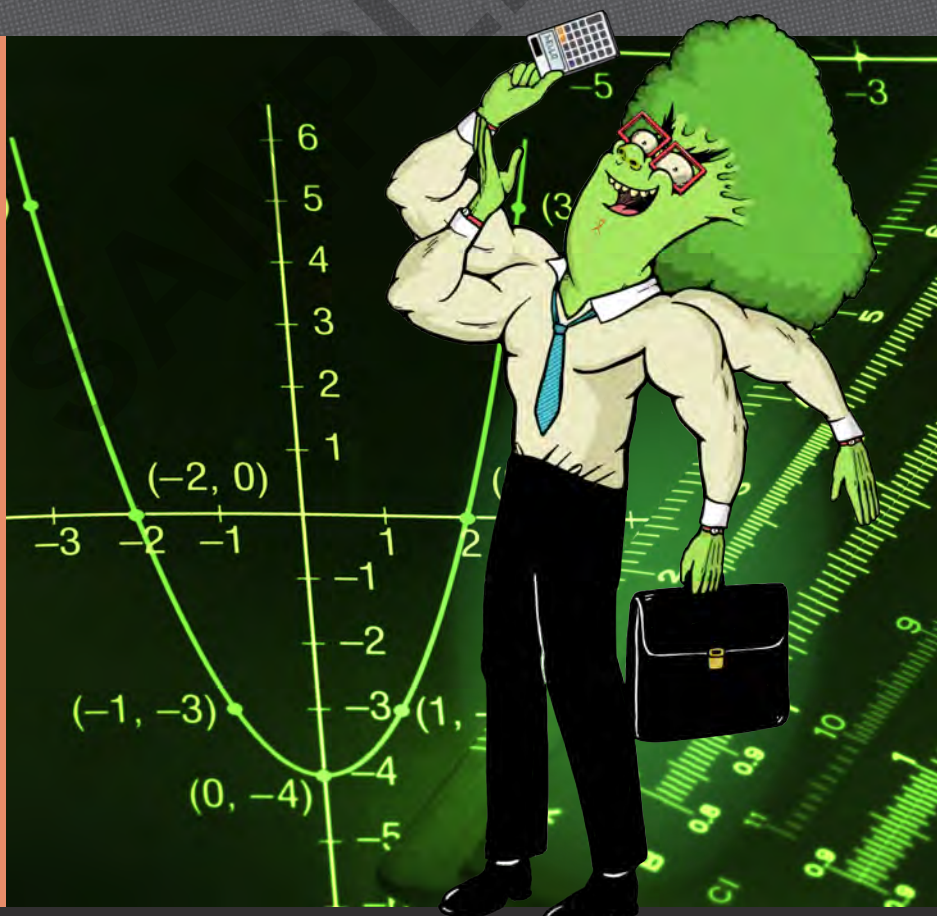

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CHAPTER 1 STUDYING FOR SUCCESS

Before you start studying for your QCE General Mathematics exams, it's important to set yourself up for success. That's exactly what this chapter is designed to do, so thanks for stopping by!

As soon as it's time to start studying for the external assessment, we recommend that you work through this whole chapter before doing anything else!

You might do this at the start of the school year or at the start of your exam study period, but whatever you do, don't skip this chapter; it contains a bunch of really important information and tips that might just give you the edge you're looking for.

1.1 OVERVIEW OF QCE GENERAL MATHEMATICS UNITS 3 & 4

In this section, we will:

- provide a brief overview of how the QCE General Mathematics Units 3 & 4 course is structured
- list all of the concepts and topics that you will need to learn and understand
- explain how you will be assessed.

1.1.1
Resource: General Mathematics General Senior syllabus

Study tip

The QCE General Mathematics General Senior Syllabus sets out all of the information you are expected to learn and also provides important information on how you will be assessed.

In this chapter, we have summarised all of the key information relating to external assessment you need to know, but the QCAA may update the syllabus from time to time, so it's important that you make sure you are using the most current version!

Make sure you visit the QCAA website and download a copy of the General Mathematics General Senior Syllabus and read the key information carefully before you sit your external assessment. To save you time, we've also included a link to it on your obook assess!

UNDERSTANDING THE QCE GENERAL MATHEMATICS UNITS 3 & 4 COURSE STRUCTURE

The General Mathematics General Senior Syllabus is the most important document supporting the QCE General Mathematics course. It sets out all the content (known as subject matter) that you will be expected to learn and provides important information about how you will be assessed.

QCE General Mathematics is a course of study consisting of four units (i.e. Units 1 & 2 and Units 3 & 4) taught over 2 years. In this revision and exam guide, we will only be focusing on information relating to Units 3 & 4. The topics you will be learning about in Units 3 & 4 are summarised in Table 1.

Study tip

The notional hours shown in Table 1 are provided by the QCAA to help teachers with their planning and give them an estimate of how long to spend teaching the subject matter in each topic.

Notional hours can be a handy way to help you structure and allocate your revision and preparation time for the external assessment because, as a general rule, there are likely to be more questions on subject matter with higher notional hours.

Course structure for QCE General Mathematics Units 3 & 4

Unit 3 Bivariate data, sequences and change, and Earth geometry	Unit 4 Investing and networking
Topic 1: Bivariate data analysis *Subject matter:* • Identifying and describing associations between two categorical variables [4 hours] • Identifying and describing associations between two numerical variables [6 hours] • Fitting a linear model to numerical data [7 hours] • Association and causation [7 hours] **Topic 2: Time series analysis** *Subject matter:* • Describing and interpreting patterns in time series data [4 hours] • Analysing time series data [10 hours] **Topic 3: Growth and decay in sequences** *Subject matter:* • The arithmetic sequence [4 hours] • The geometric sequence [5 hours] **Topic 4: Earth geometry and time zones** *Subject matter:* • Locations on the Earth [3 hours] • Time zones [5 hours]	**Topic 1: Loans, investments and annuities** *Subject matter:* • Compound interest loans and investments [6 hours] • Reducing balance loans (compound interest loans with periodic repayments) [6 hours] • Annuities and perpetuities (compound interest investments with periodic payments made from the investment) [8 hours] **Topic 2: Graphs and networks** *Subject matter:* • Graphs, associated terminology and the adjacency matrix [4 hours] • Planar graphs, paths and cycles [8 hours] **Topic 3: Networks and decision mathematics** *Subject matter:* • Trees and minimum connector problems [4 hours] • Project planning and scheduling using critical path analysis (CPA) [8 hours] • Flow networks [3 hours] • Assigning order and the Hungarian algorithm [8 hours]

Table 1 Each unit is developed to a notional (i.e. estimated) time of 55 hours of teaching and learning, including assessment. Notional times for each sub-topic are also provided.

UNDERSTANDING THE QCE GENERAL MATHEMATICS UNITS 3 & 4 ASSESSMENT STRUCTURE

You will be expected to complete a total of ***four*** **summative assessments** in QCE General Mathematics Units 3 & 4. Summative assessments are designed to evaluate your understanding of the subject matter and compare your performance against the understanding of students from across the state.

Three of these assessments are **internal** and one is **external**, but all will contribute to your Australian Tertiary Admission Rank (ATAR) calculation and to your Queensland Certificate of Education (QCE).

CHAPTER 2 REVISION

In this chapter, we provide a clear, concise summary of all examinable content from QCE General Mathematics Units 3 & 4 to help you revise and prepare for the external assessment.

Everything has been organised by unit, topic and sub-topic in the General Mathematics Senior Syllabus to help you focus your time and attention where it is needed most.

The revision notes are not designed to replace your teacher or your textbook. Instead, they have been designed to help you gauge your level of understanding of and confidence in the subject matter before the exam. You can use them to identify those topics you know inside out and those that still require some extra attention.

The revision notes are also supported by a bunch of handy features, tips and icons designed to help you get the very best result on the day.

2.1 UNIT 3 TOPIC 1 – BIVARIATE DATA ANALYSIS

Questions
on pages 104–126

IDENTIFYING AND DESCRIBING ASSOCIATIONS BETWEEN TWO CATEGORICAL VARIABLES

SUBJECT MATTER

Before the external assessment, you should be able to:

- define bivariate data
- construct two-way frequency tables and determine the associated row and column sums and percentages
- use an appropriately percentaged two-way frequency table to identify patterns that suggest the presence of an association
- understand an association in terms of differences observed in percentages across categories in a systematic and concise manner, and interpret this in the context of the data.

BIVARIATE DATA

KEY CONCEPT

Bivariate data is data that involves two different variables. When analysing bivariate data, we are looking for a relationship between the two variables.

TWO-WAY FREQUENCY TABLES AND TWO-WAY PERCENTAGE TABLES

KEY CONCEPT

- Two-way **frequency tables** can be used to represent the relationship between two categorical variables. One variable is listed in the rows and the other variable is listed in the columns.
- To convert from a two-way frequency table to a two-way percentage table, first calculate the row or column sums, then divide each frequency by its row or column sum and multiply the result by 100.

frequency table
a table that lists items and the number of times (the frequency) of their occurrence

A two-way percentage table can be used to identify patterns in the data that suggest the presence of an association between the two variables.

IDENTIFYING PATTERNS IN THE DATA

KEY CONCEPT

Two-way percentage tables allow us to make comparisons where the totals for each category are different.

Look for differences in percentages across the categories. Identify where there is a substantial difference in the percentages and interpret these differences in the context of the data.

WORKED EXAMPLE 2.1A

CONSTRUCTING A TWO-WAY PERCENTAGE TABLE TO ANALYSE DATA

Question

People in Canberra, Adelaide and Brisbane were surveyed about their favourite non-violent computer game. The resulting data is displayed in the following two-way frequency table.

	Minecraft	Fez	Journey
Canberra	131	100	87
Adelaide	73	84	45

a) Create a two-way percentage table for this data by first calculating the row sums. *[2 marks]*

b) Determine if Journey is more popular in Canberra than Minecraft is in Adelaide. *[1 mark]*

Breaking down the question

a) Create means to bring into existence. Convert the data from the two-way frequency table into a two-way percentage table.

b) Determine means to establish or conclude after consideration. Identify and compare the values from the two-way percentage table to give your answer.

Solution

a) Canberra total = 131 + 100 + 87
= 318
Adelaide total = 73 + 84 + 45
= 202

	Minecraft	Fez	Journey
Canberra	$\frac{131}{318} \times 100$ = 41.2%	$\frac{100}{318} \times 100$ = 31.4%	$\frac{87}{318} \times 100$ = 27.4%
Adelaide	$\frac{73}{202} \times 100$ = 36.1%	$\frac{84}{202} \times 100$ = 41.6%	$\frac{45}{202} \times 100$ = 22.3%

b) Journey is less popular in Canberra (27.4%) than Minecraft in Adelaide (36.1%).

Marking advice and tips

a) Calculate the total for each row. *[1 mark]*
Divide each frequency by its row sum and multiply by 100. Round to a suitable number of decimal places. *[1 mark]*

b) Use the values from the two-way percentage table to make a comparative statement. *[1 mark]*

CHAPTER 3 PRACTICE QUESTIONS

In this chapter, we provide a range of practice questions for all of the examinable content from QCE General Mathematics Units 3 & 4. What a surprise … not! I have a sneaking suspicion the title gave it away.

No fancy tricks here – we just provide more than 300 questions organised by unit and topic so you can move effortlessly between revision and practice as you study, and get as much practice in as you need to build up your confidence.

To help you direct your time and effort to where it's needed most, we've also grouped the questions by type. Multiple choice and short response questions are grouped separately, but we have also separated the short response questions into three groups according to type and level of difficulty. These include:

- **Simple familiar** – these questions will make up around 60% of the total number of questions/marks on the external assessment (so we have provided a lot more of them in this chapter)
- **Complex familiar** – these questions will make up around 20% of the total number of questions on the external assessment
- **Complex unfamiliar** – these questions will make up around 20% of the total number of questions on the external assessment.

3.1 UNIT 3 TOPIC 1 – BIVARIATE DATA ANALYSIS

MULTIPLE CHOICE QUESTIONS

Answers
on pages 266–270

QUESTION 1

Bivariate data involves

(A) two values.
(B) two variables.
(C) two data displays.
(D) two data varieties.

QUESTION 2

Two variables are displayed on a scatterplot. Which statement below is correct?

(A) Only if there is a causal relationship between the two variables will they have a positive association.
(B) If the two variables have a negative association then there is not a causal relationship between the two variables.
(C) If the two variables are associated either positively or negatively then there could be a causal relationship between the two variables.
(D) If the two variables are associated either positively or negatively then there is definitely a causal relationship between the two variables.

QUESTION 3

Fitting a least-squares line to create a model from a set of time series data ensures that

(A) the distances between the data points and the line of best fit are minimised.
(B) the same number of data points are above and below the line of best fit.
(C) the distances between the data points and the axes are minimised.
(D) the least-squares distances of all data points are added together.

QUESTION 4

Pete conducted a survey of the employees in his company. From the resulting data, he constructed a two-way frequency table involving two variables.

One of the variables was attitude towards paid parental leave (for/against).

The other variable could have been

(A) year of birth.
(B) sex (male/female).
(C) savings (nearest thousand dollars).
(D) commute time (minutes).

Use the following information to answer questions 5 and 6.

A school investigated the earnings and savings of their graduate students, with earnings being the response variable.

QUESTION 5

The coefficient of determination between the two variables was found to be 0.45.

Select which of the following is true.

(A) People who earn more money will save more money.
(B) If someone receives a pay rise, they will save more money.
(C) People earn more money because they save more money.
(D) 45% of the variation in saving money can be explained by the variation in earning money.

QUESTION 6

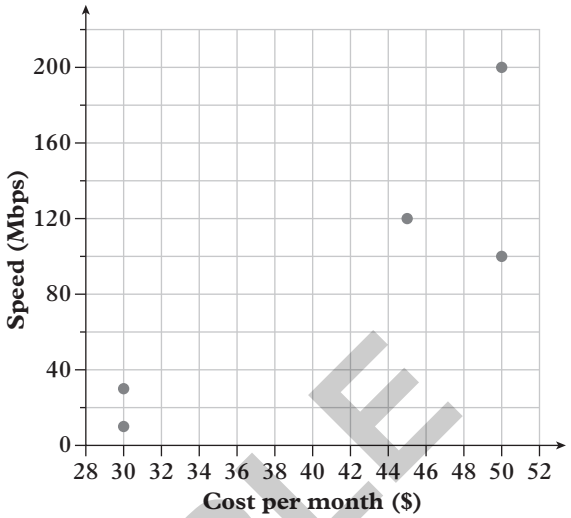
The least-squares regression line for this situation was calculated as savings = 2.5 × earning − 145 000. Select the meaning of the *y*-intercept value.

(A) If people earn \$0, they are predicted to have savings of −\$145 000.
(B) As earnings increase by \$1, savings are predicted to increase by \$2.50.
(C) There is no meaning for the *y*-intercept value.
(D) The *y*-intercept is an outlier.

QUESTION 25

The scatterplot below shows the cost per month ($) and data provided in five broadband plans.

Select the most likely value of Pearson's correlation coefficient.



(A) 0
(B) 1
(C) 0.4
(D) 0.8

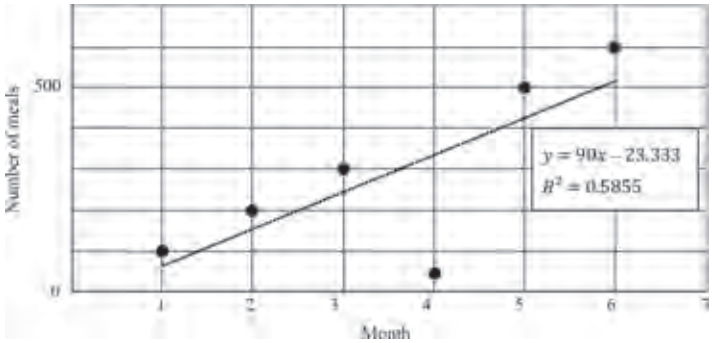
SHORT RESPONSE QUESTIONS

SIMPLE FAMILIAR

Answers
on pages 270–274

QUESTION 26 (6 marks)

The number of meals sold (y) by a restaurant each month (x) for the first six months of business is shown on the scatterplot below. The line of best fit, its equation and the coefficient of determination (R^2) are also shown.



The restaurant was closed for renovations for most of one month.

a) Identify the number of meals sold in that month. *[1 mark]*

MY MARK /1

b) Describe the effect that this outlier has on the coefficient of determination. *[1 mark]*

MY MARK /1

c) Use the line of best fit to predict the number of meals that will be sold in the 18th month of the business operation. *[2 marks]*

MY MARK /2

d) Evaluate the reasonableness of your solution for c). *[2 marks]*

MY MARK /2

CHAPTER 4 OFFICIAL PAST PAPERS

In this chapter, things get serious! It's now time for you to put your revision and practice to the test – literally – by completing the official QCE General Mathematics External assessment from 2020!

We recommend you:

- don't look at this chapter until you've finished with your revision and completed all of the practice questions in Chapter 3
- complete these papers under exam conditions (i.e. follow the instructions regarding perusal time and working time; don't refer to any notes or other materials that will not be allowed during the real exams)
- refer to the answers in Chapter 5 and use the marking advice to self-assess your responses once you've finished.

Remember … these are the QCE General Mathematics papers from 2020, so – if you complete them under exam conditions – they are arguably the best indicator of how well you're likely to perform on the day! Good luck!

4.1 EXTERNAL ASSESSMENT 2020: GENERAL MATHEMATICS PAPER 1

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 sheet provided.
- Planning paper will not be marked.

Section 1 (15 marks)

- 15 multiple choice questions

Section 2 (45 marks)

- 11 short response questions

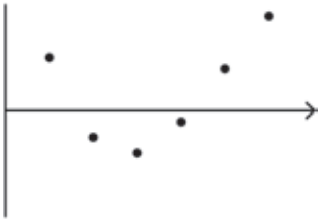
Section 1 (15 marks)

Answers
on pages 334–336

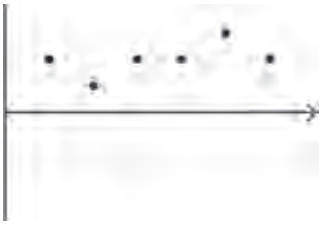
QUESTION 1

Four linear models have been developed for a data set. Identify the residual plot that indicates that the developed linear model is justified.

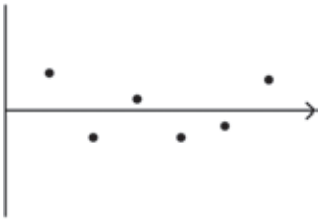
(A)



(B)



(C)



(D)

CHAPTER 5 ANSWERS

OMG, another cliff hanger … what on Earth could be in this chapter, I wonder?

You guessed it: in this chapter we provide the answers to absolutely everything! Sounds simple, I know, but to get the most out of this chapter, don't just cast an eye over the answers provided and move on.

If you really want to increase your chances of excelling on the exam, we recommend you look carefully over each of your answers in Chapters 3 and 4 and compare them with the answers in this chapter.

Be sure to use the marking advice provided under each sample answer! Use it to record a mark for each question in the 'My mark' section. Understanding what exam markers are looking for and how they award marks will make you mindful of how you need to structure your responses in order to maximise your results.

Notice to students

The answers and marking advice provided in this chapter are provided for practice purposes only. Unless specifically credited, the QCAA has not written this material and does not endorse the content.

5.1 UNIT 3 TOPIC 1 – BIVARIATE DATA ANALYSIS

MULTIPLE CHOICE ANSWERS

Question	Correct answer	Explanation
QUESTION 1	B	• Bivariate data always involves two variables; therefore, B is the correct answer. • A is a distractor, as bivariate data may include many values. • D is a distractor, as both variables in bivariate data may be of the same data type.
QUESTION 2	C	• If two variables are associated, then there could be a causal relationship between them, so C is the correct answer. • A and D are both distractors because it is possible for two variables to have an association without a causal relationship. • B is a distractor because a negative association, where one variable decreases as the other increases, can be a causal relationship.
QUESTION 3	A	• A least-squares line of best fit ensures that the squares of the distances between the data points and the line of best fit are minimised. Therefore, A is the best answer, although it does not mention the squaring of the differences. • B is a distractor because in a least-squares line of best fit there does not have to be the same number of data points above and below the line. • D is a distractor because it describes only one step in the process of creating the least-squares line.
QUESTION 4	B	• To construct a two-way frequency table, both variables should be categorical data. Therefore, B is the correct answer. • A, C and D are distractors because they are all numerical variables.
QUESTION 5	D	• The coefficient of determination expresses the percentage of variation in the response variable that can be explained by the variation in the explanatory variable. Therefore, D is the correct answer. • A and B are distractors because while there is a relationship, this pattern does not always occur. • C is a distractor because a cause is described, but can't be attributed with certainty.

Question	Correct answer	Explanation
QUESTION 6	A	• The y-intercept predicts the value of the response variable when the explanatory variable equals 0. Therefore, A is the correct answer. • B is a distractor because this is the value of the slope. • D is a distractor because this value lies on the regression line, so it is not an outlier. You can only determine whether a value is an outlier if the original data values are known.
QUESTION 7	D	• This study looks at how a change in the number of cups of coffee consumed affects the amount of sleep achieved. Therefore, coffee consumed is the explanatory variable and sleep achieved is the response variable, so D is the correct answer. • C is a distractor because coffee consumed is the explanatory variable. • A is a distractor because hours is the unit of measurement and not the variable.
QUESTION 8	A	• Using the formula for b (slope): $b = r\frac{s_y}{s_x}$ $= -0.81 \times \frac{1.3}{1.4}$ $= -0.75$ Therefore, A is the correct answer. • B is a distractor, as the values for s_y and s_x are incorrectly identified.
QUESTION 9	C	• In a scatterplot, the response variable is placed on the vertical axis. Therefore, C is the correct answer. • A is a distractor because age is the explanatory variable. • B is a distractor because years is the unit of measurement and not the variable.
QUESTION 10	D	• This value is below the line, by an amount equal to about half of the distance of the vertical scale marks, which are 10 units apart. Therefore, the residual is about −5 beats per minute, and D is the correct answer. • A is a distractor, because the point is below the line and therefore the residual is negative. • C is a distractor because the point is closer to the line than 10 units. It is around half this value.
QUESTION 11	A	• If the regression line is extended to where the age is 0, then the resting heart rate would be around 120. Therefore, A is the correct answer. • C is a distractor because the point where the line currently ends is equal to an age of about 3, so this is not the value of the intercept.

Question	Correct answer	Explanation
QUESTION 25	D	• From the scatterplot it is clear that as the cost increases, so does the data provided. Therefore, this is a strong, positive linear relationship, and D is the correct answer. • B is a distractor because the points do not lie in a straight line. • A and C are both distractors because the relationship between the variables is strong.

SHORT RESPONSE ANSWERS

QUESTION 26 (6 marks)

a) We can expect the number of meals sold for the month when the restaurant was closed to be very low. This is clearly in month 4.
The only value given on the vertical axis is 500. From this, we can see that each horizontal line represents 100 meals. The data point for month 4 appears to be just under halfway between the bottom two horizontal lines. The value represented will be in the middle of the dot, not the edge, so approximately 40 meals were sold in this month. A range of answers would be accepted here.
- *1 mark* for 40, or a value close to 40.

b) This outlier will reduce the value of the coefficient of determination because all outliers reduce the correlation between two variables.
- *1 mark* for stating that the outlier will reduce the value of the coefficient of determination.

c) In the 18th month, x will be equal to 18. Substitute this into the equation:

$$y = 90x - 23.333$$
$$= 90 \times 18 - 23.333$$
$$= 1596.667$$

1597 meals are predicted to be sold in the 18th month of operation of the business.
- *1 mark* for the correct answer.
- *1 mark* for correct working.

d) This prediction is outside the original data range, so it is an extrapolation. Extrapolations are less reliable than interpolations.
1597 meals is approximately 53 meals per day, which sounds reasonable.
- *1 mark* for using the term extrapolation and stating that extrapolations are less reliable than interpolations.
- *1 mark* for assessing that the extrapolation seems reasonable in the context of this situation.

QUESTION 27 (4 marks)

a) $33 + 132 = 165$
- *1 mark* for 165.

b) $33 + 132 + 110 + 58 = 333$
- *1 mark* for 333.

c) 33 of 333 students enjoy both activities.

$$33 \div 333 \times 100 = 9.909...\%$$
$$= 9.91\% \text{ (to 2 decimal places)}$$
- *1 mark* for 9.91%.
- *1 mark* for correct working.

QUESTION 28 (2 marks)

a) The number of students is likely to explain the number of computers, so the number of computers is the response variable.
- *1 mark* for number of computers.

b) Using a calculator, $c = 0.799s + 27.1$.
- *1 mark* for correctly stating the equation of the least-squares line.

Examiner's tip

This part is only worth 1 mark, so you only need to state the correct answer. Make sure you enter the data in correctly and assign the response variable (c) to the value of y given on your calculator.

QUESTION 29 (3 marks)

a) When $n = 3$, water consumption $= 173 \times 3 + 19$
$= 538$ L
- *1 mark* for 538 L.

Examiner's tip

Make sure you include the units in your answers.

b) Residual = actual – predicted
$= 620 - 538$
$= 82$ L
- *1 mark* for 82 L.

c) 0.8 represents a strong, positive, linear relationship.
- *1 mark* for strong, positive and linear.

QUESTION 30 (4 marks)

It is difficult to compare frequencies when the totals are different, so convert the data into a two-way percentage table.

Hours of practice	Year 7	Year 12
2 or less	15 ÷ 72 × 100 = 20.8%	2 ÷ 17 × 100 = 11.8%
2–4	53 ÷ 72 × 100 = 73.6%	11 ÷ 17 × 100 = 64.7%
4 or more	4 ÷ 72 × 100 = 5.6%	4 ÷ 17 × 100 = 23.5%

Between Years 7 and 12, the percentage of students who practised for two hours or less went down from 20.8% to 11.8%, and the percentage of students who practised for 4 or more hours went up from 5.6% to 23.5%.
This shows that there is evidence that from Year 7 to Year 12, the average music student spent more time practising their musical instrument.

- *2 marks* for converting the data into a two-way percentage table.
- *1 mark* for stating a conclusion.
- *1 mark* for giving reasons to support your conclusion.

Examiner's tip

The question asked for *reasons*, so it is better to give more than one reason to ensure full marks.

QUESTION 31 (7 marks)

a) Calculate the row sums (shown in the Total column below) and divide each frequency by its row sum to determine the percentages.

Year level	Agree (%)	Disagree (%)	Neutral (%)	Total (*n*)
Years 7 and 8	32	46	22	69
Years 9 and 10	30	58	12	86
Years 11 and 12	34	45	21	129

- *2 marks* for correctly entering in all missing values into the two-way percentage table.

b) A change in year level would explain a change in opinion. So, opinion about school uniform improving school culture is the response variable in this situation.

- *1 mark* for correctly identifying the response variable.

c) The year levels with the highest disagreement with the statement about school uniforms were the middle years (9 and 10).
The junior years (7 and 8) and senior years (11 and 12) had very similar levels of agreement and disagreement with the statement.

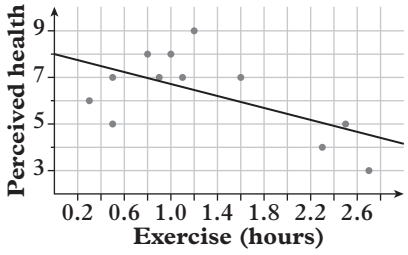
- *1 mark* for each accurate description provided (maximum of 2 marks).

d) The frequency of Year 11 and 12 students who disagreed with the statement was higher, as there were more Year 11 and 12 students who responded to the survey question. The percentage of students in Years 11 and 12 who disagreed with the statement was lower than for Year 9 and 10 students.
The provided statement was not about whether the school uniform was liked or not. It was about whether the school uniform was perceived to improve school culture. Data about whether school uniform was disliked cannot be determined from this question.

- *1 mark* for identifying the difference between the raw data (frequencies) and the percentages.
- *1 mark* for identifying that the question did not ask whether the school uniform was liked or not.
  Note: Other critiques may also be accepted to achieve full marks.

QUESTION 32 (6 marks)

a) The two missing points are those who exercised 0.8 hours and those who exercised 0.9 hours per day.



APPENDIX

GENERAL MATHEMATICS FORMULA SHEET

The QCAA has developed a formula sheet that will be provided for you to use during both examination papers. It provides a selection of useful formulas for you to refer to during the exam.

We want you to have everything you need in the one spot so that you can study effectively with this book whenever and wherever you are – on the bus, in the bath … anywhere. For that reason, we've included a formula sheet, too. Shucks, that's what buddies are for!

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	$\bar{x} = \frac{\sum x_i}{n}$
median	$\left(\frac{n+1}{2}\right)^{\text{th}}$ data value
least-squares line (slope)	$b = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sum(x_i - \bar{x})^2} = r\frac{s_y}{s_x}$
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	$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}}$
outliers (identifying)	$Q_1 - 1.5 \times \text{IQR} \leq x \leq Q_3 + 1.5 \times \text{IQR}$