

2010 HSC NOTES FROM THE MARKING CENTRE

GENERAL MATHEMATICS

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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 2010 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 2010 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 II

General comments

The instructions at the beginning of Section II indicate that *all necessary working should be shown in every question*. Candidates are reminded that where a question is worth several marks, full marks may not be awarded for an answer, even if the answer given is correct, if no working is shown.

Where candidates give an incorrect answer with little or no working shown, no marks can be given since markers have no indication of the candidate's reasoning behind the solution. Candidates are advised to show all their working so that part marks can be awarded for some correct steps towards their answer. A simple example is 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 how extensive their answers should be. Candidates should pay particular attention to the situation where a question asks them to justify with calculations or examples, and ensure that they respond appropriately.

Candidates should bring a ruler to the General Mathematics HSC examination for drawing 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 will not be awarded any marks.

In the better responses, candidates:

- showed a clear, concise and appropriate method to solve each problem. They worked in a logical manner, clearly stated what they were doing and showed all necessary working
- 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
- articulated 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.

Question 23

- (a) Most candidates gained marks in this question; however sources of error included: calculating weekly rather than annual increase; using 3% rather than 3.5%; being unable to find a percentage of a quantity; finding the base rate for the year and forgetting the increase; adding one week's wage increase to an annual base amount ($55.53 + 82\,508.40$) and poor calculator skills.
- (b) (i) Some candidates deduced the answer from its position in the plan. Many candidates lost marks due to multiple answers such as shower/bath, shower/cupboard.
- (ii) Most candidates accessed marks in this question, although answers of 2000, 3000 and 8000 were common, demonstrating that they had little exposure to transferring measurements from floor plans to elevations.
- (iii) The most successful candidates in this part first changed each of the measurements to metres before calculating the area. Those candidates who did this usually obtained full marks. The candidates who calculated the area in mm^2 had great difficulty converting to m^2 , many just dividing by 1000 rather than 1 000 000. Some candidates calculated the perimeter instead.
- (c) (i) Many candidates gave the correct answer of 34. Some incorrectly added Jonty into the calculation to make 35. A small number of candidates read the graph incorrectly, many reading 'purple' as 4 people.

- (ii) Many candidates gave the correct probability. Some found the 15 candidates and quoted $\frac{1}{15}$ as their answer. Some candidates found the correct blue and green probabilities and multiplied them.
- (d) (i) Most candidates obtained the correct answer by subtracting all the items from \$590. A number of candidates were awarded the mark even though they gave the incorrect answers because they demonstrated understanding of the process required by showing all their working.
- (ii) Common errors included putting aside Savings + Telephone/Internet funds for one week (\$80) or putting aside only the savings component (\$120).

Candidates are reminded to read the question carefully. Some candidates put $40 + 40 \times 3$ into their calculator only to obtain \$160 (order of operations).

- (iii) This question was answered in a variety of different ways by candidates. Of those who scored 3 marks, most used the same reasoning and calculations (5 weeks of Savings, 5 weeks of Telephone & Internet, 2 weeks of Entertainment and 2 weeks of Clothing & Gifts to give \$640).

The best responses included the allocated funds from part (ii) and the non-essential funds where correct calculations were shown with clear explanations and reasons. Those who failed to use the funds from part (ii), or used an erroneous value, had difficulty obtaining the total amount given as \$620 and went searching, often incorporating funds from essential and non-essential items.

Many candidates ignored the need to justify their answer with calculations and reasons.

Question 24

- (a) (i) Some common errors were: not recognising the negative multiplied by positive 3; thinking the error was with the multiplication; simply rewriting the question stating 'there is no mistake' or rewriting line 2 and followed up with $y = -14$ as per the question.
- (ii) Many candidates correctly solved their equation from part (a) (i). A number of candidates, however, mastered complex trigonometric calculations in part (a) but did not solve the linear equation in Line 1.

Most candidates did not use graphics calculators to solve the equation. As asked, they attempted to show their working for each line.

- (b) Most candidates attempted to find the point of intersection algebraically and substituted many values of x into both equations without any conclusion. Only some candidates were able to read the value directly from the graph.

Many candidates did not understand that the point of intersection on the graph was the solution to the two equations.

- (c) (i) A large number of candidates did not use their calculator correctly.

- (ii) Most candidates substituted into the formula. Few candidates indicated they knew that a z-score of 0 is the mean.
- (iii) This question was poorly attempted by many candidates even though the percentages for each of the z-score sections was given in the question. Use of a diagram in this part was very common.

Common errors included: not considering the split of percentages (answers of 68% and 95% were common); halving the 68, 95 and 99.7 but then adding too many or incorrect parts.

- (d) (i) Most candidates did not see this question as one based on two right-angled triangles, leading to many candidates using non-right angle trigonometry for this question. Many candidates attempted to find all angles and sides of each triangle.

Common errors included: not understanding the definition of 'angle of depression'; not rounding to the nearest minute; finding $\angle ADB$ or finding $\angle BDC$.

- (ii) Many candidates went on to attempt this question when part (i) had not been attempted. Many candidates used non-right angled trigonometry with the use of the sine rule being the most common approach. Less successful responses involved the use of the tan ratio in the non-right angled triangle. Common errors included: incorrect use of trigonometric calculations; using the last angle found from part (i) assuming that the answer from part (i) led on to part (ii); incorrect substitution into the sine rule, or use of right-angled trigonometric ratios in a non-right angled triangle.

Question 25

- (a) (i) Candidates were required to construct a median regression line for graphical information, by first identifying the median points for the three portions of the graph. Many candidates had difficulty gaining any marks on this question. Of those who were awarded one mark, the majority had circled the correct three median points. More successful candidates produced a well-drawn median regression line which was both parallel to and appropriately spaced from the interval joining M1 and M3.
- (ii) Many candidates did not receive marks for this question either because they did not attempt part (a) (i) or because they made errors in the form of analysis of the given points that they had chosen to do. A small number of candidates made a fundamental error reading the scale.
- (b) In calculating the interest paid on a loan, candidates were expected to locate the correct table value and calculate the total amount repaid and then calculate the interest by subtracting the principal. Some candidates were awarded a mark by finishing at the total repaid. Candidates multiplying the wrong table value by 48 and subtracting the principal were also awarded a mark. A common error was to attempt to calculate the interest paid over the term of the loan by multiplying the monthly repayment by the number of years. A number of candidates tried to calculate the interest using simple or compound interest formulae, without success.
- (c) (i) A small number of candidates expressed their answer as 56 minutes instead of 56 hours. Some used the given latitudes incorrectly and calculated the time between two places separated by 16 or 15 degrees. Many candidates converted distance or speed to

kilometres. Too many candidates incorrectly multiplied or divided by numbers such as 4, 15 or 60.

- (ii) Many candidates successfully concluded that it would be 11 pm on Thursday in Fiji when it was 7 pm on Friday in Sydney. Many candidates were awarded a mark by knowing the time difference was either 20 hours or 4 hours. About half the candidates made errors calculating longitude difference or used the latitude coordinates to corrupt this calculation.
- (d) Most candidates offered an answer to the question. Many attempted a simpler question, multiplying \$150 by 36 and adding this product to \$600, to conclude that \$6000 was not enough. A significant number also performed various simple interest calculations and made a conclusion. Many candidates were awarded marks for calculating one component correctly and either ignoring or miscalculating the other component but coming to a correct conclusion. Candidates with graphics calculators again wisely showed the values they were using (in TVM).

Question 26

- (a) (i) Many candidates answered this correctly. However quite a few did not remember that there are 26 letters in the alphabet and 10 numerals from (0 to 9). Some candidates did the addition calculation of $10^2 + 26^2 + 10^2$ instead of $10^2 \times 26^2 \times 10^2$.
- (ii) A large number of candidates recognised there were 10 000 possible combinations of the mentioned number plate, but many struggled to convert this to a probability of $\frac{2}{10000}$. A common mistake was $\frac{2}{\text{answer from (i)}}$. Also candidates often tried to convert their fraction into a percentage, which was not needed, and was incorrectly calculated in most cases. Candidates who obtained the wrong answer in part (i) received full marks in this section if they showed all working.
- (b) (i) Common incorrect answers were 5 or 25. A number of candidates reproduced the frequency distribution table, when an answer of 15 was all that was required.
- (ii) The ogive was poorly drawn. A large number of candidates joined the middle of the tops of each column, instead of corner to corner. Other common errors were starting at the origin (0, 0), instead of the left-hand bottom corner of the first column, and bringing the ogive back to the x -axis. Many candidates used freehand sketches, which affected the accuracy of their ogive. Many appeared completely straight instead of four lines with four different gradients.
- (iii) A large number of candidates failed to read the instructions carefully. The question required them to 'show by drawing lines on their graph', how they arrived at their median. Candidates need to understand that drawing the lines is part of the process of finding the median. Candidates were awarded marks whether or not they achieved the mark from part (b) (ii). Common mistakes were thinking the median was where the second column of the histogram ended (on the x -axis) or placing a cross or large dot only on the ogive. A number of candidates confused the term 'median' with 'median regression' (in Question 25) and proceeded to move their ogive across the page. If they drew more than one line, they needed to cross or erase the wrong line, or indicate which line was correct. Candidates who wrote the value for the median without drawing the required lines received no marks.

- (iv) Many candidates managed to score at least 1 mark in this part. The shorter answers were often the best. Many candidates mentioned more traffic as the problem and gave a plausible solution. Solutions dealing both with reducing traffic and managing traffic were acceptable. To this end, creating a detour, bypassing or one-way streets reduced the traffic. Solutions such as install traffic lights, enforce speed zones or put in pedestrian crossings were acceptable management strategies. Many of the solutions were quite valid and showed a concern for pedestrian safety. Some candidates did not state the problem correctly, but gave a sensible solution and gained their mark in this way.
- (c) Many candidates understood the concept of financial expectation. However many correct numerical expressions did not lead to a correct answer. Either candidates put the numbers into their calculator incorrectly or they chose to evaluate without using a calculator. A frequent error was to not include the cost of playing in the calculation, so that the \$2 entry fee was not subtracted from each outcome. Other common errors were to have a win of \$8 rather than a loss of \$8 (ie adding $\frac{3}{10} \times 8$ instead of subtracting), and merely listing financial outcomes without indicating the plus or minus signs. Several candidates added the fractions, added the dollars and then multiplied the fraction total by the dollar total. A few candidates focused on the word 'expectation' saying 'they were expecting to win' and did not offer any numerical evidence.
- (d) Most candidates who attempted this question scored at least one mark. Many worked through the question realising the need to find one angle in the triangle, used the cosine rule correctly and then correctly substituted that angle into the formula for the area of a triangle. Some candidates assumed the triangle was right-angled and bypassed the cosine rule, using $\frac{1}{2}bh$. Others found the perimeter, or obtained the product of three sides. Errors such as using $2a^2b^2$ in the denominator of the cosine rule or an incorrect area rule ($\frac{1}{2}ab \cos C$) were costly and unnecessary. A number of candidates substituted into the cosine rule correctly but ignored the minus sign that implied an obtuse angle of 134.2° and chose to use the acute angle of 45.7° to calculate the area of the triangle. A large number of candidates used their calculator incorrectly to evaluate correct numerical expressions.

Question 27

- (a) In correct responses, candidates took the reciprocal of the second term first, then multiplied correctly and then correctly simplified. Candidates who showed every step in the manipulation of the algebraic terms gave themselves the best chance of maximising their marks.

Part marks could be obtained by showing a range of algebraic steps. Common errors were to introduce an '=' sign (thus changing the question to an equation), or making a common denominator, or incorrectly handling the numerical fraction, or incorrect index manipulation.

Some otherwise good responses arrived at the correct answer $20x \div 3y^2$ but then went on to write $6\frac{2}{3}xy^2$ or similar.

- (b) (i) Some candidates incorrectly divided the population into even proportions of ages, thus commonly giving children $1750 \div 4 = 437.5 = 438$.
- (ii) Some candidates correctly multiplied their answer to part (i) by 4, but many misread the question and gave 1750 as a wrong answer.
- (iii) Candidates were required to compare two data sets, identifying the two changes with specific reference to measures of location, spread or shape of distribution. The comparison needed to be age-related, and not merely the result of an increase in population.

Many successful responses correctly stated that the median decreased from 12 to 6, the IQR rose from 8 to 10 and the skewness changed from negative to positive.

Some other comparisons included stating that there were 50% of the children over 12 in 2000 but now only 25% in 2010, there were more younger children in 2010 whereas there were more older children in 2000 and there were 25% in the 0–8 age range in 2000 but that has reduced to 0–2 in 2010.

Responses did not always use the correct terminology for location and spread. Many referred to the mean or range as changing, or that the IQR box was smaller, when describing the median or IQR, or when they meant that the box had shifted down the ages.

Many candidates reversed positive and negative skew.

- (iv) Successful responses simply gave an age-related implication, such as increasing daycare centre availability or planning more primary schools.

The requirements of the question were not well understood. Numerous responses gave an example of an event that caused the increased population such as ‘baby bonus’, or did not target a younger generation such as ‘build more houses’.

The number of marks allocated to the question are a guide to how much information is required for a written answer. Some lengthy responses were vague or contradictory.

- (c) (i) Most candidates gave the correct answer of \$3000. The only error came with misreading of the scale (in thousands of dollars).
- (ii) When questions ask candidates to ‘show’, a mathematical calculation should be used to arrive at the stated answer. Most candidates used $m = \frac{\text{rise}}{\text{run}}$ and put two suitable points on the graph to obtain the answer. If there was a slight inaccuracy in reading the graph, then the required answer was not obtained.
- (iii) Not many candidates associated the gradient in part (ii) with the required rate. Many candidates thought the question was asking how much tax was to be paid on \$18 000,

so found $\frac{1}{3}$ of \$18 000. Some candidates failed to give the amount for \$1 of income eg every \$3 of income = \$1 of tax.

Many candidates rounded their amounts incorrectly, giving $\frac{1}{3}$ of a dollar as 30c.

Some other candidates gave two different amounts, one for tax on an income at \$21 000 and another for an income of \$39 000.

- (iv) Many candidates used the equation form $y = mx + b$ and any associated $\frac{1}{3}$ with the gradient. The use of the perceived gradient from previous parts of the question was also a common response.

Better responses substituted a point successfully into the equation to find the y-intercept, but many incorrectly read the scale resulting in $T = \frac{1}{3}I - 4$ instead of the correct $T = \frac{1}{3}I - 4000$.

The y-intercept was left off most given solutions, or was recorded as \$6000, \$21 000 or similar.

Question 28

- (a) (i) Most candidates correctly identified the values from the table and answered this question correctly.

Common errors involved reading the wrong line off the table, writing the percentage change or stating the answer as a range of values.

- (ii) Many candidates did not realise that an amount between those listed in the table could be borrowed.

Many candidates successfully calculated 30% of the gross monthly salary, and concluded successfully from their stated calculations.

- (iii) Candidates struggled to use the correct terminology in the correct manner and refer it to the graphs in the question. Many candidates made random statements without focusing on the question. Others made hypotheses and observations about what might have happened. Explanations without reference to Xiang or Jack were common.

- (b) (i) Most candidates found the volume of the box and divided this by the volume of one can.

Candidates who drew a diagram or similar figure were the more successful. A number of candidates gave answers in the thousands, not checking the reasonableness of their answers.

- (ii) Many candidates realised the area of the label needed to be multiplied by their answer in part (i) above.

Errors included incorrect height, or including the area of the top and/or bottom of the can. This indicated a lack of understanding of the surface area of a cylinder.

- (iii) Most candidates doubled the diameter and calculated the necessary volumes.

However, many did not draw a conclusion about Monica being correct/incorrect. Many candidates wrote a generalised statement about the volumes.

- (iv) Many candidates did not link how the two graphs worked together.

Many candidates determined a radius, while others used a trial and error method before deciding on their best response.

Other candidates substituted values into the formula to determine their given values for radius and height.