UNIVERSITY OF MALTA

SECONDARY EDUCATION CERTIFICATE
SEC

MATHEMATICS

May 2007

EXAMINERS' REPORT

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SEC Mathematics
May 2007 Session
Examiners' Report

Part 1: Statistical Information

Table 1 shows the distribution of grades for the May 2007 session of the examination.

Table 1: Distribution of Candidates by Grade

Grade	1	2	3	4	5	6	7	U	Abs	Total
Paper A	311	430	575	461	437	-	-	109	21	2344
Paper B	-	-	-	227	573	734	593	987	257	3371
Total	311	430	575	688	1010	734	593	1096	278	5715
% of Total	5.4	7.5	10.1	12	17.7	12.8	10.4	19.2	4.9	100%

The total number of registered candidates was 5715. Compared to last year, there were 156 more candidates registering for the SEC examination; the increase in the numbers registering for the IIA and IIB papers were 71 and 85 candidates respectively. The percentage obtaining grades 1 to 5 was 52.8% while the percentage obtaining grades 1 to 7 was 76.0%. The remaining candidates were either unclassified (19.2%) or absent (4.9%).

This year 41.0% of the registered candidates sat for IIA, whereas this figure stood at 40.9% last year and at 35.0% four years ago in 2003. It is encouraging to note that the proportion of IIA candidates continues to increase slowly over the years showing that more candidates are confident to opt for the more difficult paper. However, it should still be stressed that the syllabus for the Paper IIB option does not give candidates a sound preparation for Intermediate and even less so for Advanced Matriculation in Mathematics. It is strongly suggested that students who can cope with the extended syllabus required for the IIA paper are encouraged to take this paper, in this way they will have a more solid foundation should they later decide to continue studying Mathematics at a higher level.

Part 2: Comments regarding candidates' performance

2.1 GENERAL COMMENTS

The paper contained a good spread of items that go beyond recall of definitions, facts or standard procedures for familiar problems. In some questions unfamiliar situations were included which were not typical of the exercises in the mathematics textbooks in current use. Such items, which may be called 'reasoning items' include a wide variety of items, for example those requiring: (i) a solution to a non-routine problem, (ii) justification or explanation in candidate's own words about some mathematical property and (iii) an unfamiliar proof. These questions were designed to target important mathematical ideas and care was taken to ensure a good spread of these items across the four sections of the syllabus: Number, Algebra, Shape, Space & Measures and Data Handling. For both IIA and IIB candidates, the marks allotted to reasoning items constituted around 30% of the total mark. Reasoning items do not have to be difficult. Examples of easy reasoning items were Q4 and Q7 of Paper IIB whereas Q15 and Q16 of the same paper are also reasoning items but much more difficult.

The markers were pleased to note that a good number of students have shown a very good understanding of the mathematics that is expected of them at this level. It was particularly satisfying to note that such candidates were not only proficient in familiar questions but could also explain in their own words their mathematical reasoning and could also tackle unfamiliar problems. However, it should also be noted that a number of candidates seemed to do rather poorly on the reasoning items as compared to their performance on the other items.

In all three papers, the marks ranged from very low to very high, practically spreading across the whole range of possible marks. A small number of both IIA and IIB candidates performed extremely well obtaining a total mark which was very close to, sometimes actually equal to, the maximum attainable mark.

The strengths and the weaknesses as evident from the students' responses in each question are discussed in more detail in the markers' comments in the following sections of this report. A summary of the candidates' main difficulties follows.

Generally the following difficulties were displayed by the IIA candidates:

- A good number had difficulties with fractions, for example when dividing by a fraction. Candidates' performance on the more difficult arithmetic questions (for example Q4(ii) in Paper IIA and in Q10 (ii) of the Core Paper) suggest that many find difficulty in reasoning out situations involving fractions and percentages.
- Even though IIA candidates were usually proficient in rounding numbers to a given number of decimal places, many candidates do not seem to have a notion as to how accurate a measurement or result is. Premature rounding was also very common. When an answer is required to a given standard of accuracy, care should be taken to work with a higher degree of accuracy in the calculations preceding the final answer.
- In the Mental Paper, a good number of candidates, including some of the higher performing candidates, had a much lower performance in comparison to their results on the other parts of the examination.
- While many were successful on the algebra items involving applications of learnt algorithms, many found difficulties in algebra items involving more reasoning. For example, in Q5 of the Core Paper, a substantial number did not give a suitable explanation as to why the equations they gave for the given lines were a suitable representation of those lines. In Q11 of the Core Paper, a substantial number were seen to be applying the formula for the n^{th} term of a linear sequence, without considering whether the sequence was in fact linear.
- The use of Tree Diagrams for finding the probability of compound events does not appear to be well understood. Similarly many found difficulties with determining the interquartile range from the Cumulative Frequency graph.
- Some, even among the higher achievers, were reluctant to explain their reasoning when this did not involve numerical computations. Many find difficulty with

mathematical proofs, whether algebraic or geometrical. In this area, markers remarked that candidates often used properties they were required to prove.

While a few of the IIB candidates gave a very good performance in both papers, they often showed difficulty at a more basic level than the IIA candidates. The following difficulties were apparent in the responses of the IIB candidates:

- The lower achieving of the IIB candidates often found difficulty with solving Arithmetic problems involving more than one step, even when these involved simple numbers. These candidates also found difficulty in items requiring the use of mathematics in everyday activities like using time and conversion of units of measurement, for example in length and money.
- Reasoning about situations involving simple fractions and ratios was found to be difficult for this group. Many do not appreciate the value of fractional numbers and are not able to translate appropriately between their different representations, i.e. as decimals and percentages.
- In computing expressions involving more than one operation, these candidates often made mistakes in the order in which these operations were performed; often working from left to right even when this was not appropriate.
- Many do not seem to have a good idea of rates of change, even when these are used in everyday contexts like speed.
- In the Mental Paper, a good number of candidates had a much lower performance in comparison to their results on the other parts of the examination.
- Many do not display any understanding of algebraic symbolisation, sometimes making mistakes in the simplest items involving simplification of algebraic expressions. The least performing were sometimes also found to make mistakes in naming the Cartesian coordinates of points on a graph. The better performing could usually work the algebra questions involving a simple application of learnt procedures but only a small percentage answered correctly the algebra items involving reasoning.
- Even though many could calculate the area of simple shapes, most do not seem to have a sufficiently good understanding of the notion of area to enable them to solve simple real life problems involving this measure.
- In many questions, some candidates lost marks for not showing any working.

The markers' comments on the performance on individual items in the examination papers are given below.

2.2 COMMENTS REGARDING PERFORMANCE IN PAPER I (MENTAL)

The Mental Paper turned out to be much more difficult for the IIB candidates than for the IIA candidates. In fact, while the average-mark for the IIA candidates was 13.0, that for the IIB candidates was 6.8. The markers further noted that a substantial number of IIB candidates did not attempt any of the last five questions.

Q1: For both IIA and IIB candidates, the majority answered this question correctly. Incorrect responses were mainly due to errors in addition and subtraction. A considerable number of IIB candidates added the given angles, 90° and 35°, but failed to subtract their answer from 180°.

Q2: Very few of the IIB candidates answered this question correctly. Mostly these candidates considered the statement "7 is a factor of 63" to be false. Although most IIA candidates answered the question correctly, the same mistake was noted in a considerable number of IIA scripts, suggesting that many confuse the terms "factor" and "multiple".

Q3: Both types of candidates knew they had to multiply 0.62 by 8 and most multiplied the two numbers correctly. However, most did not give the correct answer to the nearest mile. In fact the most common answers were 4.96 miles and 4 miles. This was also true for the IIA candidates

Q4: Almost all candidates substituted the values correctly in the formula but many made a mistake when multiplying the numbers. A good number of IIB candidates gave up and did not give a final answer.

Q5: Most candidates answered this question correctly. In general, the candidates who got the wrong answer wrote the right denominator but the wrong numerator; suggesting that they do not know the number of kings in a pack of cards.

Q6: Few of the IIB candidates answered this question correctly. The majority did not seem to understand the question. Most of the IIA candidates made a reasonable attempt at the question but many made mistakes in working out $\frac{1}{6} \times 48000$, multiplying 48000 by 6 instead of dividing it.

Q7: Almost all candidates answered this question correctly. In general, candidates who got the wrong answer knew the method but made a mistake when adding or dividing.

Q8: While a substantial number of IIA candidates used the short cut 49×100 to obtain the answer, hardly any of the IIB candidates did so. Many candidates ended up getting the wrong answer because of making a mistake when multiplying 49 by 99. This mistake was also frequent among IIA candidates.

Q9: The majority of candidates knew they had to divide 23 by 4, but most of the IIB candidates and a good number of IIA candidates gave incorrect answers, these usually being 5.3 and 5.

Q10: While a good number of IIA candidates managed to obtain a correct response, this was true for only a minority of the IIB candidates. Incorrect responses usually arose because candidates ignored the negative sign of the temperature $-16°$ or else because they subtracted the temperature rise, rather than adding it.

Q11: Few of the IIB candidates managed a correct response and many obtained the incorrect answer $x = 9$. This incorrect response was also evident in a good number of the IIA scripts. Such candidates appeared to transform the equation $2x - \frac{1}{3} = \frac{17}{3}$ incorrectly to the equation 2x – 1 = 17.

Q12: A good number of both types of candidates gave the correct answer. Wrong answers arose because of incorrect computations or because candidates converted 1h 30 min to minutes rather than seconds.

Q13: While the vast majority of IIA candidates answered this question correctly, few of the IIB candidates gave a correct answer. Wrong answers included those who confused "ascending order" with "descending order". Others mistakenly thought that ¼ is the smallest presumably because it is given in fraction form. The IIB candidates often considered that 0.219 was the largest number.

Q14: Most of the IIA candidates answered the question correctly. Some of these worked correctly to obtain the fraction $\frac{100}{1/4}$ but then made mistakes in computing this division.
About half the IIB candidates answered the question correctly. For these candidates, the mistakes were more varied, and they were often seen to make no meaningful attempt at finding the cost of 1kg of rice given that ¼ kg costs 20c.

Q15: Very few of the IIB candidates gave the correct answer. The response of the IIA candidates was much better, still a good number of IIA candidates also gave an incorrect response.

Q16: Some candidates chose the correct answer, but most opted for (a) or (c). This was true for both types of candidates.

Q17: Most candidates in either group answered both parts of the question correctly. The most common wrong answers in part (i) were: 0.65, 0.6.5 and $0.6\,{}^1\!/_2$. The most common wrong answer in part (ii) was 0.35.

Q18: Very few of the IIB candidates gave the correct answer. A considerable number of the IIA candidates also failed to obtain the correct answer.

Q19: Most of the IIB candidates did not attempt this question and hardly any of them gave the correct answer. The few who managed to get the right answer used simultaneous equations, not noticing the short cut.
Although the IIA candidates were more successful, few made use of the shorter method. The markers noted that these candidates often made mistakes when using simultaneous equations to find an answer.

2.3 COMMENTS REGARDING PERFORMANCE IN PAPER I (CORE)

The overall facility of each question in the Core Paper was worked out separately for the IIA and IIB candidates using the formula:

$$\text{Facility} = \frac{\text{mean mark on question}}{\text{maximum mark awarded on question}}.$$

The facility lies between 0 and 1 and gives a measure of the overall difficulty of each question, with the easier questions having a facility closer to 1. In working the mean mark on the question, use was made of the total number of candidates to include the candidates who were absent for the paper. Tables 2 and 3 below give the facility of the Core Paper questions for the IIA and IIB candidates respectively. These tables are followed by comments about the individual questions in this paper.

Table 2: Facility of the questions in the Core Paper for the IIA candidates N=2344

question	1	2	3	4	5	6	7	8	9	10	11
facility	0.93	0.80	0.76	0.83	0.68	0.85	0.67	0.66	0.84	0.50	0.71
candidates achieving full marks (%)	81.9	48.8	22.1	63.8	23.9	49.7	58.5	15.6	65.6	14.5	31.2

Table 3: Facility of the questions in the Core Paper for the IIB candidates N=3371

question	1	2	3	4	5	6	7	8	9	10	11
facility	0.64	0.31	0.35	0.48	0.29	0.51	0.32	0.22	0.34	0.15	0.35
candidates achieving full marks (%)	43.6	6.5	1.1	23.9	0.6	9.9	28.4	1.8	17.6	1.3	2.4

Q1: This question testing proportionality was the easiest question in the Core Paper. Most candidates gave correct answers. Marks were lost in failing to show the working, in using rounded results for a further part of the answer and for incorrect rounding.

Q2: In the first part of this question, the vast majority of candidates knew that the area of the plane shape could be obtained by dividing it into simpler shapes and adding their areas. While a good proportion of IIA candidates were awarded full marks on this part question, this was true for only a small proportion of the IIB candidates. In this part question, marks were lost for one or more of the following reasons:

- Some made mistakes in calculating the area of triangles and/or trapezia.
- Although correctly subdividing the cross-sectional area into various shapes, some found the area of overlapping shapes while others did not find the area of all the shapes making up the figure.

- Many made computational errors especially in positioning the decimal point in their answers.

In most cases, IIA candidates obtained full marks on the second and last part of this question but many IIB candidates failed to connect the area of cross-section they had found in the previous part to the volume of the prism.

Q3: Most of the IIA candidates managed to get a correct response to most parts of this question. For this group, the most common mistakes were the following:

- in simplifying $5x - (x - y)$, some candidates did not change the negative sign after opening the brackets.
- for the expression $x(x^2 + 3) - 3x$, some candidates simply left out the term x^3 when removing the brackets. Others failed to simplify the expression $\frac{xy + 2x}{x}$ by crossing out the common factor x.

Very few of the IIB candidates scored full marks on this question. Many of these candidates showed a very poor performance on this question, displaying no understanding of even the simplest of the conventions used in algebraic symbolisation.

Q4: This question was one of the easiest in the paper. In part (i), the vast majority of candidates gave a correct value for the exterior angle of a regular hexagon. In part (ii), many made a meaningful attempt at writing a logo program that draws a regular hexagon. However, a good number were far from accurate in writing the required program. A very common mistake was the use of incorrectly spelt commands, for example writing FW instead of FD or LFT instead of LT. Some candidates used a wrong turning angle, even though they had correctly found the exterior angle of a regular hexagon in the previous part. Others had missing or extra commands in their program.

Q5: Most of the IIA candidates completed all parts of the question successfully. However, a considerable number of these candidates omitted the explanations required in parts (ii) and (iv). It is likely that some of these candidates do not appreciate the fundamental property that the equation of a line graph is what it is simply because all the points on the graph satisfy that equation. In part (v), candidates needed to use the equations determined in the previous parts, to find the point of intersection of the two lines. A number of candidates were seen to leave out this part of the question, even when they had arrived at the equations of the given lines in previous parts.

The same difficulties were evident but to a much larger extent for the IIB candidates. Moreover, some of these were seen to interchange the x co-ordinates with the y co-ordinates in parts (i) and (iii). In parts (ii) and (iv), many of the IIB candidates did not manage to determine the equations of the given lines, i.e. $x = 5$ and $y = 4x$. Only a very small minority of the IIB candidates managed to complete part (v) successfully.

Q6: This question was the second easiest of the Core Paper and the majority of the candidates answered most parts of the question correctly. Mistakes were often made in part (ii) when writing the area of Russia, 1.71×10^7 km^2, correct to the nearest million km^2. In part (iii), a good number of candidates did not express their answer in standard form correctly.

Q7: This question was amongst the most difficult in the Core Paper. The correct responses included those where candidates made use of the equations for the areas of the triangle and the rectangle. A few candidates also gave a correct response by showing, through a diagram, that if the height of triangle ABC is double that of the rectangle BCDE, then the rectangle with base BC and whose perimeter passes through A has an area which is double that of rectangle BCDE. The area of triangle ABC was seen to be half that of the large rectangle they had constructed and consequently equal to the area of rectangle BCDE.

The most common mistakes amongst those attempting the question were as follows:

- A good number of candidates giving the right answer did not give an adequate explanation for their answer.
- Many others gave the answer without showing any working.

Q8: In order to complete this question successfully, candidates needed to be careful not to make computational mistakes. While some of the IIA candidates answered correctly all parts of the question presenting their work in an orderly way, very few of the IIB candidates did likewise.

In both groups of candidates, many started off with an incorrect radius for the outer perimeter of the track, usually using 35.5m instead of 39.5m. Marks were often lost for incorrect rounding in all parts of the question. Even candidates who managed to work out all other answers correctly sometimes found it difficult to round the cost to the nearest Lm10, often rounding to the nearest Lm100 in the last part of the question.

The IIB candidates were often found to confuse the formula for the area of a circle with that of the circumference. Other difficulties were apparent among these candidates for finding the area of the track. Some forgot to subtract the area of the smaller circle from the area of the bigger circle; while some others added 100 m^2 instead of 1600 m^2 to the area of the curved parts.

Q9: While a very large number of the IIA candidates answered part (i) correctly, few of the IIB candidates did so. Moreover, in some cases, those answering correctly lost a mark for failing to round their answer to 1 decimal place.

More candidates managed a successful response to part (ii) than for part (i), usually through a correct use of Pythagoras theorem. A common mistake was to assume that CD and AB were equal with the result that the value of CD was found to be 7.5m. In quite a number of cases, candidates worked inappropriately with the Pythagorean triplet assuming that CDE was a "3, 4, 5" triangle ending up with a value of 10m for CD. Some candidates, especially in the case of the IIB group, made incorrect use of Pythagoras theorem. These used $CD^2 = CE^2 + DE^2$ rather than the appropriate relation $CD^2 = CE^2 - DE^2$.

A considerable number of IIA candidates managed to answer the third part of this question correctly but this was true for very few of the IIB candidates. In fact, the markers noted many difficulties in the case of the IIB candidates in using trigonometric ratios. In this question, it was requested that the answer be given to 1 decimal place. The markers also noted that those using a correct method often

used the rounded length of AB (9.7 cm) to find ∠AFB. Although premature rounding was not penalised in this question, students should be helped to appreciate that this practice lowers the accuracy of their results.
For both parts (ii) and (iii), some IIA candidates took the long way by using the cosine rule, thus complicating the numerical work.

Q10: As can be seen from Tables 2 and 3, this question was the most difficult in the Core Paper for both groups of candidates.
The IIB candidates did very poorly in both parts of the question, with many not attempting either part. Very few of these candidates managed a fully complete response to both parts. In part (i), a few of the IIB candidates realised that they needed to change the metres to kilometres by dividing by a thousand but then only divided the seconds by 60 instead of by 3600 to change the seconds to hours. Part (ii) followed from part (i) and many of the IIB candidates did not even attempt this question. Very few of those who did, managed to give a meaningful attempt to this part of the question.
In part (i), IIA candidates usually converted 100m to 0.1km correctly. Similarly they converted 9.77 seconds to hours appropriately, but many used a rounded value for their time in hours to work out the speed, resulting in an incorrect answer and losing the accuracy mark. In part (ii), the most common mistake made by the IIA candidates was to divide the error by the reported value rather than by the more accurate value that had been worked out in part (i). Most of the candidates managing to work out the percentage error correctly found the reported value of the speed as a percentage of its true value and then subtracted 100% to obtain their answer.

Q11: The majority of the IIA candidates managed most parts of the question successfully. The markers noted that some of these candidates were using the formula for the n^{th} term of an arithmetic sequence ($a + (n - 1)\, d$) to find the required terms of the two sequences in part (i). Moreover, such candidates could not distinguish between situations where this formula was applicable (A & C) and where it was not (B & D). It should be noted that this formula is not within the syllabus and it does not make much sense to go beyond the syllabus unless such extra work can help the students develop more meaning.
Many of the IIA candidates gave correct answers for the n^{th} term of the two sequences. Similarly, most offered valid justifications for their answers to parts (ii) and (iii). In fact, in their answers to these parts, these candidates came up with a very wide range of valid explanations.
In part (i) the majority of the IIB candidates recognised the linear pattern for the number of white squares in the sequence and were able to determine the 4^{th} and the 10^{th} terms of this sequence successfully. However, many were not able to express the pattern for the n^{th} term algebraically. Moreover, many of the IIB candidates found difficulty in recognising the pattern for the number of grey squares in the sequence and they failed to determine the 4^{th} and the 10^{th} terms of this sequence successfully. Inevitably such candidates could not express the pattern for the n^{th} term of this sequence successfully.

A small number of IIB candidates managed to complete all parts of this question successfully to include a valid justification of how one of the shapes in the sequence has 65 squares and none of the shapes in the sequence has 410 grey squares. However, the vast majority of these candidates did not manage a correct justification for their claims in parts (ii) and (iii).

2.4 COMMENTS REGARDING PERFORMANCE IN PAPER IIA

The overall facilities of the questions in Paper IIA are set out in Table 4 below. These facilities were worked out in the same way as described in Section 2.3 for the questions in the Core Paper. Table 4 is followed by the markers' comments about the individual questions in this paper.

Table 4: Facility of the Paper IIA questions
N=2344

question	1	2	3	4	5	6	7	8	9	10	11
facility	0.57	0.56	0.57	0.47	0.40	0.55	0.52	0.51	0.32	0.68	0.38
candidates achieving full marks (%)	47.7	11.3	15.5	12.8	11.1	20.1	6.3	1.8	4.8	32.0	10.0

Q1: The question turned out to be of moderate difficulty. Candidates working out this question by first drawing up the possibility space generally managed to complete the question successfully. On the other hand, few candidates managed to solve the problem by constructing an appropriate Tree diagram. It was very clear that many candidates were trying to use Tree diagrams without knowing what these really mean, to the extent that some drew two separate Tree diagrams to solve the problem.

Q2: In part (a), a substantial number of candidates used a correct method to solve the two simultaneous linear equations, but many made mistakes by multiplying part rather than the whole equation by three or by subtracting wrongly the two equations.
In part (b)(i), most candidates attempted the question successfully but many lost marks by using $(x-3)^2 = x^2 - 9$.
In part (b)(ii), some candidates were not aware that they could use the result of the previous part. Thus they worked from scratch, often making mistakes in applying cross multiplication.

Q3: Most of the candidates succeeded in identifying the transformations requested in parts (i), (ii) and (iii) of question 3(a) correctly, but many lost marks by not describing these transformations completely.
In the first part of question 3(b), quite a large number of the candidates noticed that they had to use the cosine formula but many made mistakes in computing the

expression $12^2 + 15^2 - 2\times12\times15\times\cos20°$ because of errors in the order of performing the necessary operations.

The majority of candidates managed to complete the last two parts of question 3(b) successfully. In part (iii), some candidates using the formula $\sqrt{s(s-a)(s-b)(s-c)}$ for the area of triangle ABC lost marks by taking s as the perimeter rather than half the perimeter of the triangle.

Q4: Many candidates managed part (a) successfully by working out the discounted prices of the two cars correctly.

Few candidates attempted part (b) of the question in a meaningful way. Many used the formula for the compound interest which was inappropriate because of the instalments being paid at the end of the year. Two errors were particularly evident. Instead of subtracting the instalment paid back at the end of a given year from the amount due, a good number of students were dividing the amount due by the amount of the instalments paid back each year. Others were taking the interest for successive years to remain the same.

Q5: The question turned out to be rather difficult, and 27% of the candidates did not gain any marks from this question. On the other hand, over 11% of the candidates gave a successful response to all parts of the question.

A good number of candidates only gave correct answers to the first part where they had to find the possible values a swordfish weighing 90kg correct to the nearest 10kg could take. The next part involved a similar question, but this time the measure was 95kg correct to the nearest 5kg. This proved to be more difficult. The last part of the question was even more difficult, since gaining the correct response to this part necessitated successful completion of the previous parts.

Q6: Many students did well in part (i) of this question.

Part (ii) gave rise to many different wrong answers, the three most common incorrect answers being $(ab)^2$, $2ab$ and $2(a + b)$.

Most candidates did not manage to prove Pythagoras' Theorem in part (iii) with the result that only 20% of the candidates gained all the marks allotted to question 6. There were quite a number of candidates who just stated that $c^2 = a^2 + b^2$ but did not attempt a proof.

Q7: Although the question was of average difficulty, only slightly over 6% of the candidates completed all parts of the question successfully. In part (i), most candidates managed to find the median marks for the two papers correctly. The performance on part (ii) was weakest with many candidates not managing to find the interquartile range from the cumulative frequency curve. In fact, many found the difference between two values associated with the cumulative frequency rather than between the marks corresponding to the first and third quartile. Both parts of part (iv) were successfully completed by the majority.

Q8: The majority of the candidates obtained the correct values of A, B, C, D, E, and F and plotted the graph in the right manner. However, parts (iii) and (iv) were very poorly answered. Very few gave three solutions in part (iii) (a) – the majority giving $x = 0$ as a correct root but wrong or missing solutions for the remaining two. Few candidates gave a correct response to part (iii)(b) and many did not seem to be able to interpret the given inequality statement appropriately. Part (iv) proved to be very difficult for most of the candidates, and only few of the candidates answered this question correctly.

Q9: As can be seen from Table 4, the facility of this question was the lowest achieved in Paper IIA. Moreover, slightly over 23% of the candidates did not manage to gain any marks on this question.

In part (i), only a few candidates managed to present a coherent proof so as to show that angle AOB is a right angle. The connections made by the majority of candidates with the angle sum property within an isosceles triangle and the theorem relating the angle at the centre with that at the circumference were usually appropriate. But most do not seem to appreciate that one cannot assume what needs to be proved and they constructed their proof by initially stating that angle AOB is 90º.

More candidates managed part (ii) successfully. In order to prove that OAQB is a square, many simply set out to prove that all the interior angles are right angles. Reference to a quadrilateral with four equal sides was often missing.

Q10: This question turned out to be the easiest question in the IIA paper with a facility of 0.73 (see Table 4). Moreover around 32% of the candidates obtained full marks for this question. Marks were lost mainly in parts (ii) and (iii). A common error in part (ii) whilst finding CF was for candidates to divide AC by 2, hence obtaining 7.07cm instead of 4.71cm. Some candidates were unable to locate the required angle ECF in triangle ECF in part (iii). In general markers noted that many students worked correctly but with a total disregard for accuracy in their calculations (e.g. expressing trigonometric ratios to one or 2 decimal places; rounding off answers to the nearest whole number rather than as instructed; and using rounded answers from previous work in working successive parts of the question.

Q11: Only 10% of candidates obtained full marks in this question. In fact, Table 4 indicates that this was the second most difficult question. Responses to part (i) were particularly poor, in most cases the working indicates a lack of the necessary algebraic skills required to change the subject of this formula. Common errors included rewriting the given expression as $\frac{x^2+y^2}{a^2+b^2}=1$; $x^2+\frac{y^2}{b^2}=a^2$; $\frac{x}{a}+\frac{y}{b}=1$.

In part (ii) most candidates managed to rewrite the given constraints suitably in the form of two simultaneous equations but many mistakes were made in attempting to eliminate one of the unknowns from the two equations. On the other hand, some candidates managed to obtain the correct answers by trial and error.

2.5 COMMENTS REGARDING PERFORMANCE IN PAPER IIB

The markers' comments about the individual questions in Paper IIB are given in this section.

Q1: Most candidates gave a correct solution to this question. Usually, candidates giving an incorrect response did not consider that Ugo's overtime hourly rate of pay and his hourly pay during the normal working week were different. Such candidates worked out the weekly pay by multiplying either of these rates by 48 hours.

Q2: This question was one of the easiest in the IIB paper and few candidates did not manage a correct response. It could easily be solved, in one step, by dividing 57 by 1.5.and most candidates employed this method successfully. Some managed to find the correct answer by trial and error, i.e. by multiplying 30 by 1.5 and then 35 by 1.5 and so on, until they found the correct answer.

Q3: Part (i) of this question was within reach of the vast majority of candidates. Some lost a mark because they did not round up their answer to the nearest Lm10 as required.
In the second part, more marks were lost for one or more of the following reasons:

- The final answer was not rounded to 1 decimal place.
- The selling price was correctly determined as a percentage of the cost price but candidates did not subtract 100% to determine the percentage profit.
- The fraction used to determine the percentage profit was not appropriate.

Q4: Most of the candidates did well in this question, especially in part (i). Most mistakes were made in part (iii) with the most common incorrect answer being that triangle C has an angle of 135°.

Q5: In part (i), most candidates completed the possibility space without difficulty.
Parts (ii) and (iii) were similar and generally candidates who worked out part (ii) correctly, also completed part (iii) successfully. In these two items, many candidates obtained the correct value for the requested probabilities from the possibility space. Others ignored their answer to part (i) and started on the last two parts from scratch. Of these, a small number of candidates worked out the probabilities of the combined events successfully by multiplying the probabilities of the relevant independent simple events. However, others just gave the probabilities of the simple events and failed to multiply. For example in part (ii) they gave the answer $P(H)=\frac{1}{2}$ and $P(3)=\frac{1}{5}$ for the probability of obtaining a head and the number 3 when the coin and the spinner are tossed together.

Q6: A considerable number of candidates performed well in this question. In part (i), a few candidates divided the length of the model 17.5cm by 201 (i.e. 1 + 200) as if the length 17.5cm was to be shared in the ratio 1:200.
In both parts of this question, candidates often made mistakes in converting from centimetres to metres and vice versa.

Q7: Many candidates labelled the bar chart correctly. "Senglea" was the easiest to name and most candidates labelled the last bar correctly.
Some candidates interpreted 'twice as many listeners from Tarxien as from Marsa' incorrectly and labelled the first two bars in the order "Marsa", "Tarxien" rather than "Tarxien", "Marsa" as appropriate.
Other candidates incorrectly labelled the fourth bar "Vittoriosa", probably due to the wrong interpretation of the frequency scale.

Q8: Few candidates completed this question successfully. Some managed to calculate the price of the dress on 3rd January but failed to obtain the correct price on 15th January.
Candidates found difficulty in working out the percentage reduction on the reduced price. In general, this was carried out by adding 25% (i.e. the first reduction) to 25% (i.e. the second reduction). The result was a 50% reduction of the original price.

Q9: The first two parts of this question were quite straightforward and many candidates worked them out correctly. But parts (iii) and (iv) presented some difficulty. In part (iii) few candidates used the correct formula to find the speed. In part (iv) most of the candidates just drew a straight line from the point (12:00 , 21) to the origin!

Q10: This question was generally answered correctly by the great majority of the candidates. Students preferred to write their answer without showing any working. A number of the lower achieving candidates appear to have difficulty in adding and subtracting time intervals.

Q11: Very few answered this question correctly. Some tried to use Pythagoras Theorem or trigonometric ratios to find PR. Others just wrote answers without showing any working. It was clear, from the results given, that these candidates did not have the vaguest idea how to tackle the problem and presumably they preferred to write down something rather than omitting the question. Few candidates managed to use the similarity of the given triangles to construct the appropriate equation to determine PR.

Q12: The majority of the candidates succeeded only in answering part (i) correctly. The majority of these candidates divided the shape into a square and a triangle to find the area. A small number of candidates managed a correct solution by using the formula for the area of a trapezium appropriately.

Parts (ii) and (iii) proved to be difficult for most candidates with many missing the link between the three parts of the question, suggesting that they lack an understanding of the meaning of area.
Very few candidates managed a fully correct answer to all parts of the question.

Q13: Most students scored full marks for part (i) as they identified A as the centre of rotation. A considerable number of these candidates made errors in specifying the angle of rotation.

Q14: Very few candidates managed a fully correct response to this question. A good number of candidates managed the construction of the equilateral triangle and the requisite perpendicular bisectors. Parts (iii) and (iv) were more difficult, even because a correct answer was only possible following a correct response to previous parts. Some candidates failed to answer part (iii) correctly because their constructions were not accurate.

Q15: A small percentage of the candidates gave a correct explanation that Joanna and Karl could be both correct. Still, most candidates just said that Joanna and Karl could both be correct, using incorrect or missing explanations to back their claim.

Q16: This question involved reasoning about ratio. Again, only a small percentage managed a fully correct response, namely that statements b and e are correct. A good number of candidates lost all the marks by claiming that statements a and b which contradict each other are correct. It was also common for candidates to consider b and f as the correct statements.

Q17: In part (i), most candidates found no difficulty in substituting values in the formula given. However, a good number of candidates lost marks because of incorrect rounding to the nearest cm^3.
In part (ii), most had difficulties with making *r* the subject of the formula $V = \frac{4\pi r^3}{3}$. In this process, many candidates either did not find any root at all or found the square root instead. A few candidates started off the question incorrectly by changing $100cm^3$ to $1000mm^3$.

Q18: Many candidates found no difficulty in either working with Pythagoras theorem or referring to the 3:4:5 ratio. Some forgot to subtract 5m to get *h* in the end. Some candidates attempted to use trigonometry to solve the problem but very few gave a correct solution using this method.

Q19: In the first two parts of this question, most candidates managed to find the required means, medians and ranges. The most common mistake was in calculating the range in part (i) where candidates considered 6 – 1 = 5 instead of 6 – 0 = 6.
In part (iii), most candidates realized that supplier B should be chosen. However, the reason given in most cases was that "he has less damaged fruit", therefore

ignoring completely the results they had obtained from parts (i) and (ii). Other candidates mentioned the lower range, but failed to notice that the most important result to consider should be the mean.

Q20: Overall, this question turned out to be the most difficult question in the IIB paper with some candidates leaving it out completely, showing difficulties in presenting a proof.

In part (i), many candidates showed they confuse similarity with congruence and they tried to show that the two triangles are similar by SAS or ASA. Candidates who were able to show corresponding angles did not always include reasons.

Part (ii) was the most difficult part of this question. Many just stated the conditions for an isosceles triangle i.e. two sides equal and/or two angles equal, without a proper proof. Other candidates used the angle given in part (iii) to "show" that two angles are equal.

In part (iii), many candidates obtained a correct result. Others wrongly assumed that point E was the centre of the circle and tried to use the fact that an angle at the centre is twice the angle at the circumference, giving an answer of 50^o (or 200^o!)

Chairperson
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