# 2001 HSC Notes from the Examination Centre General Mathematics

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# Contents

# 2001 HSC NOTES FROM THE EXAMINATION CENTRE GENERAL MATHEMATICS

**Introduction**

This document has been produced for the teachers and candidates of the Stage 6 course in General Mathematics. It provides comments with regard to responses to the 2001 Higher School Certificate Examination, indicating the quality of candidate responses, and highlighting the relative strengths and weaknesses of the candidature in each section and each question.

It is essential for this document to be read in conjunction with the relevant syllabus, the 2001 Higher School Certificate Examination, the Marking Guidelines and other support documents, which have been developed by the Board of Studies to assist in the teaching and learning of General Mathematics.

## Section I – Multiple Choice

**Questions 1 – 22**

| Question | Correct Response |
|---|---|
| 1 | C |
| 2 | A |
| 3 | D |
| 4 | B |
| 5 | A |
| 6 | D |
| 7 | D |
| 8 | A |
| 9 | C |
| 10 | B |
| 11 | C |

| Question | Correct Response |
|---|---|
| 12 | C |
| 13 | D |
| 14 | C |
| 15 | C |
| 16 | B |
| 17 | D |
| 18 | B |
| 19 | B |
| 20 | C |
| 21 | A |
| 22 | B |

## Section II

**General Comments**

Candidate responses indicated that the range of ability of candidates presenting for this paper is considerable, from those with little literacy or numeracy skills to others who are able to present their work well with articulate responses and who think about the reasonableness of their answers.

One of the difficulties markers had was when candidates did not gain the correct answer and showed no working towards obtaining their answer. Candidates need to be encouraged to write their working down so that part marks can be awarded for progress towards their answer.

A considerable number of questions required candidates to explain their answer and/or justify their result in words and/or by using calculations. Candidates generally have difficulty writing about their mathematical thinking clearly and concisely. This is the major area of the course that

candidates need to practise. They need to become familiar with appropriate terminology and get into the habit of reading their answers after they have been written to ensure that they make sense. Candidates need to be shown how to interpret what the question is asking and to become familiar with words such as 'explain', 'justify', 'compare' and 'contrast' as presented in the Board of Studies glossary of key words. Candidates also need to pay attention to the number of marks given to each part of a question, so that they know the expected extent of their answers. A simple yes/no is not enough for a three-mark question, whereas a three-page explanation for one mark is not necessary. Many candidates wrote pages of unrelated material that, in the end, did not answer the question and therefore did not attract marks.

Graphics calculators were not as widely used as expected. Their use will probably increase in future HSC examinations as more schools begin to use the technology. The marking team could see no real advantage to candidates who used graphics calculators in these questions.

**Specific comments**

**Question 23**

(a) (i) The eleven points were plotted well by most candidates. Many decided to join the dots, although this may have also been their attempt at the line of fit. Some completed a column graph/histogram or dot plot. Quite a few candidates forgot to label their axes, or labelled one, or swapped the labels around. Some candidates had two or three attempts at the correct answer.

(ii) Many candidates joined the dots for their line of fit, or did not know what to do, since they had already joined the dots in part (i). Quite a few drew a curve. Some attempted to construct a median regression line using various methods. Most candidates answered this part incorrectly. It was obvious that many candidates did not take a ruler into the examination centre.

(iii) This part was ignored by many candidates. After completing the graph, it appears they forgot to come back to this part. Only a few candidates knew what this question meant and answered correctly 'negative correlation'. Candidates who gave a bald numerical answer, eg –0.7, needed to state that this was the correlation coefficient. Some mentioned negative skew or negative slope.

Many decided to use their cricket knowledge to describe how they thought a cricket team should play their game. Most of these candidates identified a trend, however, many simply mentioned the top batsmen and/or the bottom batsmen without identifying a trend or relationship throughout the entire innings. Due to cricket knowledge, an answer such as 'the lower the order, the smaller the number of runs' was accepted as correct. Some introduced probability terms such as 'most likely'.

(b) (i) This part was poorly answered in general and there was a large number of non-attempts. Some just knew 'below the mean' or 'two standard deviations away from the mean' but could not connect both statements. Some attempted to use percentages (eg within 95%). A number of candidates stated that the $z$-score was 2 standard deviations below the mean, rather than relating Kim's score. Some just quoted the formula, or attempted to use the formula to get a numerical answer for this part. Some gave a definition of the $z$-score, or how to find it. Many candidates answered '2 below the mean' or 'two scores

below the mean'. A number of candidates made comments like 'the test was too hard' or 'Kim failed'.

(ii) This part was well answered, despite many candidates misunderstanding part (b)(i). Some had difficulty with substituting into the formula. Common errors were: dividing the mean by the standard deviation, $75 - 5 - 5 = 60$, $75 - 2$ (= 73), $75 + 5 + 5$ (= 85), $75 - 5 - 2$ (= 68); and making algebraic errors in the equation for the formula after substitution. Some transposed score and mean. Some who had correctly answered part (i) could not correctly transfer their statement to a numerical calculation.

(c) (i) This part was well answered. Some selected the smallest tree or stated the range of East Park (16 metres) or the upper quartile (9.5 metres) for the height of the tallest tree. A number of candidates clearly had no idea how to read a box-and-whisker plot.

(ii) This was mostly well answered. Some candidates tried comparing medians of the two parks. Some tried averaging the quartiles or averaging the elements of the five number summary. A common answer was 5 instead of 7.

(iii) This part was very poorly answered by the majority of candidates. Many presented essays (up to two full pages) describing the physical location of the parks within the city, the dates or methods of planting the trees, the skills of the council workers, or the amount of rain and sunshine in each park, without any mathematical comparison or connection. The question asked candidates to compare and contrast the two data sets, not the two parks.

Many candidates described one park without making a comparison with the other park. The concept of 'compare and contrast' was overlooked by far too many. They had considerable difficulty organising their response to cover location, spread and skew. Only a few candidates tabulated the details of each park, which made their comparisons much more obvious. Some candidates stopped mid-sentence at the bottom of the page, as if they were glad to be finished writing their essay.

Common errors:

Location: General confusion with the term 'location' — misuse of mean and average, and use of mode instead of median.

Spread: Use of descriptors such as spread, variation, cluster or dispersion instead of range, interquartile range or calculation of these measures. 'Upper/lower (inter) quartile range' mentioned. Common misuse of outliers/outliners/outcasts for the extremities of the whiskers (they are actually not outliers at all). Some stated (incorrectly) that the majority of trees were between the upper and lower quartiles (instead of 50%).

Skew: Confusion with the difference between the concepts of 'spread' and 'skewness'. Confusion with negative/positive skew for East Park, incorrect use of 'normal' or 'bell shaped' rather than 'symmetrical' or even 'unskewed' to describe Central Park. There was common mention of 'screwed' or 'skewered' data.

**Question 24**

(a) (i) A large number of candidates had difficulty finding the required angle *AOB* in the radial survey.

There was a great many non-attempts and attempts to find the required angle using the sine or cosine rule that led to no marks. It was clear to markers that the concept of bearings is poorly understood.

(ii) Many candidates wrote down the sine rule correctly, but often substituted the wrong angle value. A number of candidates did not see the connection with part (i), while others ignored, or carelessly forgot, to round their answer when the question specifically asked them to do so.

(iii) A large number of candidates used a version of Pythagoras' theorem to find AB, even though it was not a right-angled triangle. Candidates who substituted correctly into the cosine rule often made errors in using their calculators. Some candidates did not see the connection with (i) and (ii) and introduced another angle.

(b) (i) This part was very poorly done. Many candidates did not attempt this part or they used the wrong angle or wrong conversion. There seemed little understanding of how to answer this question. This is obviously a poorly understood section of the course.

(ii) Many candidates answered 70 (and did not indicate North) or gave both coordinates (latitude and longitude) when only latitude was asked for. Many candidates gave an incorrect answer of 70° West.

(iii) Many candidates had more success in this part, despite the fact that some used $r$ instead of $2r$. Conversion between nautical miles and kilometres was often done indiscriminately with many candidates dividing by 1.852. Those who knew to multiply the angle by 60 and then by 1.852 were more successful than those who used the circumference method.

(c) (i) The measurement part of this question was fairly well handled by most candidates. Many multiplied by the correct scale factor (250), but had trouble converting their answer to metres. Many thought that the answer to the question stopped with the multiplication of their measurement by 250. It was obvious and disappointing that many candidates sat the examination without a ruler.

(ii) The vast majority of candidates attempted to find the area by using the 'area of trapezium' formula or by the composite area method (rectangle and triangle or triangle and triangle). The results varied greatly depending on the measurements obtained in part (i). Certainly the candidates who came up with the correct units in part (i) had a much greater chance of getting the correct answer for this part. Many candidates did not try to use the scale until after obtaining the area using their measurements and consequently had major difficulties converting to square metres. Those candidates who used the composite area method were generally more successful than those attempting to use the area of trapezium formula.

**Question 25**

(a) (i) A large proportion of candidates answered this part correctly. Most candidates gave a bald answer of $\frac{3}{8}$ as expected. Of the incorrect responses, the most common were $\frac{1}{8}$ or $\frac{3}{5}$

(ii) 1 The tree diagram was generally copied correctly from the examination paper and most candidates managed to use correct fractions for the first selection, but the second selection was less well done. Many candidates did not see the connection to part (a)(i).

Most common incorrect responses involved not reducing the denominators in the second selection, adding many more selections to the tree, interpreting the first question to mean that one person had already left, resulting in fractions out of 7 initially and then 6. Many candidates drew the tree and added no fractions at all.

2 Many candidates misinterpreted 'exactly one female' and took it to mean 'at least one female'. Some candidates missed this part completely, despite gaining full marks for the tree diagram.

(iii) The gender issue distracted many candidates: many gave probabilities for females and males staying on the island compared to a total number. Many candidates did not indicate whether they agreed or disagreed with the statement and hence lost marks. An interpretation of their calculation was required. Many candidates believed that the question was based on a TV show and indicated personal bias and other factors apart from strict probability and randomness.

(b) (i) The most common answer was 42, reflecting confusion with a frequency histogram. It was apparent that most candidates failed to realise that the graph was a cumulative frequency histogram, affecting their answers to other parts of the question.

(ii) This part was well done, however many candidates stumbled onto the correct answer with some incorrect logic.

(iii) This part was not well answered. Many candidates were confused by the question when asked to give the number of students they would expect to weigh less than 70 kg. Many tried various techniques for estimating, including guessing ages of those surveyed and estimating their body weights to determine which class they would be in.

(iv) 1 Many could not explain why the first 50 was not a random sample. Many candidates repeated the question, giving no further explanation. Most candidates did not understand the concept of 'equally likely', or what random sampling was.

2 Many candidates suggested a wide variety of methods based on physical characteristics of candidates, which were not random. The suggestion that names be drawn from a hat was the most common successful response in explaining a method.

**Question 26**

(a) (i) This part required substitution. It was answered correctly by the majority of the candidates.

(ii) This was well done except for some calculation errors and insertion of different values for the independent variable.

(iii) Many candidates did not recognise that the equation was a straight line and hence plotted points only, or drew columns or curves. Scales (often freehand) and labelling were often incomplete or inaccurately done. A common error on the $d$ axis was marking 0, 10, 30 and 50 at even intervals.

(iv) Most candidates were able to substitute 60 into the formula and get a negative value of $s$ and thus declare it does not make sense etc. However, their explanations indicated that in many cases they really did not understand the implication of the negative value, most of them thinking it meant Otto would lose $20. Marks were awarded for good answers arguing either Yes or No, and in both cases very good arguments were sometimes provided.

(b) (i) 1 The formula given was similar to the compound interest formula from the formula sheet (with the $A$ and $P$ reversed) which may have confused some of the candidates. Many candidates did not recognise that the value of $A$ could be read from the graph and hence often calculated $A$ incorrectly after substituting values into the formula.

2 In general, the identification of the inflation rate was done poorly. Those who gave the correct rate usually just wrote down 20% with no working.

A common error for (b)(i) 1 and 2 was to say that $A$ represented the inflation rate, which meant that the same answer was given for (b)(i) 2 as for $A$ in (b)(i) 1.

(ii) The placement of the names of each graph and/or the word ‘Jan’ with each year confused many candidates in this part. A significant number tried unsuccessfully to break the year up into months despite an inappropriate scale for this purpose.

1 2002–2003 was a common answer as many candidates found it difficult to determine where the graphs crossed.

2 125 or 110 were common errors due to misreading of the vertical scale.

3 Many recognised that the relationship was linear but had difficulty calculating the gradient. Errors reading the scale were carried through from the previous parts. Many candidates gave an incorrect bald answer, which meant that there was no opportunity for part marks.

**Question 27**

(a) The vast majority of candidates answered this part incorrectly. The most common answer was $57.42. A significant number found the cost of the television before GST ie $522, but failed to write down the amount of the GST ($52.20). Candidates need to read the question carefully and to look for the key words.

(b) Most candidates answered this part very well. They found and used the right formula from the formulae sheet while others proceeded to laboriously work out the salvage value year by year. Common errors were: using the wrong formula eg straight-line formula for depreciation; transcribing $4200 instead of $42 000 from the question paper; using 0.015 as the interest rate expressed as a decimal; or failing to follow correct procedures for order of operations on a scientific calculator.

(c) (i) This part was generally well done. Most candidates were able to, in one form or another, explain the difference in the time the money was invested eg 'Rosetta invested for longer', as being the major factor in the large difference between the values of the investments. Many candidates did not clearly communicate their explanation while some just restated parts of the information given in the question.

(ii) Many candidates misinterpreted this question with most calculating the difference in investment values for the final five years of contributions only, ignoring the interest accumulating on the current value of the investments. Some used the simple interest formula rather than the future value formula. The majority of candidates who attempted this part of the question, including those who had correctly calculated the future values of Derek's and Rosetta's final investments, failed to indicate what was happening to the differences in these investments. Many candidates did not support their conclusions with calculations, while those who did made a variety of errors including failing to convert years to months and percentage rates from yearly to monthly.

(d) (i) This part was generally well answered, with candidates required to explain that a division by 12 was required to convert from the annual interest rate. A significant number of candidates knew that a relationship between 6.24% and 0.0052 existed but could not adequately explain the connection. A common incorrect response was that there were 52 weeks in a year.

(ii) This part was generally very well done with the majority of candidates achieving full marks. Many candidates correctly calculated $A$ but then subtracted this from $69 684 to get $B$. Other candidates forgot to add $A$ to $69 684 before subtracting the payment of $680. A significant number of candidates who gave a correct answer for $A$ failed to give a correct answer for $B$.

(iii) 1 This part attracted a variety of answers, a lot of them failing to include an appropriate conclusion. There was some confusion with the 'approximately equal to' sign and the division sign. Some candidates actually divided their answer by 84 424. Some candidates rounded off their answers too early and consequently did not obtain answers close enough to the required answer. Future candidates need to be reminded about this during lessons, particularly when dealing with money. As in part (b) the order of operations on calculators was not correctly used and the incorrect answer $21 0376.32 was frequently given.

2 Most candidates made the correct conclusion based on the answer to the previous part. Some candidates read too much into the question and actually worked out a more accurate value of $n$, when a reasonable guess was all that was required.

**Question 28**

In summary, the number of candidates obtaining full marks for the question was very small, but in each part there was evidence of good teaching and learning.

(a) (i) 'To show' means to deduce the result required and many candidates did this by substituting for $n$ and $d$ and solving for $k$. While this method was fine, it was difficult for markers to tell if many candidates did a calculation at all as they often simply substituted for $n$, $k$ and $d$ and left a statement that appeared to be correct.

(ii) This was the easiest mark in the question.

(iii) This was an interesting question, because of the number of ways candidates chose to answer it. The common approach of $A = 625$, $\pi r^2 = 625$ leading to $r = 14.1$ and $d = 28.2$ and hence $n = 0.02 \times 28.2^2 = 15.9$ was probably the most successful.

Comparison methods were often used but usually were not carried through to the correct answer. The rate method was not often used, that is, for the standard pizza, $d = 30$, $r = 15$, $A = 706$ cm$^2$. This led to area/olive = 706/18 = 30.26 cm$^2$, leading to 625/39.26 = 15.9 olives.

A significant number of candidates determined a diameter by dubious methods in order to find a value to substitute for $d$ in $n = 0.02 \times d^2$.

(b) The correct answer, 4.8 minutes, as a result of good work following an inverse variation statement, was pleasingly common. Many other candidates knew the answer must be slightly less than 5 minutes but could not obtain the precise answer. This latter group was showing perhaps more thought than the large number of candidates who used direct variation to obtain their answer but would have burnt the pizza!

(c) (i) Many candidates were able to write down the correct expression for obtaining the surface area but made arithmetic errors leading to answers other than 2400. This is another good example of why candidates should show all their calculations.

(ii) The words 'these boxes' were interpreted by about half of the candidates as referring to the $30 \times 30 \times 5$ cm box above. They then proceeded to obtain a numerical answer, with or without the correct inclusion of $N$.

The other half ignored the above boxes and concentrated entirely on 'these boxes' below. These boxes below had no dimensions and candidates thought they were expected to introduce a total set of matching or non-matching pronumerals for the dimensions of these boxes and arrived at generalised formula for all such boxes. The need to use $N$ was often lost in this type of attempt. Being required to give two unconnected answers within the one question caused confusion for a significant number of candidates. Despite this, it was pleasing to see many correct answers.

# General Mathematics

## 2001 HSC Examination Mapping Grid

| Question | Marks | Content | Syllabus outcomes |
|---|---|---|---|
| 1 | 1 | FM1: Earning money | P2 |
| 2 | 1 | AM1: Basic algebraic skills | P2 |
| 3 | 1 | M5: Further applications of area and volume | H6 |
| 4 | 1 | FM4: Credit and borrowing | H8 |
| 5 | 1 | AM1: Basic algebraic skills | P2 |
| 6 | 1 | M1: Units of measurement | P2 |
| 7 | 1 | PB2: Relative frequency and probability<br>DA5: Interpreting sets of data | P10<br>H4 |
| 8 | 1 | DA4: Summary statistics | P2 |
| 9 | 1 | FM6: Depreciation | H5 |
| 10 | 1 | FM3: Taxation | P2 |
| 11 | 1 | PB3: Multi-stage events | H10 |
| 12 | 1 | FM5: Annuities and loan repayments | H8 |
| 13 | 1 | AM2: Modelling linear relationships | P4 |
| 14 | 1 | M1: Units of measurement | P7 |
| 15 | 1 | DA5: Interpreting sets of data | H4, H9 |
| 16 | 1 | DA5: Interpreting sets of data | H4, H9 |
| 17 | 1 | AM2: Modelling linear relationships<br>M1: Units of measurement | P2 |
| 18 | 1 | AM3: Algebraic skills and techniques | H2 |
| 19 | 1 | DA6: The normal distribution | H4, H5 |
| 20 | 1 | M6: Applications of trigonometry | H6 |
| 21 | 1 | DA5: Interpreting sets of data | H4 |
| 22 | 1 | PB3: Multi-stage events | H10 |
| 23(a)(i) | 2 | DA7: Correlation | H2 |
| 22(a)(ii) | 1 | AM2: Modelling linear relationships<br>DA7: Correlation | P5<br>H4 |
| 23(a)(iii) | 1 | DA7: Correlation | H4 |
| 23(b)(i) | 2 | DA6: The normal distribution | H4 |
| 23(b)(ii) | 1 | DA6: The normal distribution | H9 |
| 23(c)(i) | 2 | DA5: Interpreting sets of data | H4 |
| 23(c)(ii) | 1 | DA5: Interpreting sets of data | H4 |
| 23(c)(iii) | 3 | DA5: Interpreting sets of data | H4, H9, H11 |
| 24(a)(i) | 1 | M6: Applications of trigonometry | H6 |
| 24(a)(ii) | 2 | M6: Applications of trigonometry | P7, H6 |
| 24(a)(iii) | 2 | M6: Applications of trigonometry | H6 |
| 24(b)(i) | 1 | M7: Spherical geometry | H6 |
| 24(b)(ii) | 1 | M7: Spherical geometry | H6 |
| 24(b)(iii) | 2 | M7: Spherical geometry | H6 |
| 24(c)(i) | 2 | M3: Similarity of two dimensional figures | P2, P6 |
| 24(c)(ii) | 2 | M2: Applications of area and volume | P2, P6 |

| Question | Marks | Content | Syllabus outcomes |
|---|---|---|---|
| 25(a)(i) | 1 | PB2: Relative frequency and probability | P10 |
| 25(a)(ii)1 | 2 | PB3: Multi-stage events | H4 |
| 25(a)(ii)2 | 2 | PB3: Multi-stage events | H10 |
| 25(a)(iii) | 2 | PB3: Multi-stage events | H10, H11 |
| 25(b)(i) | 1 | DA3: Displaying single data sets | P4 |
| 25(b)(ii) | 1 | DA3: Displaying single data sets | P4 |
| 25(b)(iii) | 2 | DA3: Displaying single data sets<br>DA5: Interpreting sets of data | P4, H4 |
| 25(b)(iv)1 | 1 | DA2: Data collection and sampling | P9 |
| 25(b)(iv)2 | 1 | DA2: Data collection and sampling | P9 |
| 26(a)(i) | 1 | AM1: Basic algebraic skills | P2 |
| 26(a)(ii) | 1 | AM1: Basic algebraic skills | P2 |
| 26(a)(iii) | 2 | AM2: Modelling linear relationships | P4, P5 |
| 26(a)(iv) | 1 | AM2: Modelling linear relationships | P3, P11 |
| 26(b)(i)1 | 2 | AM4: Modelling linear and non-linear relationships<br>FM2: Investing money | H2, H5 |
| 26(b)(i)2 | 1 | AM4: Modelling linear and non-linear relationships<br>FM2: Investing money | H2, H5 |
| 26(b)(ii)1 | 2 | AM4: Modelling linear and non-linear relationships | H2, H5, H11 |
| 26(b)(ii)2 | 1 | AM4: Modelling linear and non-linear relationships | H2, H5, H11 |
| 26(b)(ii)3 | 2 | AM4: Modelling linear and non-linear relationships | H2, H5, H11 |
| 27(a) | 1 | FM3: Taxation | P2 |
| 27(b) | 2 | FM6: Depreciation | H5 |
| 27(c)(i) | 1 | FM5: Annuities and loan repayments | H8, H11 |
| 27(c)(ii) | 3 | FM5: Annuities and loan repayments | H5, H8, H11 |
| 27(d)(i) | 1 | FM4: Credit and borrowing | H8 |
| 27(d)(ii) | 2 | FM4: Credit and borrowing | H8 |
| 27(d)(iii)1 | 2 | FM5: Annuities and loan repayments | H5, H8 |
| 27(d)(iii)2 | 1 | FM5: Annuities and loan repayments | H8 |
| 28(a)(i) | 1 | AM4: Modelling linear and non-linear relationships | H3 |
| 28(a)(ii) | 1 | AM3: Algebraic skills and techniques<br>AM4: Modelling linear and non-linear relationships | H2, H5 |
| 28(a)(iii) | 3 | AM3: Algebraic skills and techniques<br>AM4: Modelling linear and non-linear relationships | H2, H5 |
| 28(b) | 3 | AM4: Modelling linear and non-linear relationships | H5 |
| 28(c)(i) | 1 | M2: Applications of area and volume | P6 |
| 28(c)(ii) | 4 | M2: Applications of area and volume<br>M5: Further applications of area and volume | H3, H6 |

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# 2001 HSC General Mathematics
# Marking Guidelines

**Question 23 (a) (i)** (2 marks)

*Outcomes assessed: H2*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Labels both axes correctly and correctly plots ALL points | 2 |
| • Correctly labels axes but makes at least one error in plotting points<br>OR<br>• Plots all points correctly but does not label both axes correctly | 1 |

**Question 23 (a) (ii)** (1 mark)

*Outcomes assessed: P5, H4*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Draws a straight line of fit with at least 2 points above and at least 2 points below or draws correct median regression line. The line should be close to most of their points or consistent with incorrectly plotted points (Joining dots is worth 0 marks) | 1 |

**Question 23 (a) (iii)** (1 mark)

*Outcomes assessed: H4*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Negative correlation or a correct statement relating increase or decrease of batting order to decrease of average runs | 1 |

**Question 23 (b) (i)** (2 marks)

*Outcomes assessed: H4*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Accurately describes the relationship between Kim's result, the mean for the test and the standard deviation. An example may be used to illustrate this relationship | 2 |
| • Indicates that Kim's score is below mean/average<br>OR<br>• 2 standard deviations away from mean<br>OR<br>• 2 standard deviations above mean | 1 |

**Question 23 (b) (ii)** (1 mark)

*Outcomes assessed: H9*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Correct calculation (or correct numerical expression) for Kim's mark | 1 |

**Question 23 (c) (i)** (2 marks)

*Outcomes assessed: H4*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Identifies park with tallest tree (East Park) and correctly states its height 18 (m) | 2 |
| EITHER<br>• Identifies park with tallest tree (East Park) only<br>OR<br>• States tallest tree height of 18 (m) only | 1 |

**Question 23 (c) (ii)** (1 mark)

*Outcomes assessed: H4*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Writes median height of the trees in Central Park as approximately 7. (Accept any value between or equal to 6.5 and 7.5) | 1 |

**Question 23 (c) (iii)** (3 marks)

*Outcomes assessed: H4, H9, H11*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| Three mark answer should include:<br>• Reference to very different spread (using terms like range/whiskers/IQR)<br>• Marked positive skew of East Park compared to symmetrical distribution of Central Park<br>• Significant difference between median values<br>and may include:<br>• boxes for the two distributions are not dissimilar or similarity of interquartile ranges compared to ranges<br>• students may sensibly compare standard deviations without calculations, as measures of spread<br>• Uses appropriate terminology in response eg. median, range and positive skew | 3 |
| • Identifies some aspect of shape or skewness that is different/similar, and some aspect of location and spread that is different/similar<br>• Some appropriate terminology used eg. median, range, positive skew | 2 |
| • Identifies some aspect of the display that is similar or different<br>• Some appropriate terminology used eg. median, range, positive skew | 1 |

**Question 24 (a) (i)** (1 mark)

*Outcomes assessed: H6*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Correct answer or numerical expression for $\angle AOB$ | 1 |

**Question 24 (a) (ii)** (2 marks)

*Outcomes assessed: P7, H6*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Calculates area of triangle AOB consistent with their $\angle AOB$ or has correct expression eg. $\frac{1}{2} \times 60 \times 85 \times \sin 87°$<br>• Their answer correctly rounded | 2 |
| • Correctly rounded incorrect answer<br>• Correct consistent answer, not rounded or rounded incorrectly | 1 |

**Question 24 (a) (iii)** (2 marks)

*Outcomes assessed: H6*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Calculates distance from A to B consistent with their ∠AOB | 2 |
| • Correctly/consistently substitutes appropriate values for OA, OB and ∠AOB in cosine rule | 1 |

**Question 24 (b) (i)** (1 mark)

*Outcomes assessed: H6*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Determines correct time difference, or has a correct numerical expression for time difference, between point A and Greenwich (5 hours) | 1 |

**Question 24 (b) (ii)** (1 mark)

*Outcomes assessed: H6*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • 70 $^{(\circ)}$ N – must have both angle and N | 1 |

**Question 24 (b) (iii)** (2 marks)

*Outcomes assessed: H6*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Calculates great circle distance consistent with method used and π value used (if applicable), using 70° or 290°<br>• Rounding errors ignored | 2 |
| • Uses either method, with errors in substitutions or calculations eg. wrong angle<br>OR<br>• Calculates great circle distance as 4 200 nautical miles<br>• Rounding errors ignored | 1 |

**Question 24 (c) (i)** (2 marks)

*Outcomes assessed: P2, P6*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Measures required three sides and multiplies total by scale factor to find required number of metres of fencing<br>(Accept 94 ± 2 mm, 110 ± 2 mm, 85 ± 2 mm for side lengths<br>ie. 289 ± 6 mm giving a total length of 70.75 (m) to 73.75 m) | 2 |
| • Multiplies their incorrect measurement total by 250 to give consistent length of fencing in metres<br>OR<br>• Measures three or four sides correctly (within tolerances) and adds measurements | 1 |

**Question 24 (c) (ii)** (2 marks)

*Outcomes assessed: P2, P6*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Calculates area of Lot 3 (accept 456 – 501 $m^2$) | 2 |
| • Uses their measurements in area of trapezium formula without converting to metres or makes errors converting to square metres<br>OR<br>• Uses their measurements in composite area calculation without converting to metres or makes errors converting to square metres<br>OR<br>• Substitutes incorrectly into trapezium formula (ie. wrong side in wrong place) | 1 |

**Question 25 (a) (i)** (1 mark)

*Outcomes assessed: P10*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • 0.375 or $\frac{3}{8}$ or 37.5%, or equivalent | 1 |

**Question 25 (a) (ii) 1** (2 marks)

*Outcomes assessed: H4*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Completes all probabilities correctly (or consistent with part (a) (i)) on tree diagram | 2 |
| • Incomplete diagram – at least two correct (consistent) probabilities on tree diagram (of which at least one applies to second section) | 1 |

**Question 25 (a) (ii) 2** (2 marks)

*Outcomes assessed: H10*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Calculates (or correct numerical expression) the probability of selection including one female consistent with their tree diagram | 2 |
| • Writes P (exactly one female) = P(MF) + P(FM)<br>OR<br>• Demonstrates use of multiplication along branch using MF combination | 1 |

**Question 25 (a) (iii)** (2 marks)

*Outcomes assessed: H10, H11*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Supports affirmative answer by well reasoned explanation of Antoinette's chances of remaining (3/4) | 2 |
| • Agrees with statement, but gives flawed explanation<br>OR<br>• Supports negative answer with consistent (incorrect) calculation<br>OR<br>• Applies a reasonable explanation to wrong numerical calculation of probability | 1 |

NOTE:
Agrees with statement with no attempt at justification or completely wrong justification scores zero

**Question 25 (b) (i)** (1 mark)

*Outcomes assessed: P4*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • 42 – 26 = 16 students<br>Correct answer or correct numerical expression | 1 |

**Question 25 (b) (ii)** (1 mark)

*Outcomes assessed: P4*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Any single rational number $\geq 70$ and $\leq 79$<br>OR<br>• Any range of values within the range 70–79 | 1 |

**Question 25 (b) (iii)** (2 marks)

*Outcomes assessed: P4, H4*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Correct answer (96 students) or correct numerical expression | 2 |
| • Answer showing attempt to use proportion of male students weighing less than 70 kg to calculate number of male students in class under 70 kg<br>ie $\frac{\text{incorrect}}{50} \times 300$ OR $\frac{16}{\text{incorrect}} \times 300$<br>(either numerator or denominator must be correct)<br>OR<br>• $16/50$ or equivalent numerical expression | 1 |

**Question 25 (b) (iv) 1** (1 mark)

*Outcomes assessed: P9*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Give plausible reason(s) why this method would not be a random sample, indicating what is wrong with the method | 1 |

**Question 25 (b) (iv) 2** (1 mark)

*Outcomes assessed: P9*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Clear explanation of reasonable method of obtaining a random sample | 1 |

**Question 26 (a) (i)** (1 mark)

*Outcomes assessed: P2*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • 190 (stalls) (or correct numerical expression) | 1 |

**Question 26 (a) (ii)** (1 mark)

*Outcomes assessed: P2*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • All values of $s$ correct | 1 |

**Question 26 (a) (iii)** (2 marks)

*Outcomes assessed: P4, P5*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Line(s) (or curve) drawn through points consistent with part (ii)<br>• Each axis labelled, including scale | 2 |
| • Line(s) or curve drawn through points consistent with part (ii)<br>OR<br>• Each axis correctly labelled, including scale | 1 |

**Question 26 (a) (iv)** (1 mark)

*Outcomes assessed: P3, P11*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Answer showing recognition that $d$ = \$60 gives negative $s$, and that this does NOT make sense, or that it does make sense because the negative value obtained implies that no stalls will be rented | 1 |

**Question 26 (b) (i) 1** (2 marks)

*Outcomes assessed: H2, H5*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Gives correct value of A(200)<br>• Explains that A = 200 represents initial (or equivalent) price (ie price in Jan 2000) | 2 |
| • Gives correct value of A (200)<br>OR<br>• Explains that $A$ represents initial (or equivalent) price (ie price in Jan 2000) | 1 |

**Question 26 (b) (i) 2** (1 mark)

*Outcomes assessed: H2, H5*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Annual rate of inflation assumed is 20% (0.2), or equivalent numerical expression | 1 |

**Question 26 (b) (ii) 1** (2 marks)

*Outcomes assessed: H2, H5, H11*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Writes 2002 as required year or states the third year<br>• Explains why this is first year in terms of two graphs (straight line above curve for first time) | 2 |
| • Writes 2002 as required year or states the third year<br>OR<br>• Explains what graphical interpretation is needed from two graphs to obtain the required year ie savings line above the price curve for first time. | 1 |

**Question 26 (b) (ii) 2** (1 mark)

*Outcomes assessed: H2, H5, H11*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • 120 (clams) or correct numerical expression (720 – 600) | 1 |

**Question 26 (b) (ii) 3** (2 marks)

*Outcomes assessed: H2, H5, H11*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • $c = 10\,n$ | 2 |
| • $c = 120\,n$ *or* $c = mx$ where $m$ is an attempt at finding the gradient<br>OR<br>• 10 clams/month<br>OR<br>• $c = 10\,n + b$ | 1 |

**Question 27 (a)** (1 mark)

*Outcomes assessed: P2*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Correct answer ($52.20) or correct working (574.20 ÷ 11) or equivalent. Accept 52.2 | 1 |

**Question 27 (b)** (2 marks)

*Outcomes assessed: H5*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Correct answer – $21 924.26. Accept 21 924 or 21 924.26 | 2 |
| • Substitution of 42 000 for $V_0$ and 0.15 (15%) for $r$, and 4 for $n$. ie. 42 000 $(1 - 0.15)^4$ OR 42 000 $(1 - 15\%)^4$ or equivalent<br>• Allow 1 mark for partially complete declining balance method ie. 42 000 $\times 0.85 = 35\,700$ | 1 |

**Question 27 (c) (i)** (1 mark)

*Outcomes assessed: H8, H11*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Explanation that Rosetta's investments have earned compound interest for longer time period | 1 |

**Question 27 (c) (ii)** (3 marks)

*Outcomes assessed: H5, H8, H11*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Correct conclusion (difference is growing larger) supported by correct calculations/working for Derek and Rosetta | 3 |
| • Correct calculations for Derek and Rosetta with no conclusion/incorrect conclusion<br>OR<br>• Conclusion (possibly incorrect) consistent with working with minor errors | 2 |
| • A correct calculation for either Derek or Rosetta's investment value<br>OR<br>• Conclusion (possibly incorrect) supported by some reasoning from their calculations and working | 1 |

**Question 27 (d) (i)** (1 mark)

*Outcomes assessed: H8*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Written or numerical explanation of why 0.0052 is used rather than 6.24%. Explanation needs to include that 6.24% has to be divided by 12 | 1 |

**Question 27 (d) (ii)** (2 marks)

*Outcomes assessed: H8*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • A and B are both correct | 2 |
| • Only one of A or B correct, or A incorrect but B consistent with incorrect A<br>• Accept 362.36 or 362.3568 for A (or rounded to the nearest dollar)<br>• Accept 69 366.36 or 69 366.3568 for B (or rounded to the nearest dollar) | 1 |

**Question 27 (d) (iii) 1** (2 marks)

*Outcomes assessed: H5, H8*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Correctly calculates \$60 590.10 and concludes that n = 120 is too small (accept 60 590) | 2 |
| • Correctly calculate (\$)60 590.(10 )with no conclusion or incorrect conclusion<br>OR<br>• Conclusion consistent with incorrect calculation | 1 |

**Question 27 (d) (iii) 2** (1 mark)

*Outcomes assessed: H8*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Any $n$ such that $120 < n < 200$<br>OR<br>• $n$ value consistent with incorrect value in (iii) 1 | 1 |

**Question 28 (a) (i)** (1 mark)

*Outcomes assessed: H3*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Substitutes pair of $d$, $n$ values to show $k = 0.02$ | 1 |

**Question 28 (a) (ii)** (1 mark)

*Outcomes assessed: H2, H5*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Substitutes $d = 52$ (or implied) to obtain $n \div 54$ olives (accept 54.08, 54.1, 55) | 1 |

**Question 28 (a) (iii)** (3 marks)

*Outcomes assessed: H2, H5*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Shows correct working and calculates number of olives needed (16) accept 15.9 (…) | 3 |
| • Calculates area of square and uses this area to find (incorrect) diameter of round pizza with same area<br>• Uses this diameter to calculate number of olives required<br>OR<br>• Calculates area of square and finds correct radius, but uses radius rather than diameter in formula for olives<br>OR<br>• Calculates area of square and finds correct diameter | 2 |
| • Calculates area of square and uses this area to find (incorrect) diameter of round pizza with same area or links 625 to another area<br>OR<br>• Uses a diameter obtained from other working to calculate consistent number of olives required (using 25 cm as diameter $\rightarrow$ 0 marks) | 1 |

Note: Answer of 16 (or 15.9(…)) with no working is awarded 0 marks.

**Question 28 (b)** (3 marks)

*Outcomes assessed: H5*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Calculates number of minutes (or correct numerical expression) | 3 |
| • Uses given information to make some progress – eg finding the constant | 2 |
| • Statement of proportionality<br>eg : $t \propto \frac{1}{p}$ or $t = \frac{k}{p}$<br>OR<br>• 'Correct' use of direct variation method | 1 |

**Question 28 (c) (i)** (1 mark)

*Outcomes assessed: P6*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Calculates surface area of 1 box (or correct numerical expression) | 1 |

**Question 28 (c) (ii)** (4 marks)

*Outcomes assessed: H3, H6*

**MARKING GUIDELINES**

| Criteria | Marks |
|---|---|
| • Correct (or consistent with 28(c)(i)) formula for surface area of N separate boxes<br>• Correct (or consistent with 28(c)(i)) unsimplified formula for surface area of stack of N boxes | 4 |
| • Correct (or consistent) formula for surface area of N separate boxes<br>• Correct calculation of surface area of at least 2 different stacks of ≥ 2 boxes<br>• Some progress towards generalisation of relationship<br>OR<br>• Correct (or consistent) formula for surface area of N separate boxes<br>• Attempt at generalisation of form<br>= constant (or equivalent) + expression including $n$ from their working on surface area<br>OR<br>• Correct (or consistent) formula for surface area of stack of N boxes | 3 |
| • Correct (or consistent) formula for surface area of N separate boxes<br>• One correct calculation of surface area of stack of more than one box or one box algebraically<br>OR<br>• Correct numerical expressions of surface area of at least 2 different stacks of ≥ 2 boxes<br>• Some progress towards generalisation of relationship<br>OR<br>• Attempt at generalisation of form<br>= constant (or equivalent) + expression including $n$ from their working on surface area | 2 |
| • Correct (or consistent) formula for surface area of N separate boxes<br>OR<br>• One correct numerical expression of surface area of stack of more than one box<br>OR<br>• A generalised expression for surface area one box, eg SA = $2xy + 4xh$ | 1 |