2008 HSC Notes from the Marking Centre General Mathematics

Published by Board of Studies NSW
GPO Box 5300
Sydney 2001
Australia

Tel: (02) 9367 8111
Fax: (02) 9367 8484
Internet: www.boardofstudies.nsw.edu.au

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2008 HSC NOTES FROM THE MARKING CENTRE GENERAL MATHEMATICS

Introduction

This document has been produced for the teachers and candidates of the Stage 6 General Mathematics course. It contains comments on candidate responses to the 2008 Higher School Certificate examination, indicating the quality of the responses and highlighting their relative strengths and weaknesses.

This document should be read along with the relevant syllabus, the 2008 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.

General comments

One of the main difficulties that markers continue to have is marking responses that involve an incorrect answer with little or no working shown. In these cases it is not possible to give part marks, since markers have no indication of candidates' thinking towards their solution. Candidates are advised to write their working down so that part marks can be awarded for some correct steps towards their answer. A simple example of this occurs when candidates have to round their answer to a certain degree of accuracy. Candidates should always write their calculator display before rounding their answer, and only round their answer in the last step of working, not in an earlier step. Markers can then see that candidates have rounded correctly, even if the answer is not correct.

Some questions required candidates to explain their answer and/or justify their result in words and/or by using calculations. This presented a problem for a significant number of candidates. They need to become familiar with appropriate terminology and read their answers after writing them to ensure that the answers make sense.

Candidates need to pay attention to the number of marks allocated to each part of a question so that they know the expected extent of their answers. Candidates should pay particular attention to the situation where a question asks them to justify with calculations or examples, and ensure that they provide an appropriate response.

Candidates should bring a ruler to the General Mathematics HSC examination in order to draw graphs and diagrams accurately. Candidates should also take note of diagrams where 'Not to scale' is indicated since in these cases measuring lines or angles to obtain a result is not going to be awarded any marks.

In the better responses, candidates:

- showed a clear, concise and appropriate method to solve each problem. Those who worked in a logical manner, stated what they were doing clearly and showed all necessary working were at an advantage compared to those who showed poor or no working, or who did not indicate where they were heading
- referred correctly to the formulae sheet, were familiar with it and used it carefully where necessary
- drew large, clear, well-labelled diagrams and included given information as well as information calculated while doing the question
- did not round off too early in their calculations

- were able to articulate their explanations, either with the support of calculations or in clear, written form
- considered the reasonableness of their answers within the context of the question.

Section I – Multiple choice

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

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

Section II

Question 23

(a) Better responses answered both parts correctly, providing one of the four months accepted for part (i) and stating November for part (ii).

(b) Weaker responses demonstrated little or no understanding of the relationship between precision, absolute error and percentage error.

The capacity of a bottle was given as 1.25 litres, correct to the nearest 10 millilitres.
The solution required a solution of the form $\frac{5}{1250} \times 100\% = 0.4\%$.

Common errors included:
- not recognising the measurements had to be in the same units before working out the percentage
- not recognising the absolute error for the numerator is half the 10 mL precision
- not finding the percentage error, that is giving the answer as the absolute error or as a fraction.

(c) (i) Candidates who wrote the percentage 5.5% as a decimal 0.055 generally had more success than candidates writing it in fraction form.

(ii) The most common error was in trying to convert the volume of the 375 mL bottle containing 1.6 standard drinks to one standard drink. Instead of dividing by 1.6, candidates often tried various incorrect methods such as $375 \times 0.6 = 225$ mL or ignored the required operation of division. Mid-range responses answered this first step correctly but failed to answer the question by not giving the rate per minute.

(d) Candidates were often able to obtain some marks by showing each step of their solution. Some candidates demonstrated the basic concepts of solving an equation but lacked the algebraic manipulation skills, especially in performing inverse operations. Weaker responses made errors in relation to directed numbers when rearranging the equation. The manipulation of the denominator was the first potential mistake in many weaker responses. Often only one term of the right-hand side was multiplied by two, or both algebraic expressions were multiplied, or the denominator was unsuccessfully left until later in the process.

Even though many responses were awarded a mark for handling the coefficient correctly as their last step, candidates are reminded not to round off answers early. A better solution would demonstrate the use of a fraction answer to avoid this problem.

(e) Many candidates did not use or have a ruler to accurately measure segments of the divided bar graph (which was drawn to scale).

Responses that contained the measurements of $\frac{3.5\text{ cm}}{9\text{ cm}}$ were mostly successful in finding the solution of $\frac{3.5}{9} \times 450 = 175$ people. Occasionally, this ratio was converted to a percentage of $\frac{3.5}{9} \times 100 = 38.\dot{8}$, but any early rounding of this percentage to 38% or 39% would not allow for the correct answer to be obtained.

Also, since the context of the question was a number of people, a whole number should have resulted, not a decimal part. There were many attempts to divide the graph into fractions or a ratio, which often gave answers close to the correct solution.

(f) The use of a trial-and-error method was as successful as any other valid method used by candidates. Incorporating the fourth test into the calculations was often lacking when progressing towards the answer.

A common incorrect approach in weaker responses was to ignore the number of tests specified, that is $\frac{72 + 74}{2} = 73\%$, therefore providing 74% as the mark required.

Question 24

(a) (i) Weaker responses only calculated the monthly amount, while some added the commission to the yearly sales amount.

(ii) Many candidates thought that there were four weeks in one month but were able to find the commission and total earnings for the month or the year, thus providing a correct conclusion based on their answer to part (a)(i). Many candidates did not know the number of weeks in a year, using 56 or 48 weeks. Some rounded off during the calculation causing the final answer to be inaccurate. Weaker responses often indicated a failure to read the question carefully and added the weekly wage to the monthly commission, and some candidates demonstrated difficulty expressing their choice of method.

(b) (i) Weaker responses incorrectly counted the combinations by including repeats. Many candidates assumed replacement while others tried to list all 60 numbers.

(ii) Better responses obtained the correct answer realising that three of the five cards were labelled with odd numbers.

(iii) Better responses demonstrated an ability to calculate the complement of the probability of odds and used their part (b)(ii) total combinations to give the number of evens. A common error was to give a probability instead of the number of times the event could occur.

(iv) Weaker responses did not show working that could have assisted in gaining the correct answer. Many misunderstood the concepts of 'less than 500' and 'descending' with these responses listing ascending numbers or using numbers starting with '5'. Others could list three of the four numbers, while some did not link all four parts.

(c) Weaker responses used all the 'financial' formulae, hoping that one would be correct. Many used the wrong future value formula or the present value formula to calculate the regular contributions, *'M'*. Those that used the correct future value (compound interest) formula to calculate *N* knowing that 740 000 was the value *A*, were able to be awarded part marks if either the correct interest rate or the correct time periods were used. Poor skills in calculating the answer included rounding off too early in the calculation which produced an error.

Question 25

(a) (ii) Candidates need to show working for part marks to be awarded. Drawing a conclusion was also necessary to achieve full marks for this part. Many weaker responses incorrectly deduced that $6 \times 2^t = 12^t$ while many better responses used logarithms successfully.

(b) (i) Weaker responses indicated that candidates had difficulty with the concept of 'non-replacement', with many demonstrating that 'drawing two…' meant that the denominator decreased from 30 to 28. Some candidates did not interpret the given diagram.

(ii) Weaker responses indicated that multiplication/addition of fractions is a difficult concept for many candidates. Many of these weaker responses added numerators and/or added denominators.

(c) (i) Many weaker responses did not recognise that the radius of each segment was the height of the box. Finding the length as the sum of the four arcs was a common response. Many mid-range responses only calculated two dimensions of the box.

(ii) Many candidates could not make the distinction between a pyramid, a cone and a prism. Rounding was tested in this part with many responses losing a mark for failing to round off correctly.

Question 26

(a) (i) Better responses indicated that candidates were able to add and subtract to obtain the correct answer.

(ii) Candidates should be encouraged to read and interpret the wording of probability questions very carefully. A common error was to find the probability that 'a person who was less than 40 years old did not like the movie'. Responses that attempted to find the correct probability by multiplying two probabilities were rarely successful since the events were not independent. Drawing a probability tree diagram would have helped candidates who wished to proceed in this way.

(iii) Better responses included a correct calculation and a correct, consistent conclusion. They showed that the number of critics who approved of the movie was 58%, less than the required 65%. Other responses correctly found that 114 critics were needed to like the movie and that 102 critics was not enough. Weaker responses misinterpreted the question, suggesting that since a 65% approval rating had been gained the movie was a success. A correct conclusion in this part had to be supported by a correct calculation.

(b) (i) Some candidates were confused about the meaning of 'relative frequency'. Simply writing the frequency (35 000 or 35), the cumulative frequency (70 000 or 70) or the class centre multiplied by the frequency ($53 \times 35\,000$) were the more common errors. Many candidates who were able to obtain the correct answer spent unnecessary time adding the frequencies when the total was given in the question.

(ii) Better responses indicated that the data was negatively skewed. Responses that contained a sketch of the graph were often drawn to the correct answer. Typical weaker responses concluded that the data was positively skewed or did not specify the type of skewness. Many responses were long and wordy and missed the point of the question. Other weaker responses concluded that the graph was bell shaped, normal or not symmetrical.

(c) Better responses demonstrated a sound knowledge of financial expectation and they correctly evaluated $0 \cdot 1 \times 12 + 0 \cdot 4 \times 6 + 0 \cdot 3 \times 3 \; (= 4 \cdot 5)$. Successful responses proceeded to the correct answer either by solving the relevant equation or by using 'trial and error' to obtain a loss of \$22.50. A large number of weaker responses failed to show an understanding of financial expectation. Typical incorrect answers included adding the winning amounts together (\$21), just quoting the percentage of Outcome 4 (20%) or indicating that the value of the loss must be \$0.

(d) (i) Typical better responses correctly stated that the number of females was 0.6 million or 600 000. Weaker responses failed to include the 'millions' (0.6) or converted incorrectly (eg 60 000). Some candidates read the wrong side of the graph and gave the population of the males.

(ii) Weaker responses generally involved more than one group (eg 35–49).

(iii) Incorrect responses generally resulted from not reading the scale on the graph correctly or from incorrectly adding the two numbers. Weaker responses indicated that some candidates have difficulty converting 0.75 million to 750 000.

(iv) Weaker responses often included reference to the First and Second World Wars, the Great Depression, baby boomers, post-war migration, and nursing care. However a mathematical interpretation was required and better responses indicated that there was a greater range of ages in the 80+ category.

Question 27

(a) (i) Weaker responses did not proceed beyond the angular distance of 75° between the two locations. $\frac{75}{360} \times \pi \times 6400^2$ was a common incorrect response with candidates often dividing by multiples of 60 to make their answers appear reasonable. Candidates often omitted the '2' and/or 'π' in the arc length formula.

(ii) Weaker responses confused the time difference with the time of flight (approximately 9 hours), presenting the solution as 75 ÷ 15 = 5 hours, ignoring the speed (913 km/h) completely. Of those who correctly answered this part of the question a surprising number changed 8 378 km to nautical miles and 913 km/h to knots first.

(iii) A significant number of responses were confused by the instruction to ignore time zones. Some actually made written comment addressing this issue with others identifying two separate solutions, one with time zones considered and the other with time zones ignored. Unfortunately, 'ignore time zones' was taken to mean ignore time differences and even though many had already calculated the time difference of 5 hours in part (ii) many ignored it in part (iii).

(b) (i) When asked to obtain a given result candidates are advised to write down the result to a significantly greater degree of accuracy than required initially and thereafter round to the appropriate level of accuracy. This is particularly relevant when a graphics calculator has been used.

A significant number of candidates appeared to be unaware of the relationship between the present value formula and a reducing balance loan with simple and compound interest calculations common.

(ii) Many candidates bypassed the simple solution, that is

$$\$2\,178.67 \times 360 = \$784\,321.20$$

attempting to use either a simple or compound interest or a future or present value calculation.

(iii) A common weaker response was 'No, because \$2 428.67 × 240 = \$582 880 80 (< \$784 321.20)'. Future value calculations were also common responses. Many candidates obtained the new monthly repayment (\$2 428.67) and the number of periods (240), however most were unable to use the present value formula correctly. For those candidates who used graphics calculators, many misinterpreted the signs of the PV (present value) and PMT (payment) entries. Successful responses, and in particular those in which graphics calculators were used, presented a variety of solutions to part (b) (iii). Comparisons of present values, future values, the amounts of the payments and the numbers of repayments required were all used in correct answers.

(c) The following (incorrect) solution was common:

$$2023 = V_0 (1 - 0.15)^2$$

$$V_0 = 2\,023(1 - 0.15)^2$$
$$= 1\,461.617\,5.$$

Question 28

(a) (i) Better responses were awarded the one mark available here by finding the 'line curve' on which the ordered pair $(6(\text{yrs}), 120(\text{cm}))$ was located and following it to the *z*-score scale. The most common error was a *z*-score of 2, found by following the curve from 120.

(ii)(2) Better responses contained a simplified normal distribution diagram and worked from it to calculate that the percentage above a *z*-score of –1 was 68% +16% or 100% –16% = 84% Common errors included attempting to add an incorrect *z*-score associated or not associated with their answer in part (1). Weaker responses demonstrated a poor knowledge of percentages linked with *z*-scores. Candidates who realised the parts of this question were related were more successful here as they based their answer on their value from part (ii)(1).

(iii) Common errors were due to candidates calculating an average such as 110 cm, $(95 + 100 + 105 + 110 + 115 + 120 + 125) \div 7$ rather than reading from the graph.

(iv) Many candidates failed to read the question carefully and missed the word 'minimum', instead working on values of $B = 22 \rightarrow 25$. Weaker responses substituted the height in cm into the formulae and had difficulties obtaining a realistic answer. Taking the square root of the answer or ignoring the squaring of 'h' were also common errors. Those responses that converted to metres first had more success as the answer automatically came out in kilograms. Trial and error was used by many in preference to substitution into the formula. Assumed knowledge seemed to be that between 50 and 60 kg was a good weight and a number in that range was used to begin. Iteration ceased when answers approached B = 21. Candidates need to consider the reasonableness of their answers within the context.

(v) Better responses demonstrated clear understanding of the intention of the question.

(1) Better responses indicated that the gradient is a rate and related it to a change in height per year, which is the growth rate of 6 cm/year.

(2) Better responses correctly interpreted from the graph that the growth rate was slowing or decreasing, with heights 'plateauing'. Other responses noted that the gradient needed to change so a constant gradient model was not relevant. Another correct response was that continuing with the equation beyond A = 11 soon gave a value of C beyond the height that girls would reach in their lifetime. Many candidates who chose this response used examples successfully to explain that the equation gave unrealistic answers.

A common error was to use biological reasoning such as puberty and growth spurts to explain why the equation was not suitable. These reasons generally indicated an incorrect response with regard to the mathematical model presented.

(b) (i) Common errors included failing to add the two applications and maintaining the subscripts 'f, m and l' after substitution. Weaker responses did not answer the first part of this question which required an expression and went straight into numeric substitutions into the formula.

(ii) Many weaker responses demonstrated poor manipulation skills with fractions and basic algebraic errors.

General Mathematics

2008 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
Section I			
1	1	AM1: Basic algebraic skills	P2
2	1	M2: Applications of area and volume	P2, P6
3	1	DA3: Displaying single data sets	P4
4	1	AM4: Modelling linear and non-linear relationships	H2, H3
5	1	M6: Applications of trigonometry	H6, H7
6	1	FM3: Taxation	P2, P8
7	1	FM1: Earning money	P2, P8
8	1	DA4: Summary statistics	P2
9	1	AM3: Algebraic skills and techniques	H2
10	1	DA5: Interpreting sets of data	H4, H5
11	1	M5: Further applications of area and volume	H6, H7
12	1	DA7: Correlation	H5, H9
13	1	DA4: Summary statistics	P2
14	1	M6: Applications of trigonometry	H6
15	1	FM4: Credit and borrowing	H2, H8
16	1	PB2: Relative frequency and probability	P2, P10
17	1	M6: Applications of trigonometry	H6
18	1	PB3: Multi-stage events	H3, H10
19	1	AM4: Modelling linear and non-linear relationships	H2, H3
20	1	M4: Right-angled triangles M6: Applications of trigonometry	P6, H2, H6, H7
21	1	AM3: Algebraic skills and techniques	H2, H3
22	1	PB4: Applications of probability	H2, H10, H11
Section II			
23 (a) (i)	1	DA3: Displaying single data sets	P11
23 (a) (ii)	1	DA3: Displaying single data sets	P11
23 (b)	1	M1: Units of measurement	P5, P7
23 (c) (i)	1	M1: Units of measurement	P5
23 (c) (ii)	2	M1: Units of measurement	P5
23 (d)	3	AM1: Basic algebraic skills	P2, P7
23 (e)	2	DA3: Displaying single data sets	P4, P7
23 (f)	2	DA3: Displaying single data sets	P4, P7

Question	Marks	Content	Syllabus outcomes
24 (a) (i)	2	FM1: Earning money	P2, P8
24 (a) (ii)	3	FM1: Earning money	P2, P8
24 (b) (i)	1	PB1: The language of chance PB3: Multi-stage events	P3, H3, H10
24 (b) (ii)	1	PB2: Relative frequency PB3: Multi-stage events	P4, P10, H3, H4
24 (b) (iii)	1	PB2: Relative frequency PB3: Multi-stage events	P4, P10, H3, H4, H10
24 (b) (iv)	2	PB1: The language of chance PB3: Multi-stage events PB4: Applications of probability	P3, P10, H2, H4, H10, H11
24 (c)	3	FM5: Annuities and loan repayments	H5, H6
25 (a) (i)	2	AM3: Algebraic skills and techniques	H2, H3
25 (a) (ii)	2	AM3: Algebraic skills and techniques	H2, H3
25 (b) (i)	1	PB3: Multi-stage events	H4, H10
25 (b) (ii)	2	PB3: Multi-stage events	H4, H10
25 (c) (i)	4	M6: Applications of trigonometry	H2, H6, H11
25 (c) (ii)	2	M6: Applications of trigonometry	H6, H7
26 (a) (i)	1	PB4: Applications of probability DA5: Interpreting sets of data	H4, H10
26 (a) (ii)	2	PB4: Applications of probability DA5: Interpreting sets of data	H4, H10
26 (a) (iii)	1	PB4: Applications of probability DA5: Interpreting sets of data	H2, H4, H10, H11
26 (b) (i)	1	PB2: Relative frequency and probability	P2, P4, P10
26 (b) (ii)	1	DA3: Displaying single sets of data DA5: Interpreting sets of data	P2, P4, P9, H4, H5
26 (c)	2	PB4: Applications of probability	H2, H4, H10
26 (d) (i)	1	DA5: Interpreting sets of data	H2, H4, H5
26 (d) (ii)	1	DA5: Interpreting sets of data	H2, H4, H5, H9
26 (d) (iii)	2	DA5: Interpreting sets of data	H2, H4, H5
26 (d) (iv)	1	DA5: Interpreting sets of data	H2, H4, H9
27 (a) (i)	2	M7: Spherical geometry	H2, H6
27 (a) (ii)	1	M7: Spherical geometry	H2, H6
27 (a) (iii)	2	M7: Spherical geometry	H2, H6, H7
27 (b) (i)	2	FM5: Annuities and loan repayments	H2, H5
27 (b) (ii)	1	FM5: Annuities and loan repayments	H2, H5
27 (b) (iii)	3	FM5: Annuities and loan repayments	H2, H5, H8
27 (c)	2	FM6: Depreciation	H2, H5

Question	Marks	Content	Syllabus outcomes
28 (a) (i)	1	DA6: The normal distribution AM4: Modelling linear and non-linear relationships	H2, H3, H4, H5, H9
28 (a) (ii) (1)	1	DA6: The normal distribution	H2, H4, H5
28 (a) (ii) (2)	2	DA6: The normal distribution AM4: Modelling linear and non-linear relationships	H2, H4, H5
28 (a) (iii)	1	DA6: The normal distribution AM4: Modelling linear and non-linear relationships	H2, H4, H5
28 (a) (iv)	2	DA6: The normal distribution AM4: Modelling linear and non-linear relationships AM1: Basic algebraic skills	P3, H2, H5, H11
28 (a) (v) (1)	1	DA6: The normal distribution AM4: Modelling linear and non-linear relationships	H2, H3, H4
28 (a) (v) (2)	1	DA6: The normal distribution AM4: Modelling linear and non-linear relationships	H2, H4, H5
28 (b) (i)	2	AM4: Modelling linear and non-linear relationships M5: Further applications of area and volume	H2, H3, H6
28 (b) (ii)	2	AM4: Modelling linear and non-linear relationships M5: Further applications of area and volume	H2, H3, H6

BOARD OF STUDIES
NEW SOUTH WALES

2008 HSC General Mathematics
Marking Guidelines

The following marking guidelines were developed by the examination committee for the 2008 HSC examination in General Mathematics and were used at the marking centre in marking student responses. For each question the marking guidelines are contained in a table showing the criteria associated with each mark or mark range. For some questions, 'Sample Answers' or 'Answers may include' sections are included. These are developed by the examination committee for two purposes. The committee does this:

(1) as part of the development of the examination paper to ensure the questions will effectively assess students' knowledge and skills, and

(2) in order to provide some advice to the Supervisor of Marking about the nature and scope of the responses expected of students.

The examination committee develops the marking guidelines concurrently with the examination paper. The 'Sample Answers' or similar advice are not intended to be exemplary or even complete answers or responses. As they are part of the examination committee's 'working document', they may contain typographical errors, omissions, or only some of the possible correct answers.

The information in the marking guidelines is further supplemented as required by the Supervisor of Marking and the senior markers at the marking centre.

A range of different organisations produce booklets of sample answers for HSC examinations, and other notes for students and teachers. The Board of Studies does not attest to the correctness or suitability of the answers, sample responses or explanations provided. Nevertheless, many students and teachers have found such publications to be useful in their preparation for the HSC examinations.

A copy of the Mapping Grid, which maps each question in the examination to course outcomes and content as detailed in the syllabus, is also included.

Section II

Question 23 (a) (i)

Outcomes assessed: P11

MARKING GUIDELINES

Criteria	Marks
• ONE month correct	1

Sample answer:

February or March or November or December

Question 23 (a) (ii)

Outcomes assessed: P11

MARKING GUIDELINES

Criteria	Marks
• Correct answer — November	1

Sample answer:

Rainfall < 80 mm = July, September, October, November
And temperature in range 20–30°C
Means November is the month satisfying both conditions

Question 23 (b)

Outcomes assessed: P5, P7

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

$$\frac{5}{1250} \times 100\% = 0.4\%$$

Question 23 (c) (i)

Outcomes assessed: P5

MARKING GUIDELINES

Criteria	Marks
• Correct numerical expression	1

Sample answer:

$5.5\% \times 375 \text{ mL} = 20.625 \text{ mL}$

Question 23 (c) (ii)

Outcomes assessed: P5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Correct calculation of the number of mL in one standard drink OR • Correct numerical expression for consumption rate	1

Sample answer:

One standard drink = 375 mL ÷ 1.6
= 234.375 mL

Consumption rate = 234.375 ÷ 60 mL per minute
= 3.9 mL per minute

Question 23 (d)

Outcomes assessed: P2, P7

MARKING GUIDELINES

Criteria	Marks
• Correct answer	3
• Significant progress eg TWO correct steps	2
• Some progress eg ONE correct step	1

Sample answer:

$$\frac{5x+1}{2} = 4x - 7$$

$$5x + 1 = 8x - 14$$

$$-3x = -15$$

$$x = 5$$

Question 23 (e)

Outcomes assessed: P4, P7

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Correct numerical expression OR • Significant progress eg $3.5 \div 9$	1

Sample answer:

$3.5 \div 9 \times 450 = 175$ people

Question 23 (f)

Outcomes assessed: P4, P7

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Progress towards correct answer	1

Sample answer:

Total marks in three tests $= 3 \times 72$

$= 216$

$$\frac{216 + x}{4} = 73$$

$$216 + x = 292$$

$$x = 76$$

Question 24 (a) (i)

Outcomes assessed: P2, P8

MARKING GUIDELINES

Criteria	Marks
• Correct answer OR • Correct numerical expression	2
• Progress towards solution	1

Sample answer:

Earnings = 13% of [\$15 670 × 12]
= 0.13 × 15 670 × 12
= \$24 445.20

Question 24 (a) (ii)

Outcomes assessed: P2, P8

MARKING GUIDELINES

Criteria	Marks
• Correct calculation of earnings with conclusion	3
• Calculation of Method 2 earnings (no conclusion) OR • Attempted calculation of Method 2 which is incorrect with a correct conclusion	2
• Progress towards answer	1

Sample answer:

Method 2 commission = 4.5% of [\$15 670 × 12]
= \$8461.80

Method 2 earnings = \$8461.80 + \$350 × 52
= \$26 661.80

Method 1 earnings = \$24 445.20

∴ Greater income earned by Method 2.

Question 24 (b) (i)

Outcomes assessed: P3, H3, H10

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

$$\begin{aligned}\text{Combinations} &= 5 \times 4 \times 3 \\ &= 60\end{aligned}$$

Question 24 (b) (ii)

Outcomes assessed: P4, P10, H3, H4

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

$$P(\text{odd}) = \frac{3}{5}$$

Question 24 (b) (iii)

Outcomes assessed: P4, P10, H3, H4, H10

MARKING GUIDELINES

Criteria	Marks
• Correct answer OR • Correct from previous answer	1

Sample answer:

$$\left(1 - \frac{3}{5}\right) \times 60 = 24$$

Question 24 (b) (iv)

Outcomes assessed: P3, P10, H2, H4, H10, H11

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Indication that there are four members in the sample space	1

Sample answer:

$$P(\text{3 digit} < 500) = \frac{4}{60}$$

$$= \frac{1}{15}$$

Question 24 (c)

Outcomes assessed: H5, H6

MARKING GUIDELINES

Criteria	Marks
• Correct answer	3
• Correct numerical expression	2
• Correct conversion of interest rate and time periods to monthly	1

Sample answer:

$$N = \frac{740\,000}{\left(1+\frac{4}{200}\right)^{40}}$$

$$N = \$335\,138.91$$

Question 25 (a) (i)

Outcomes assessed: H2, H3

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Progress towards correct answer	1

Sample answer:

$$P = a \times 2^t$$

$$24 = a \times 2^2$$

$$24 = a \times 4$$

$$a = \frac{24}{4}$$

$$a = 6$$

Question 25 (a) (ii)

Outcomes assessed: H2, H3

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Progress towards correct answer	1

Sample answer:

Trial and error

eg $t = 6$

$6(2)^6 = 384$

eg $t = 7$

$6(2)^7 = 768$

eg $t = 8$

$6(2)^8 = 1536$

$\therefore$ 8 years

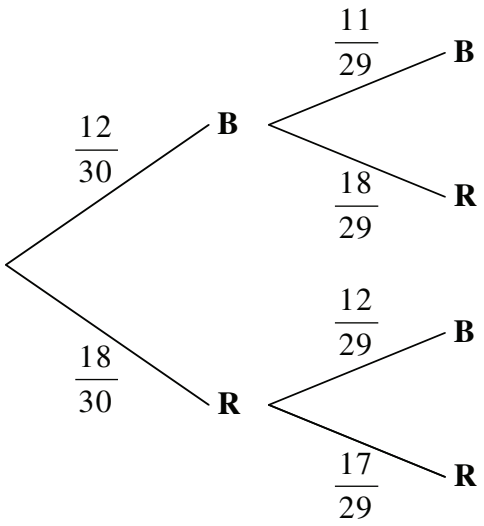
Question 25 (b) (i)

Outcomes assessed: H4, H10

MARKING GUIDELINES

Criteria	Marks
• Correct answer ie any two correct probabilities	1

Sample answer:



Question 25 (b) (ii)

Outcomes assessed: H4, H10

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Progress towards correct answer	1

Sample answer:

$$P(\mathbf{BB} \text{ or } \mathbf{RR}) = \frac{12}{30} \times \frac{11}{29} + \frac{18}{30} \times \frac{17}{29}$$

$$= \frac{73}{145}$$

Question 25 (c) (i)

Outcomes assessed: H2, H6, H11

MARKING GUIDELINES

Criteria	Marks
• Correct answer	4
Significant progress towards correct answer OR • Correct numerical expression involving cosine rule and height and width	3
• Progress towards correct answer eg both height and width	2
• Limited progress eg only height or width correct	1

Sample answer:

Height of box = radius of circle = 15 cm
Width of box = 3×7 cm = 21 cm

Length of piece: $C^2 = 15^2 + 15^2 - 2 \times 15 \times 15 \cos 40°$
$= 105.28\ldots$
$C = \sqrt{105.28\ldots}$

Length of box = $4 \times C$
= 41.0424 cm

$\therefore$ The dimensions of the box are 15 cm, 21 cm 41.04 cm

Question 25 (c) (ii)

Outcomes assessed: H6, H7

MARKING GUIDELINES

Criteria	Marks
• Correct answer, correctly rounded	2
• Progress towards correct answer	1

Sample answer:

$A = \frac{1}{2} \times 15 \times 15 \sin 40°$
$= 72.31\ldots \text{ cm}^2$

$V = A \times 7$
$= 506.195\ldots$
$\doteqdot 506 \text{ cm}^3$

Question 26 (a) (i)

Outcomes assessed: H4, H10

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

	Aged <40	*Aged ≥40*	Totals
Movie critics who liked the movie	65	37	102
Movie critics who did not like the movie	42	31	73
Totals	107	**68**	175

$A = 68$

Question 26 (a) (ii)

Outcomes assessed: H4, H10

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Progress towards correct answer	1

Sample answer:

$$P(\text{critic <40 years old did not like movie}) = \frac{42}{175}$$

$$= \frac{6}{25}$$

Question 26 (a) (iii)

Outcomes assessed: H2, H4, H10, H11

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

Number who liked movie $= 102$

Percentage who liked movie $= \dfrac{102}{175} \times 100\%$

$\doteqdot 65\%$

$\therefore$ The movie will not be a box office success.

Question 26 (b) (i)

Outcomes assessed: P2, P4, P10

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

$$\text{Relative frequency} = \frac{35\,000}{2\,000\,000}$$

$$= \frac{7}{400}$$

Question 26 (b) (ii)

Outcomes assessed: P2, P4, P9, H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

Distribution is negatively skewed

Question 26 (c)

Outcomes assessed: H2, H4, H10

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Progress towards correct answer	1

Sample answer:

$$\begin{aligned} 0.1 \times \$12 + 0.4 \times \$6 + 0.3 \times \$3 - 0.2 \times \$X &= 0 \\ 1.2 + 2.4 + 0.9 &= 0.2 \times \$X \\ X &= \frac{1.2 + 2.4 + 0.9}{0.2} \\ &= \frac{4.5}{0.2} \\ &= 22.5 \\ \text{Loss} \quad \text{is} \quad &\$22.50 \end{aligned}$$

Question 26 (d) (i)

Outcomes assessed: H2, H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

$0.6 \times 1\,000\,000 = 600\,000$

Question 26 (d) (ii)

Outcomes assessed: H2, H4, H5, H9

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

35–39

Question 26 (d) (iii)

Outcomes assessed: H2, H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Progress towards correct answer (eg 0.7 million)	1

Sample answer:

0.7 million + 0.75 million = 1.45 million

Question 26 (d) (iv)

Outcomes assessed: H2, H4, H9

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

80+ age group is not 5 years — it is all ages greater than 80, whereas 75–79 age group is only a range of 5 years, so there are likely to be more people in 80+ age group.

Question 27 (a) (i)

Outcomes assessed: H2, H6

MARKING GUIDELINES

Criteria	Marks
• Correct answer OR • Correct numerical expression	2
• Progress towards correct answer (eg finding 75° OR substituting incorrect angle into correct formula)	1

Sample answer:

$$\text{Distance} = \frac{\theta}{360} \times 2\pi r$$

$$= \frac{75}{360} \times 2\pi(6400)$$

$$= 8\,377.580\,41 \text{ km}$$

$$\doteqdot 8378 \text{ km}$$

Question 27 (a) (ii)

Outcomes assessed: H2, H6

MARKING GUIDELINES

Criteria	Marks
• Correct answer (in hours *or* hours and minutes) OR • Correct numerical expression	1

Sample answer:

$$T = \frac{d}{s}$$

$$= \frac{8\,377.580\,41}{913}$$

$$= 9.1758\ldots \text{ hours}$$

$$\doteqdot 9 \text{ hours } 11 \text{ minutes}$$

$$\doteqdot 9 \text{ hours}$$

Question 27 (a) (iii)

Outcomes assessed: H2, H6, H7

MARKING GUIDELINES

Criteria	Marks
• Correct answer (to nearest hour) OR • Correct from previous answer from part (ii) using 5 hours correctly	2
• Time difference of 5 hours OR • Correctly using part (ii) answer with incorrect time difference	1

Sample answer:

Time difference $= 4 \times 75$
$= 300$ minutes
$= 5$ hours

Time in Borneo at departure time in Kenya is 3 am.
$\therefore$ Arrival in Borneo is 12:11 pm.

Question 27 (b) (i)

Outcomes assessed: H2, H5

MARKING GUIDELINES

Criteria	Marks
• Correct substitution into correct formula to equal 2178.76 OR • Correct numerical expression	2
• Correct formula with one error • Significant progress towards correct answer	1

Sample answer:

$$290\,000 = \frac{M\left(\left(1.006\,875\right)^{360} - 1\right)}{\left(0.006\,875\right)\left(1.006\,875\right)^{360}}$$

$$r = \frac{8.25}{12} \text{ per month}$$

$$r = 0.006\,875$$

$$M = \frac{290\,000 \times 0.006\,875\left(1.006\,875\right)^{360}}{\left(\left(1.006\,875\right)^{360} - 1\right)}$$

$$n = 30 \times 12$$

$$= 360$$

$$= 2178.67$$

Question 27 (b) (ii)

Outcomes assessed: H2, H5

MARKING GUIDELINES

Criteria	Marks
• Correct numerical expression	1

Sample answer:

$$\text{Total} = 2178.67 \times 360$$

$$= \$784\,321.20$$

Question 27 (b) (iii)

Outcomes assessed: H2, H5, H8

MARKING GUIDELINES

Criteria	Marks
• Need statement indicating difference/shortage	3
• Correct calculation/substitution • Significant progress towards correct answer	2
• One of either correct M or n • Progress towards correct answer	1

Sample answer:

$n = 20 \times 12$ $\quad M = 2428.67$

$= 240$ $\quad r = 0.006\,875$

$$\text{Present value: } N = \frac{2428.67\left(\left(1.006\,875\right)^{240} - 1\right)}{0.006\,875\left(1.006\,875\right)^{240}}$$

$$= \$285\,033.20$$

No, she is still short of the \$290 000 by \$4966.80

Question 27 (c)

Outcomes assessed: H2, H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Correct numerical expression	1

Sample answer:

$$S = V_0(1-r)^n$$

$$2023 = V_0(1-0.15)^2$$

$$V_0 = \frac{2023}{(1-0.15)^2}$$

$$= \$2800$$

Question 28 (a) (i)

Outcomes assessed: H2, H3, H4, H5, H9

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

From graph, z-score = 1

Question 28 (a) (ii) (1)

Outcomes assessed: H2, H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

From graph, z-score = 2 gives a height of 155 cm

Question 28 (a) (ii) (2)

Outcomes assessed: H2, H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Progress towards correct answer (z-score = –1)	1

Sample answer:

From graph, z-score = –1
Answer is 84%

Question 28 (a) (iii)

Outcomes assessed: H2, H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

From graph, 162–164 cm

Question 28 (a) (iv)

Outcomes assessed: P3, H2, H5, H11

MARKING GUIDELINES

Criteria	Marks
• Correct answer OR • Correct from previous answer	2
• Progress towards correct answer	1

Sample answer:

Using the answer obtained in part (iii)

$$B = \frac{m}{h^2}$$

$$21 = \frac{m}{(1.63)^2}$$

$$21 \times (1.63)^2 = m$$

$$\therefore \quad m = 55.7949$$

$$\fallingdotseq 56 \text{ kg}$$

Question 28 (a) (v) (1)

Outcomes assessed: H2, H3, H4

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

Average rate of growth is 6 cm per year

Question 28 (a) (v) (2)

Outcomes assessed: H2, H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Sample answer:

Eg (1) Growth rate begins to slow as girls get older
(2) Ages > 12 were not used to calculate the equation of line.

Question 28 (b) (i)

Outcomes assessed: H2, H3, H6

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Progress towards correct answer	1

Sample answer:

$$A \approx \frac{h}{3}\left(d_f + 4d_m + d_l\right) + \frac{h}{3}\left(d_f + 4d_m + d_l\right)$$

$$= \frac{h}{3}(0 + 4a + b) + \frac{h}{3}(b + 4a + 0)$$

$$= \frac{2h}{3}(4a + b)$$

Question 28 (b) (ii)

Outcomes assessed: H2, H3, H6

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Progress towards correct answer	1

Sample answer:

$$A = \frac{2h}{3}(4a + b)$$

If $A = 600$, $h = 20$ then

$$600 = \frac{40}{3}(4a + b)$$

$$1800 = 160a + 40b$$

$$b = 45 - 4a$$

If a increases by 2

$$b = 45 - 4(a + 2)$$

$$= 45 - 4a - 8$$

Therefore the effect on b is a decrease of 8.