2005 HSC Notes from the Marking Centre General Mathematics

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

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Fax: (02) 9367 8484
Internet: http://www.boardofstudies.nsw.edu.au

ISBN 174147390X

2006120

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2005 HSC NOTES FROM THE MARKING CENTRE GENERAL MATHEMATICS

Introduction

This document provides candidates and teachers with feedback in relation to the quality of responses provided by candidates to the 2005 General Mathematics HSC examination paper. It should be read in conjunction with the 2005 HSC General Mathematics examination paper, the marking guidelines and the *General Mathematics Stage 6 Syllabus*.

General Comments

Just over 28 600 candidates attempted the 2005 General Mathematics HSC examination, slightly fewer than the 2004 number of candidates. Responses again indicated the wide range of ability of candidates presenting for this paper, from those with poor literacy and/or numeracy skills to others who are able to present their work well, write articulate responses and think about the reasonableness of their answers.

One of the main difficulties markers continue to have occurs in the marking of 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 the candidates' thinking towards their solution. The message to continue giving to candidates is for them 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 the middle of a solution. 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. Responses were generally of a better standard than in 2004 and it is clear that candidates are improving the clarity of their expression. This does, however, still present a problem for a significant number of candidates. They still need to become familiar with appropriate terminology and read their answers after writing them to ensure that the answers make sense.

Candidates still 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. A three-page explanation for a small number of marks is not necessary. Candidates should pay particular attention to the situation where a question asks them to justify with calculations or examples, since the wording of the question is intended to be helpful.

It seemed that more candidates than in the past are using graphics calculators and most of these are writing the list of substitutions for the Financial Mathematics questions, so that part marks may be awarded for some progress towards the answer, even if it is incorrect.

Candidates should bring a ruler to the General Mathematics examination for drawing graphs and diagrams accurately, and take note of diagrams where 'Not to scale' is indicated. In these cases, measuring lines or angles to find a result is not going to be awarded any marks.

Candidates who gained higher marks:

- showed a clear, concise and appropriate method to solve each problem. That is, 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

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

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

Section II

Question 23

This question was answered very well. The scores overall were negatively skewed with most marks ranging between 4 and 13, and with many candidates scoring 10 or higher. There were very few non-attempts or zeros.

(a) (i) This part was answered very well and most candidates used the information from the table to state that the tickets sold were in unequal quantities or referred to some comparison of the number of tickets bought by two or more friends. Candidates need to be reminded that a one-mark question that requires a reason does not require a full-page explanation. Many responses to this part reflected very poor literacy and communication skills, indicating that much more practice is required in answering this type of question.

(ii) This part required knowledge of complementary events and was done well by many candidates. The most common incorrect response was $\frac{31}{100}$. Other incorrect responses included $\frac{31}{69}, \frac{69}{31}, \frac{95}{100}$ and $\frac{74}{100}$.

(b) (i) This part was not answered well by some candidates. A number of candidates expected the formula to be one from the formulae sheet and used any they thought may be suitable. Others decided that the question could not be easy and proceeded to complicate it by performing unusual additional operations. Common errors included attempts to find the surface area of a rectangular prism and the total of the lengths of the edges of the prism.

(ii) This part was generally answered well, with most candidates showing suitable working. When finding the volume of one cylinder the most common error was to multiply by 9 rather than 8. Many candidates did not multiply the volume of one cylinder by 3; however, most subtracted their answer from their answer to part (i).

(iii) This part was answered well by candidates who answered parts (i) and (ii) correctly. Some candidates chose to find the percentage of clay left and subtracted from 100 to give the percentage of clay removed.

(c) (i) This part was generally answered well. The most common incorrect answer was $\frac{5}{7}$.

Surprisingly some candidates who answered incorrectly in this part produced the correct answer on the probability tree in part (ii).

(ii) Although most candidates managed to copy the probability tree correctly from the question paper, a significant number extended the branches further or did not write the words 'red' and 'blue' on the tree or wrote the probabilities on the ends of the branches. Many candidates who successfully copied the diagram had trouble writing the correct probabilities on the branches. The most common error was to forget to subtract one from the denominator and one from the appropriate numerator. Most candidates wrote their probabilities as fractions and these were generally more successful than candidates who wrote their probabilities as decimals or percentages.

(iii) This part was not answered as well as the other parts and the most common error was to confuse the operations of multiplication and addition required to give the final answer. Several candidates simply gave *P*(RR) as their answer. The most alarming error made in this part was the incorrect addition of two fractions. Many candidates made the serious mistake of adding the denominators as well as the numerators and it was common to see the error $\frac{5}{12}+\frac{4}{11}=\frac{9}{23}$. Candidates are encouraged to use their calculators to check their answers.

Question 24

Overall, the question was done very well. High scores of 11–13 marks were common and low scores of 0–5 were infrequent. There were very few non-attempts.

(a) (i) The stem-and-leaf plot was drawn in a recognisable fashion by most candidates, although the need to place 10 numbers on the plot ensured that there were some leaf omissions or duplications and the ascending order of numbers was not always adhered to. Some candidates put 10, 20, 30 etc in the stem column and other variations included inverted plots and plots which were reflected or translated to the left. The most common major error was to produce a box-and-whisker plot.

(ii) The correct median value, 28, was obtained by many candidates, but unfortunately some candidates wrote '8' ie the leaf of the median. The most common incorrect response was 27. The mean also appeared as an answer.

(iii) The one mark here was obtained by recognising that the scores were positively skewed. A fair proportion of candidates were able to write down this fact, indicating that the concept of 'skewness' had been learnt and remembered. A smooth 'normal curve' with a tail towards the highest scores was sometimes drawn around the right-hand side of the stem-and-leaf plot by those who answered correctly. Some candidates provided several sentences referring to the range, standard deviation and clustering of the scores indicating no real understanding of the meaning of 'skewness'. Some candidates indicated that they were not familiar with the term 'skewness'.

(b) (i) This question was done well. The major source of error came from $A = 9$ (months) being converted to $\frac{9}{12} = 0.75$ (years).

(ii) This involved substitution into the 'subject' variable of a formula and solving the resulting two-step equation, then using the solution obtained to solve the original problem. Many candidates followed this path and obtained the correct age difference, 21 months. A small number of candidates found the correct value of George's age $(\text{ie } A = 30)$, but mistakenly thought this was years and went on to convert to months.

One interesting response using the formula was: The difference in dosage is $4 - 1.2 = 2.8 \text{ mL};\ 2.8 = \frac{2A}{15};\ 2A = 2.8 \times 15;\ A = \frac{2.8 \times 15}{2} = 21$ months difference.
Alternatives to using the formula involved (mostly unsuccessfully) rates or proportion.

(c) The correct solution to this 'change the subject of the formula' question required a division of both sides by 2π followed by the taking of the square root of both sides of the resulting equation. Candidates who attempted to take the square root before dividing almost universally ignored the square root of 2π, ie $T = 2\pi L^2 \rightarrow \sqrt{T} = 2\pi L$. Quite common was the subtraction of 2π from both sides as the first step ie $T - 2\pi = L^2$. Candidates who did obtain $L^2 = \frac{T}{2\pi}$, and knew that the next step was $L =$ the square root of $\frac{T}{2\pi}$, did not always ensure that $L = \sqrt{\frac{T}{2\pi}}$ was the result.

Too often the final line implied (intentionally or unintentionally) that only the numerator contained the square root.

(d) (i) Common answers used the unitary method in different ways, such as finding 1% from 15% of the population is 24 000 and going directly to the total $100\% = 160\,000$ or finding the population for the other three suburbs and then completing a sum.

Another type of response was: $ES = 15\% = 24\,000$,
$NS = 3 \times 24\,000$, $SS = 2 \times 24\,000$ and $WS = \frac{SS}{3}$, and then the total for the four suburbs was found. Those candidates who used $160\,000$ in their calculations were in danger of presenting a circular argument. The most common such one was to subtract from $160\,000$ and then use the number found as part of a sum to obtain $160\,000$. There were some references to the sector angle for Eastern Suburbs being $54°$ and attempts to use proportion to show that the total population was $160\,000$ based on this.

(ii) Most candidates were able to identify the column for Western Suburbs as incorrectly drawn, some by observing that it was half the height of the one to the left (Eastern Suburbs) and then observing that the sector graph percentages, 10% and 15%, did not confirm this. Perhaps the best justification used by many candidates was that Western Suburbs should be $16\,000$ (from the calculation of 10% of $160\,000$) and not $12\,000$ as shown in the column graph. Also, candidates suggested that Western Suburbs should be more than $12\,000$ (it was 4000 short), because the total could not be $160\,000$ as the other column heights were correct from calculations in part (i). Some candidates used percentages indicating that $12\,000$ was only 7.5% of $160\,000$ and not the 10% shown in the sector graph.

Question 25

The most successful responses were those which had clear logical steps in working, and clear calculations to justify answers.

Candidates are reminded to check answers to see if they are sensible given the context.

(a) (i) This part was done quite well. Some candidates, rather than multiplying a monthly figure by 12, divided it by 4 and then multiplied by 52 weeks, effectively using 13 months in a year. Quite a few candidates were unable to calculate 4% of $5000 successfully, many using 0.4 instead of 0.04. Some candidates attempted to treat the whole question as a weekly budget, creating problems with rounding errors and recalculations to come up with a yearly figure.

(ii) Some candidates did not realise that interest on an investment is in fact part of the income, opting to treat the interest as an expense. A common error was to ignore the $624 expense noted on the spreadsheet. Some candidates either did not justify their answer with calculations or gave a worded explanation, often contradicting themselves or making up additional scenarios such as ‘if the car was worth less he could afford it’ or ‘yes he can afford 10% of $2100’. Some candidates correctly used their answers from part (i) in suitable calculations to justify their answer.

(b) (i) This part was generally done well. Common incorrect answers were $5^2 = 12^2 + 13^2$ or $12^2 = 5^2 + 13^2$. Some candidates felt that all they needed to do was to explain how to draw a square on the angle to show that it was right-angled!

(ii) Many candidates did not realise that the use of sin, cos or tan was all that was required and, instead, tried to use the cosine rule or sine rule (with limited success). Many were able to write down the required trigonometry but were then unable to calculate the angle using their calculator. Some candidates drew a scale drawing of the triangle and measured the angle. If done accurately this resulted in the correct answer, but some measured inaccurately. A common error was to find the size of the wrong angle.

(c) (i) This part was generally done well, although many candidates did not realise that the question was asking for the number of times that the '4' card would be expected to occur in 60 games, providing the probability of choosing a '4' instead.

(ii) Many candidates demonstrated little understanding of the concept of financial expectation, answering the question with comments such as 'good', 'not bad', 'she expects to win'. Many candidates incorrectly dealt with the 'Lose $8' card, adding rather than subtracting.

(iii) Many candidates repeated their calculations from part (ii), stating that there was no effect of an additional card. Some candidates, confused by 60 games, tried to include the number of games. Many candidates rounded answers partway through calculations. Overall, candidates showed a poor understanding of financial expectation, treating it as a simple probability or just as an expectation of winning. Candidates should realise that a calculation will suffice for a justification of an opinion and that a long, worded response is not required.

Question 26

This question was generally answered well. The best responses included clear diagrams with relevant information on them, and clear working.

(a) The majority of candidates demonstrated the ability to use 'guess and check' to obtain an answer in this part. However, it was important for the candidates to draw a conclusion based on their calculations and some did not do this. Candidates who tried to substitute in the declining balance formula and then solve for n were generally unsuccessful, although a few were able to correctly use logarithms to find n. The most common error in this question was the use of the straight-line method instead of the declining balance method of depreciation.

(b) (i) Many candidates did not read or interpret this question correctly and used the Future Value of an Annuity formula (or occasionally calculated from first principles), rather than the table given. Other errors included using wrong (or many) table values and using simple or compound interest. Many candidates appeared to have difficulty using interest and repayment tables. Most could find the correct value from the table, but a large proportion of candidates incorrectly interpreted the value in the table as an interest rate (4.3101%) rather than the future value of $1 ($4.3101).

(ii) Some candidates did not realise that the concept 'Interest earned = final amount – amount invested' was required in this part. Of those candidates who did, a large number calculated the interest by subtracting $3600 rather than the full amount of four lots of $3600.

(c) Candidates found this the most challenging part of Question 26. Many did not have an understanding of the normal distribution and the meaning of *z*-scores and made little or no attempt to answer the questions.

(i) A large number of candidates did not know that the *z*-score of the mean is always zero. A very common error was $\frac{754-754}{2}=377$, resulting from incorrect use of the calculator.

(ii) Candidates who correctly answered part (i) generally succeeded in answering part (ii). Many candidates could substitute into the *z*-score formula correctly, but then were unable to manipulate the equation to find the correct solution.

(iii) Very few candidates scored full marks in this part. Correct recall of the percentages 68%, 95% and 99.7% was the exception rather than the norm, although candidates seemed to find this easier than trying to remember the four smaller percentages 0.15%, 2.35%, 13.5% and 34%. Of those who could remember the percentages, many struggled to apply them correctly.

(d) (i) Candidates need to take note of words such as 'compounding monthly'. The most common errors in this part included the use of $n=9$ and $r=0.06$ or changing one (usually $n=108$), but not the other; not being sure whether to multiply or divide the values of *n* and *r* by 12; using $r=5^{-03}$; and substituting into the Future Value formula rather than the one written on the page.

(ii) Most candidates who answered part (i) correctly were also able to answer part (ii) correctly. A few candidates who had used incorrect values for *n* and/or *r* in part (i) were then able to go on and evaluate the appropriate value of *M*. However, most candidates were unable to successfully solve for *M*. Even those who did work out the calculation on the right-hand side of the equation did not finish by dividing into $28\,000$.

Question 27

Very few candidates scored full marks in this question.

(a) (i) This question was generally answered well, but many candidates misread the graph by reading the value for school shoes without subtracting the value for boots. Scale reading on the vertical axis was a problem for many candidates, as they could not interpolate values between given indicators such as $15\,000$ and $20\,000$. Many candidates cited $18\,000$ sales, indicating the reading of a line graph.

(ii) Most candidates answered this part well.

(iii) Many candidates misread the graph as a line graph rather than an area graph. It was clear that candidates did not know what a trend was or how to write what the trend was from the graph. Most indicated high sales of shoes at the beginning of the year, as that is when school returns.

(b) Many candidates used the wrong formula for arc length. Many confused the use of 1.852 to convert to nautical miles or went on further after calculating 2580.

(c) (i) Most candidates realised that a true bearing related to $360°$ or a circle. Some candidates claimed there were $360°$ in a triangle. Many candidates explained by doing a calculation. Many obviously knew what they wanted to say but could not find the correct words.

(ii) This part was done well by candidates who knew to use the cosine rule. A surprising number of candidates tried to find the length by Pythagoras' theorem or other right-angled triangle methods. Candidates are to show as much working as possible, including a full calculator display before rounding off, and need to ensure their calculator is set to degree mode.

(d) (i) There was confusion between the sample standard deviation and population standard deviation. Most candidates were able to use the calculator to enter the score correctly but were unable to make the decision about which standard deviation to use. Many calculated the mean instead of the standard deviation. An answer to two decimal places was given in most cases.

(ii) This part was not answered well. Most candidates described the use of standard deviation rather than its meaning. Many candidates went to elaborate lengths to draw bell curves with *z*-scores, quartiles and other irrelevant information. Candidates need to take a clue from the number of marks allocated to the question as to the amount they need to write to answer the question.

Question 28

Many candidates attempted at least some parts of the question. In general, candidates were more successful in answering part (b) than part (a). A great percentage of candidates simply wrote bald answers, without the support of working. Candidates who showed full working had a greater chance of being awarded full or part marks. In some parts, candidates who set work out clearly were able to gain marks for correct numerical expressions even when final answers were incorrect, particularly in parts such as (a) (ii) and (a) (iii) that required many calculations.

(a) (i) Many candidates were successful in this part. Overall, candidates were often neither clear nor succinct in their explanations. Often, those who wrote lengthy explanations contradicted themselves. Some candidates were confused about the 2 in front of the xy and thought that both the length and breadth of the rectangle were being doubled. Of more concern were the candidates who stated that the '2' in πy^2 was used because there were two semicircles. Other candidates used terminology incorrectly in their explanations, such as 'the hemispheres on the end', 'πy^2 is the radius of a circle' and 'πy^2 is the formula for the area of a semicircle'.

(ii) Few candidates were able to gain full marks. The majority of candidates calculated the area of the base of the pool only or calculated the volume of the pool rather than the surface area. Other candidates correctly calculated the surface area of some walls, but left one out or added additional walls. Candidates who clearly labelled their surfaces as they calculated them (eg base = …, curved ends = …, etc) appeared to have more success. Other incorrect responses involved the use of inappropriate formulae such as those for the area of an ellipse, the surface area of a sphere or the area of an annulus. Many candidates did not show any working.

(iii) Many candidates made some progress towards the correct solution, but were not able to keep track of all the calculations required, often leaving out one piece of information or using it twice. A large number of candidates could not successfully convert litres to kilolitres or ignored the conversion altogether. Many candidates rounded too often or incorrectly. Some candidates also ignored the 365 days given in the question and instead used 7×52 or 360. Others incorrectly tried to connect this question with part (ii).

(b) (i) Many candidates were successful in writing $C = 700 + 12x$ for this part. The most common error was to write an algebraic expression rather than a formula, or to simplify incorrectly to obtain, for example, $C = 712x$. Calculating the gradient and *y*-intercept accurately from the graph proved to be a challenge because of the scales on the axes. Most candidates attempting this method were not successful. Some candidates wrote a cost per head formula (eg $C = \frac{700}{x} + 12$) rather than a total cost formula. Some candidates were not careful enough with + and $\times$ signs.

(ii) This part was answered well by many candidates. Errors often resulted from an incorrect interpretation of the horizontal scale of the graph.

(iii) The majority of candidates successfully answered this question. A noticeable number of candidates incorrectly evaluated \$3000 – \$2500 as \$5000, rather than \$500. Errors often resulted from estimating the dollar value of the point of intersection from the graph, or confusing the terms 'income' and 'profit' and giving an incorrect answer of \$3000.

(iv) This part provided candidates with the opportunity to display a range of strategies to solve the problem. Many candidates used trial and error to obtain the correct answer. The majority of candidates did not know to add the required profit to the costs in order to calculate the required income from 200 tickets. This resulted in many nonsensical answers less than the original ticket price, such as \$7.50 per ticket or \$3 per ticket. Many candidates showed no working at all.

General Mathematics

2005 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
Section I			
1	1	DA4 Summary statistics	P2
2	1	AM1 Basic algebraic skills AM3 Algebraic skills and techniques	P2, H2
3	1	PB2 Relative frequency and probability	P10
4	1	M3 Similarity of two-dimensional figures	P2, P6
5	1	M6 Applications of trigonometry	H2, H6
6	1	FM3 Taxation	P2, P8
7	1	AM3 Algebraic skills and techniques	H2
8	1	M4 Right-angled triangles	P2, P7
9	1	DA3 Displaying single data sets	P4
10	1	FM4 Credit and borrowing	H8
11	1	PB2 Relative frequency and probability	P10
12	1	M5 Further applications of area and volume	H2, H6
13	1	FM2 Investing money	P2, P8
14	1	AM3 Algebraic skills and techniques	H2
15	1	FM6 Depreciation	H8
16	1	DA5 Interpreting sets of data PB4 Applications of probability	H4, H10
17	1	AM3 Algebraic skills and techniques	H2
18	1	M3 Similarity of two-dimensional figures M5 Further applications of area and volume	P2, P6, H2, H6
19	1	M7 Spherical geometry	H6, H7
20	1	PB3 Multi-stage events	H10
21	1	DA2 Data collection and sampling	P9
22	1	DA5 Interpreting sets of data	H4, H9

Question	Marks	Content	Syllabus outcomes
Section II			
23 (a) (i)	1	PB1 p40 Language of probability	P11
23 (a) (ii)	2	PB2 p42 Relative frequency	P2, P10
23 (b) (i)	1	M2 p34 Applications of area and volume	P2, P6
23 (b) (ii)	3	M5 p64 Further applications of area and volume	H6
23 (b) (iii)	1	M1 p32 Units of measurement	P2
23 (c) (i)	1	PB2 p42 Relative frequency and probability	P10
23 (c) (ii)	2	PB3 p70 Multi-stage events	H4
23 (c) (iii)	2	PB3 p70 Multi-stage events	H10
24 (a) (i)	2	DA3 p28 Displaying single data sets also page 41 of support document	P4
24 (a) (ii)	1	DA3 p28 Displaying single data sets	P9
24 (a) (iii)	1	DA5 p58 Interpreting sets of data	H4
24 (b) (i)	1	AM1 p44 Basic algebraic skills	P2
24 (b) (ii)	3	AM3 p74 Algebraic skills and techniques	H2
24 (c)	2	AM3 p74 Algebraic skills and techniques	H2
24 (d) (i)	1	DA3 p28 Displaying single data sets	P4
24 (d) (ii)	2	DA3 p28 Displaying single data sets	P4
25 (a) (i)	3	FM1 p16 Earning money FM2 p18 Investing money	P2, P8
25 (a) (ii)	2	FM1 p16 Earning money	P2, P11
25 (b) (i)	1	M4 p38 Right-angled triangles	P2, P11
25 (b) (ii)	2	M4 p38 Right-angled triangles	P6
25 (c) (i)	1	PB4 p72 Applications of probability	H10
25 (c) (ii)	2	PB4 p72 Applications of probability	H10
25 (c) (iii)	2	PB4 p72 Applications of probability	H11
26 (a)	2	FM6 p56 Depreciation	H5
26 (b) (i)	2	FM5 p52 Annuities and loan repayments	H8

Question	Marks	Content	Syllabus outcomes
26 (b) (ii)	2	FM5 p52 Annuities and loan repayments	H8
26 (c) (i)	1	DA6 p60 The normal distribution	H9
26 (c) (ii)	1	DA6 p60 The normal distribution	H9
26 (c) (iii)	2	DA6 p60 The normal distribution	H9
26 (d) (i)	2	FM5 p52 Annuities and loan repayments	H8
26 (d) (ii)	1	FM5 p52 Annuities and loan repayments	H8
27 (a) (i)	1	DA5 p58 Interpreting sets of data	H4
27 (a) (ii)	1	DA5 p58 Interpreting sets of data	H4
27 (a) (iii)	2	DA5 p58 Interpreting sets of data	H4
27 (b)	2	M7 p68 Spherical geometry	H6
27 (c) (i)	1	M6 p66 Applications of trigonometry	H6
27 (c) (ii)	3	M6 p66 Applications of trigonometry	H6
27 (d) (i)	2	DA4 p30 Summary statistics	P2
27 (d) (ii)	1	DA4 p30 Summary statistics	P11
28 (a) (i)	1	AM4 Modelling linear and non-linear relationships M5 Further applications of area and volume	H2, H3, H6
28 (a) (ii)	4	AM4 Modelling linear and non-linear relationships M5 Further applications of area and volume	H2, H6, H11
28 (a) (iii)	2	M1 Units of measurement	P2
28 (b) (i)	1	AM2 Modelling linear relationships FM1 Earning money	P5, P8
28 (b) (ii)	1	AM4 Modelling linear and non-linear relationships FM1 Earning money	P8, H5
28 (b) (iii)	1	AM4 Modelling linear relationships FM1 Earning money	P8, H3
28 (b) (iv)	3	AM4 Modelling linear relationships FM1 Earning money	P8, H2, H3

BOARD OF STUDIES
NEW SOUTH WALES

2005 HSC General Mathematics
Marking Guidelines

Section II

Question 23 (a) (i)

Outcomes assessed: P11

MARKING GUIDELINES

Criteria	Marks
• Correct reason	1

Question 23 (a) (ii)

Outcomes assessed: P2, P10

MARKING GUIDELINES

Criteria	Marks
• Correct calculation of required probability or correct numerical expression	2
• Progress towards correct answer eg $\frac{31}{100}$	1

Question 23 (b) (i)

Outcomes assessed: P2, P6

MARKING GUIDELINES

Criteria	Marks
• Correct calculation of volume or correct numerical expression	1

Question 23 (b) (ii)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Correct calculation of remaining volume or correct numerical expression or correct from previous answer	3
• Substantial progress towards correct answer with one step missing or incorrect	2
• Some progress towards correct answer of volume of one cylinder or one correct step in working	1

Question 23 (b) (iii)

Outcomes assessed: P2

MARKING GUIDELINES

Criteria	Marks
• Correct percentage of clay removed or correct numerical expression or correct from previous answer Accept $\frac{147.78}{1512}$ but NOT $\frac{1364}{1512}$, NOT $\frac{147.78}{1364}$ NOTE. Incorrect numbers (except for correct from previous answer) correctly converted to percentages are not acceptable	1

Question 23 (c) (i)

Outcomes assessed: P10

MARKING GUIDELINES

Criteria	Marks
• Correct probability	1

Question 23 (c) (ii)

Outcomes assessed: H4

MARKING GUIDELINES

Criteria	Marks
• Correct tree diagram with correct probabilities on all the branches or correct from previous answer	2
• Progress towards correct tree diagram	1

Question 23 (c) (iii)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Correct probability or correct numerical expression or correct from previous answer	2
• Progress towards correct answer, eg correct expression for probability for two red ties or two blue ties or addition and multiplication transposed	1

Question 24 (a) (i)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct plot	2
• Progress towards plot eg leaves with correct stem, but out of order	1

Question 24 (a) (ii)

Outcomes assessed: P9

MARKING GUIDELINES

Criteria	Marks
• Correct answer or correct numerical expression or correct from previous answer	1

Question 24 (a) (iii)

Outcomes assessed: H4

MARKING GUIDELINES

Criteria	Marks
• Correct answer or equivalent description of the distribution	1

Question 24 (b) (i)

Outcomes assessed: P2

MARKING GUIDELINES

Criteria	Marks
• Correct answer or correct numerical expression, ignore units	1

Question 24 (b) (ii)

Outcomes assessed: H2

MARKING GUIDELINES

Criteria	Marks
• Correct answer, accept 30–9	3
• Progress towards correct answer eg Correct calculation of $A = 30$	2
• Correct substitution into formula	1

Question 24 (c)

Outcomes assessed: H2

MARKING GUIDELINES

Criteria	Marks
• Correct equation (± not required)	2
• Correct equation for L^2 OR • Progress towards correct answer with one error only	1

Question 24 (d) (i)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct method leading to answer of 160 000	1

Question 24 (d) (ii)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct region identified or implied and correct justification	2
• Correct region identified with no or incorrect or insufficient justification OR • Significant progress towards identifying appropriate region but no statement about incorrect region	1

Question 25 (a) (i)

Outcomes assessed: P2, P8

MARKING GUIDELINES

Criteria	Marks
• All three answers or correct numerical expression	3
• Two answers or correct numerical expression	2
• One answer or correct numerical expression	1

Question 25 (a) (ii)

Outcomes assessed: P2, P11

MARKING GUIDELINES

Criteria	Marks
• Correct answer (yes) or correct from previous answer with correct justification	2
• Correct calculation or correct numerical expression or correct from previous answer with no conclusion OR • Incorrect calculation with consistent conclusion	1

Question 25 (b) (i)

Outcomes assessed: P2, P11

MARKING GUIDELINES

Criteria	Marks
• $13^2 = 12^2 + 5^2$ or implied	1

Question 25 (b) (ii)

Outcomes assessed: P6

MARKING GUIDELINES

Criteria	Marks
• Correct answer, not necessarily rounded	2
• Correct substitution into any one of the trigonometric ratios or any other appropriate formula	1

Question 25 (c) (i)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Correct numerical expression, ignore subsequent errors	1

Question 25 (c) (ii)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Correct answer or equivalent or correct numerical expression, ignore units, ignore subsequent errors	2
• Progress towards correct answer	1

Question 25 (c) (iii)

Outcomes assessed: H11

MARKING GUIDELINES

Criteria	Marks
• Correct answer with correct justification	2
• Significant progress towards justification or incorrect calculation with correct conclusion OR • Correct calculations without conclusion	1

Question 26 (a)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer, accept either the correct year or during the 3rd year	2
• Progress towards correct answer	1

Question 26 (b) (i)

Outcomes assessed: H8

MARKING GUIDELINES

Criteria	Marks
• Correct answer or correct numerical expression	2
• Identification of the correct number in the table OR • Wrong number from table correctly used	1

Question 26 (b) (ii)

Outcomes assessed: H8

MARKING GUIDELINES

Criteria	Marks
• Correct answer or correct numerical expression or correct from previous answer	2
• Progress towards correct answer	1

Question 26 (c) (i)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Correct answer (0)	1

Question 26 (c) (ii)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 26 (c) (iii)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Correct answer or correct numerical expression	2
• Progress towards correct answer	1

Question 26 (d) (i)

Outcomes assessed: H8

MARKING GUIDELINES

Criteria	Marks
• Correct substitution of n and r	2
• Either value of n or r correct	1

Question 26 (d) (ii)

Outcomes assessed: H8

MARKING GUIDELINES

Criteria	Marks
• Correct value or correct from previous answer	1

Question 27 (a) (i)

Outcomes assessed: H4

MARKING GUIDELINES

Criteria	Marks
• Answer in suitable range	1

Question 27 (a) (ii)

Outcomes assessed: H4

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 27 (a) (iii)

Outcomes assessed: H4

MARKING GUIDELINES

Criteria	Marks
• A correct trend in the graph (ie change over time) and a valid reason	2
• A correct trend in the graph with no valid reason	1

Question 27 (b)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Correct answer or correct numerical expression	2
• Progress towards correct answer	1

Question 27 (c) (i)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 27 (c) (ii)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Correct answer	3
• Substantial progress towards correct answer eg correct numerical expression not evaluated or incorrectly evaluated	2
• Progress towards correct answer eg reasonable attempt to use cosine rule	1

Question 27 (d) (i)

Outcomes assessed: P2

MARKING GUIDELINES

Criteria	Marks
• Correct answer, correctly rounded	2
• $\sigma_n = 1.59$, or correct sample deviation not rounded or rounded incorrectly	1

Question 27 (d) (ii)

Outcomes assessed: P11

MARKING GUIDELINES

Criteria	Marks
• Mention of the word ‘spread’ or equivalent	1

Question 28 (a) (i)

Outcomes assessed: H2, H3, H6

MARKING GUIDELINES

Criteria	Marks
• Evidence of the recognition that the width of the rectangle is $2y$ OR • Evidence of πy^2 being area of two semi-circles or a circle	1

Question 28 (a) (ii)

Outcomes assessed: H2, H6, H11

MARKING GUIDELINES

Criteria	Marks
• Correct calculation of area of tiled base and sides	4
• Substantial progress towards correct answer	3
• Progress towards correct answer	2
• Some progress towards correct answer eg calculation of base area only	1

Question 28 (a) (iii)

Outcomes assessed: P2

MARKING GUIDELINES

Criteria	Marks
• Correct numerical expression	2
• Progress towards correct numerical expression	1

Question 28 (b) (i)

Outcomes assessed: P5, P8

MARKING GUIDELINES

Criteria	Marks
• Correct formula	1

Question 28 (b) (ii)

Outcomes assessed: P8, H5

MARKING GUIDELINES

Criteria	Marks
• Correct integer answer (approximately 88) from graph	1

Question 28 (b) (iii)

Outcomes assessed: P8, H3

MARKING GUIDELINES

Criteria	Marks
• Correct answer or correct numerical expression	1

Question 28 (b) (iv)

Outcomes assessed: P8, H2, H3

MARKING GUIDELINES

Criteria	Marks
• Correct answer (ignore one arithmetic error)	3
• Significant progress towards correct answer, eg finding total income required	2
• Progress towards correct answer, eg total cost for 200 people	1