UNIVERSITY OF MALTA

SECONDARY EDUCATION CERTIFICATE
SEC

MATHEMATICS

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EXAMINERS' REPORT

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD

SEC Mathematics
May 2009 Session
Examiners' Report

Part 1: Statistical Information

Table 1 shows the distribution of grades for the May 2009 session of the examination.

Table 1: Distribution of the candidates' grades for SEC Mathematics May 2009

GRADE	1	2	3	4	5	6	7	U	ABS	TOTAL
PAPER A	298	392	558	408	409			111	19	2195
PAPER B				186	608	661	576	949	250	3230
TOTAL	298	392	558	594	1017	661	576	1060	269	5425
% OF TOTAL	5.49	7.23	10.29	10.95	18.75	12.18	10.62	19.54	4.96	100

The total number of registered candidates was 5425. Compared to last year, there were 347 less candidates registering for the SEC examination; the decrease in the numbers registering for the IIA and IIB papers were 168 and 179 candidates respectively. Considering that the number of absent candidates decreased by 5 and 50 for the IIA and IIB papers respectively, in total there were 292 fewer candidates who sat for this examination as compared to the May 2008 session. The percentage obtaining grades 1 to 5 was 52.2% while the percentage obtaining grades 1 to 7 was 75.4%. The remaining candidates were either unclassified (19.6%) or absent (4.9%).

The number of candidates registering for the IIA SEC Mathematics paper since 2003 is shown in Table 2.

Table 2: Number of candidates registering for SEC Mathematics Paper IIA over time

Year	2003	2004	2005	2006	2007	2008	2009
IIA candidates (N)	1922	2049	2143	2273	2344	2363	2195
IIA candidates (%)*	35.0	38.1	38.1	40.9	41.0	40.9	40.5

* Percentage of total registered candidates for SEC Mathematics who opted for Paper IIA

Over the last two years, the percentage of candidates opting for IIA has registered a slight decline. Although the difference is small, it is still noteworthy. It should be noted that Paper IIB syllabus does not give candidates a sound preparation for Intermediate and even less so for Advanced Matriculation in Mathematics. For this reason, students who can cope with the extended syllabus required for the IIA paper should be encouraged to take this option; 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

Analysis of the results revealed that the three papers in order of increasing difficulty were Paper IIB, Paper I and Paper IIA, as intended when the papers were constructed. The candidates' marks ranged from very low to very high in all the papers. In the case of the IIA candidates, the highest mark attained was 100% in both Paper I and Paper IIA. In the case of the IIB candidates, the highest marks on both Paper I and Paper IIB were 93% and 96% respectively.

During the examination process, many issues about teaching, learning and assessment arise naturally. The following subsections include brief comments on two selected issues.

Lower performing candidates and non-routine questions

During the paper-setting process, it was considered important to include a good number of non-routine questions. Such questions cannot be solved using learnt rules and procedures, but need to be solved by reasoning through the associated ideas. This is considered very important because Mathematics is not about learning a set of rules for examination purposes, to be forgotten once the examination is over. On the other hand, students need to learn to connect ideas, solve problems and apply their knowledge in different contexts. This is true not only for high achieving students. For this reason, it was considered important to include a balance of such questions, to include easier and more difficult questions of this type. It is useful to comment about a couple of non-routine questions set in Paper IIB, even because of a common assumption, even amongst teachers, that low achievers should be taught through drill and practice, rather than through understanding.
Question 4, in this paper, involved a problem set in a cookery context, involving simple mathematics. It was non-routine in that it is unlikely that candidates would have been taught some procedure for working it out. Many candidates gave correct responses. These included some of the lowest performing candidates, a few of whom did not manage a total mark of 10% on Paper IIB. At the same time, a considerable number of the higher performers in Paper IIB did not manage a correct response. In question 12 (iii), Paper IIB; candidates were asked to use a graph of a kitten's weight against time to determine when it was gaining more weight. The question involves reasoning about rates of change, ideas more sophisticated than those targeted in question 4, ideas which give a grounding for the meaning of gradient. In fact, this question turned out to be more difficult. But it was interesting to note that a number of weaker performing candidates managed a fully correct response. In fact, the results showed that almost 20% of the candidates gaining full marks on question 12 gained a total mark on Paper IIB which was lower than 50%. It was surprising to note that a few candidates gaining a total mark in Paper IIB of around 20% actually managed to get full marks on this question. In fact the results show that these two reasoning questions were accessible to the lower achieving candidates. Certainly one of the qualities which helped make these questions accessible even to some of the very lowest performing candidates is their being set in a real-life meaningful context.

Working and explanations

In the SEC Mathematics examination, candidates are expected to show their working. Consequently, in many questions, marks are only awarded if the working shown is correct. This holds for all three papers, with the exception of Paper I- Section A, in which case only the answers given are considered in the award of marks. The working helps to support the answers given; it is in effect an explanation for the answer being given. By crediting working, due importance is given to the syllabus requirement that candidates are expected to show an ability to communicate mathematics. Moreover, using this process, candidates showing correct working usually gain most of the marks allotted to the question when they make a small mistake in some intermediate step. However, as in previous years, a number of candidates were found to loose marks for not showing their working.

A number of questions in the different papers tested students' reasoning even more explicitly. In such questions, candidates were specifically asked to explain their reasoning. For example, in question 7(i) of Paper I, Section B, the candidates were asked for an explanation why the angle shown in the diagram was equal to 20°. Examiners find the marking of such questions to be rather problematic; questions arise as to how much detail is required and whether errors in writing should be penalised. However, such questions may be resolved effectively after a discussion of a number of candidates' responses, and the ensuing decisions can be written down into the marking scheme. For this particular question, the marking scheme shown in Figure 1 was used. Grammatical and other writing errors did not require any discussion; the procedure normally used was adopted; namely not to penalise such errors as long as the meaning is sufficiently clear.

Figure 1: Criteria established for marking Q7(i) of Paper I Section B

A full explanation includes a reference both to 180 degrees and to 9 equal sections.

Candidates explaining by showing working of 180÷9 or 20×9 are also given full marks – 2 marks

Some examples of marking candidates’ explanations are given below:

Because the angles are equal - 0 marks
The outer semicircle is cut into equal parts - 0 marks
For that circumference to fit 9 equal pieces meaning that every piece will have the same angle which is 20 - 1 mark
Because all of the nine sections are equal and if they are 20 each they enter exactly in the semicircular arc - 1mark
When added together they form a 180 arch - 1 mark
Because all of the nine sections are equal and with an angle of 20° each, they make an angle of 180° at the centre of the circle. -2 marks
Equal arcs subtend the same angle at the centre, so $\frac{1^{\circ}}{9} = 2\,0^{\circ}$. – 2 marks

2.2 COMMENTS REGARDING PERFORMANCE IN PAPER I – SECTION A

Section A of Paper I consisted of 20 questions each carrying one mark, giving a total of 20 marks. The IIA candidates gave a good performance on this section, achieving a mean mark of 12.7. However, the IIB candidates gave a much weaker performance and only achieved a mean mark of 5.7 marks overall. Some comments about candidates’ performance on each individual question in this paper follow.

Q1. Most answered this question correctly but mistakes were more common with IIB candidates. The most common mistake was to consider x to be 75°.

Q2. Nearly all IIA candidates and many IIB candidates determined the median height of the five boys correctly. A considerable number of IIB candidates gave the mean height instead of the median as requested.

Q3. Many of the weaker performing candidates chose to work this out through a long multiplication often performing mistakes in their computation.

Q4. Most candidates managed to solve the equation correctly but a small number of the IIB candidates left it unattempted.

Q5. The question was answered correctly by most candidates. The most common incorrect answer was 70°.

Q6. The question asked for the combined probability of obtaining a head and a six when a coin and a dice are tossed together. Many candidates were not successful. Such candidates often gave two separate probabilities $\frac{1}{2}$ and $\frac{1}{6}$, instead of working out the probability of the two combined events.

Q7. This question requiring candidates to choose the largest from 5%, 2.579%, $\frac{12}{25}$ and 0.4 was generally suitably answered by both types of candidates.

Q8. A common mistake was to work out the volume of a cylinder using πrh, rather than $\pi r^2 h$.

Q9. The question required candidates to name the order of rotational symmetry of a fan-like shape. Although this question was not considered difficult; even amongst the IIA candidates, many left this question unattempted.

Q10. The question involves a simple application of the distributative property of multiplication over addition. Many, even amongst Paper IIA candidates, left this question unattempted or appeared to be using guess work in their responses.

Q11. In order to complete the question successfully, candidates needed to use that the sum of the angles on a straight line is 180° and that the opposite angles of a cyclic quadrilateral add up to 180°. Many did not manage to give a correct response.

Q12. A very common mistake, especially amongst the IIB candidates was to convert 90km/h to 9000m/s.

Q13. Most managed a correct response. This was also true for IIB candidates. The most common incorrect answer was LT 90.

Q14. Converting 0.0061 to standard index form proved to be within reach of the vast majority of candidates. The most common incorrect answers were 6.1^{-3} and 6.1×10^3.

Q15. The question involved finding the number of birds remaining from 5000 birds after a decrease by 10%. A good number of candidates were successful on this question. A common mistake involved just finding the 10% of 5000 without also subtracting from 5000. Others added this percentage rather than subtracting getting an answer of 5500.

Q16. Many IIB candidates just assumed that triangle ABC was isosceles concluding that EB = 26cm. On the other hand, the vast majority of the IIA candidates gave a correct response.

Q17. Many did not manage a correct response, even amongst the IIA candidates. Most of the IIB candidates did not even attempt the question.

Q18. A very common mistake was to consider 39 or 49 to be a prime number.

Q19. Only a few Paper IIA candidates gave a correct response to this question. Most candidates moved the decimal point only one space to the right giving 14086.46592 as their answer.

Q20. A very common mistake was to consider 5^{-2} to be equal to 5.

2.3 COMMENTS REGARDING PERFORMANCE IN PAPER I – SECTION B

The overall facility of each question in the this paper was worked out separately for the IIA and IIB candidates using the formula: Facility = $\dfrac{\text{mean mark on question}}{\text{maximum mark awarded on question}}$.

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. Tables 4 and 5 below give the facility of the Paper I Section B questions for the IIA and IIB candidates respectively. These tables are followed by comments about the individual questions in this paper.

Table 4: Facility of the questions in the Paper I – Section B for the IIA candidates
N = 2195

Question No	1	2	3	4	5	6	7	8	9	10	11
Facility	0.70	0.81	0.62	0.84	0.70	0.83	0.75	0.64	0.52	0.79	0.85
IIA Candidates achieving full marks (%)	24.0	46.0	25.1	55.0	34.0	46.7	45.0	13.6	20.2	16.8	59.5

Table 5: Facility of the questions in the Paper I – Section B for the IIB candidates
N = 3230

Question No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Facility	0.28	0.35	0.30	0.32	0.37	0.53	0.29	0.30	0.22	0.35	0.41
IIB Candidates achieving full marks (%)	3.1	8.7	6.3	11.8	17.6	16.3	6.7	2.1	0.7	1.3	11.5

Q1: Generally this question was suitably answered by IIA candidates but IIB candidates usually gave a poor performance.

In part (i) many realised that triangle B was obtained from triangle A through a rotation of 90° anticlockwise. Many of the IIB candidates lost one of the marks by not including that the centre of the rotation was the origin.

For part (ii) candidates needed to reflect triangle A in the line $y = x$. Most IIA candidates and a considerable number of IIB candidates gave a correct response but some candidates lost the mark allotted because of inaccuracies or incorrect labelling in their drawings.

In part (iii) most IIB candidates found difficulty in enlarging triangle B by a scale factor of ½ to obtain image S.

In part (iv), many IIB candidates lost the mark allotted because of imprecision or incorrect labelling.

Generally part (v) was suitably answered by both types of candidates.

Q2a: Most IIA candidates gave a fully correct response. Marks were generally lost on part (i) involving changing the subject of the given formula.

Q2b: Most IIA candidates gave a fully correct response. On the other hand, many IIB candidates lost marks on this question where they were required to solve two linear simultaneous equations. In general these candidates used the elimination method for solving simultaneous equations. In the process of eliminating one variable, some candidates did not multiply the equation throughout by the same value. Mistakes were also evident in subtracting negative terms. Fewer errors occurred when calculating the second unknown.

Q3: In part (i) most candidates managed to draw triangle ABD accurately even though many lost marks for not showing the necessary arcs. This was also true for many IIA candidates. Candidates were sometimes found to make inaccurate measurements and only few of the IIB candidates obtained an accurate scale drawing of the land.

In part (ii) many candidates found difficulty in drawing the perpendicular from B to DC. Two difficulties were very evident. Some understood the question but did not know how to use compasses for this construction. Such candidates just drew a perpendicular line from B to DC, probably with the use of a protractor. Others had difficulty with understanding what was required. In fact they drew a perpendicular at B to meet DC rather than the perpendicular from B to DC as required.

Q4: The responses show that many IIB candidates find difficulty in expressing numbers in standard form. Generally this was not the case for IIA candidates. These however often showed lack of understanding of rounding in this question. This is because many IIA candidates got correct answers but lost marks when they rounded their answers to the required number of significant figures.

Generally most candidates, even amongst the IIB candidates, knew how to find the percentages requested. However, many do not seem to appreciate that when answers are requested to a given degree of precision, the rounding should be done at the end of the calculation- otherwise the resulting answers may not be sufficiently accurate.

Q5: Most of the IIA candidates divided 10cm, the length of the strip, suitably by ¾ cm to obtain 13 pieces as required. However, marks were often lost for the last part of the question where they had to find the length of the left over piece.

The IIB candidates showed more serious errors – the majority of these candidates multiplied 10 by ¾ instead of dividing. Such candidates show a lack of understanding of the division process; especially where it comes to dividing by a fraction. IIB candidates who managed to do the division often found difficulty with finding the length of the left over piece.

A number giving correct answers lost the marks allotted to the question for failing to show any working. This was true both for IIA and IIB candidates.

Q6a: Most candidates gave a correct response for this question by working out the calculation directly on the calculator without showing any intermediate steps. Candidates who showed intermediate steps were more likely to loose marks due to early rounding. Many IIB candidates lost marks for not rounding their answer correct to three decimal places.

Q6b: Many different but valid methods were used to work out part (b) and candidates generally gained most marks allotted to this part question. A common mistake encountered was when candidates did not take into consideration that the two different types of chocolate had different costs. Moreover, some candidates did not take into account the condition that two of the chocolate boxes had not been sold.

Q7: In part (i), candidates were considered to give a correct explanation for mentioning that the angle of a semicircle (180°) is divided into 9 equal sectors. Answers like $180 \div 9 = 20$ and $20 \times 9 = 180$ were accepted as correct. Most IIA candidates answered this part of the question correctly. However, a considerable number of IIA candidates and many of the IIB candidates gave a completely inadequate explanation by subtracting 140cm from 160cm to get 20°

Though many IIA candidates managed to work part (ii) correctly, the most common mistake encountered was in the fraction which was used to calculate the area of each section. Instead of $\frac{20}{360}$ they used $\frac{20}{180}$ of the given shaded area, thus their answer was double its correct value. This error was even more evident amongst the responses of the IIB candidates. At times the last mark was lost for not rounding their answer to the nearest cm^2 as required.

Q8a: Many candidates answered part (i) of this question correctly. On the other hand, the explanations given in part (ii) were very weak. Even IIA candidates were frequently found to compare the number of girls and the number of boys employed rather than the fraction (or ratio or percentage) of girls and boys employed.

Q8b: This question was answered successfully by the majority of the IIA candidates. On the other hand, IIB candidates gave a weak performance often just subtracting the salary per month (€1200) from the mean salary (€1212.50).

Q9: This question turned out to be the most difficult question in this paper.

Part (i) involved a direct reading from the given graph and many, even amongst IIB candidates, gave a correct response. Part (ii) was more difficult. Candidates needed to sort out that the travel costs could be read directly from the graph by taking the duration of stay at the hotel to be zero. A good majority of IIA candidates and a considerable number of IIB candidates managed this successfully.

The question in part (iii), finding the cost per night at the hotel could most easily be deduced from the gradient of the given graph. Few candidates managed a successful response to this question and such candidates did not usually make use of the gradient. Instead they often subtracted the travel costs from €360, the total cost (travel cost and hotel cost) for a stay of one night. A very common wrong answer was €360, indicating that the candidates did not understand the question properly and included the travel costs in their answer.

In part (iv) candidates were required to give the equation of the given straight line graph. Correct answers were extremely rare amongst IIB candidates. Even amongst IIA candidates, the vast majority did not manage a successful response.

The results suggest that though candidates, especially IIA candidates, may be very familiar with the gradient / intercept form of the straight line, the vast majority cannot use these ideas in practical applications.

Q10: In part (i), the vast majority of candidates made a good choice of sides AB and BC which were in the ratio of 2:3. There was a lot of variety in the correct answers given by the candidates. The sketch of triangle ABC was also usually correct. However a small number of candidates sketched a right angled triangle with sides in ratio of 2:3 but did not match the larger number with side BC. This then affected their answer to part (iii).

Once again most candidates used Pythagoras' theorem correctly in part (ii) of the question but some candidates lost an accuracy mark for not rounding correctly to 2 d.p.

In part (iii) many used trigonometry correctly to determine the required angle. However, even amongst IIA candidates, few managed to round 56.3099° correctly to the nearest half of a degree.

In part (iv)(a), many answered that the sides of the two triangles need not be of the same lengths, with the majority of IIA candidates giving a correct explanation for their assertion. One of the most common correct explanations was "There is no need for sides to be the same length as long as they are in the same ratio." A common wrong explanation was "No, since the diagram is only a sketch." Few of the IIB candidates managed a correct explanation.

In part (iv)(b) many correctly claimed that the angles in both triangles have to be the same. Explanations supporting this claim were considered as sufficient when candidates made meaningful connections to similarity or to enlargement or to trigonometry. A good number of IIA candidates gave such correct responses, but very few of the IIB candidates did so. Many candidates not awarded the mark for explanation simply wrote the "the angles are the same because the ratio is the same."

Q11: The question required candidates to find the terms of three sequences arising from a geometric pattern. Candidates needed to find the fourth, tenth and n^{th} term of the three sequences: *Number of Grey Squares*, *Length of Side of Border* and *Number of White Squares*.

The fourth term of each sequence could easily be determined by counting and the vast majority of candidates gave correct responses for the 4^{th} term of each sequence. The tenth term of each sequence is more difficult to find – one has to figure it out from the pattern or tediously draw all the intermediate shapes. The pattern for the *Number of Grey Squares* was very transparent, it was the square of the term number – and the vast majority gave a correct response for the 10^{th} term in this case. The pattern for the Length of Side of Border was also quite transparent, just adding two to the term number. Still a number of candidates gave 102 rather than 12 as an answer. Mistakes for the 10^{th} term were more common for the last sequence. For the *Number of White Squares*, many IIB candidates gave 45 or 40 instead of the correct response which was 44. This mistake was also evident amongst a number of the IIA candidates.

Even amongst the IIB candidates, the majority of candidates managed successfully the n^{th} term for the *Number of Grey Squares* – n^2. In this case, the most common incorrect answer was $2n$. The majority of IIA candidates also gave correct answers for the other two sequences; *Length of Side of Border* ($n + 2$) and *Number of White Squares* ($4n + 4$). But many IIB candidates gave wrong answers or left these parts unattempted. A common incorrect answer for the last sequence was $n + 4$ instead of $4n + 4$.

2.4 COMMENTS REGARDING PERFORMANCE IN PAPER IIA

The overall facilities of the questions in Paper IIA are set out in Table 6 below. These facilities were worked out in the same way as described in Section 2.3 for the questions in the Paper I Section B. Table 6 is followed by the examiners' comments about the individual questions in this paper.

Table 6: Facility of the questions in Paper IIA
N = 2195

Question No	1	2	3	4	5	6	7	8	9	10
Facility	0.65	0.49	0.68	0.66	0.49	0.67	0.61	0.46	0.56	0.36
IIA Candidates achieving full marks (%)	10.6	8.6	25.4	42.7	14.5	8.3	20.4	1.7	38.2	7.4

Q1: **Part (a):** The majority of candidates managed to complete this part successfully. However, a small number did not subtract €2150 from the total amount Sandra paid so as to obtain the required difference.

Part (b): Question (b)(i) involved a reverse percentage problem. The population in a city today was given and the population had increased by 5% within the last year. Candidates needed to find the population last year. Not many managed to work out this question correctly. Many failed to associate 105% with the population today. Instead, these candidates represented today's population with 100% and considered last year's population to be 95% of today's population.

Although many gave a correct response to question (b)(ii), a good number of candidates do not seem to know the meaning of the terms "lowerbound" and "upperbound".

Q2: The vast majority gave a correct response to part (i) and used the appropriate method for finding the mean of the grouped data. However, a considerable number did not attempt to multiply each frequency by an estimate of the mid-point for the group category. Others used extreme values rather than mid-points of the intervals concerned.

It is clear from parts (ii) and (iii) that most candidates know about cumulative frequency curves but do not seem to have very little understanding of their significance. This was particularly evident since most candidates plotted a frequency rather than a cumulative frequency curve and then used the curve drawn to work out the median height by finding the frequency corresponding to the 30^{th} or 30.5^{th} candidate. Although this method is correct, the cumulative frequency curves were most often incorrect, with candidates often plotting points like (87.5, 24) where 87.5 represents the mid-point of the interval $85\text{cm} < h \leq 90\text{cm}$ and 24 represents the frequency of toddlers whose height lie within this interval. In their graphs, many candidates also reversed the axis or used a different scale from the one suggested. Others drew their graphs on the squared paper rather than the graph paper provided, thus working with lesser accuracy than that demanded in the question.

In part (iv), again the majority were referring appropriately to the 15^{th} / 15.25^{th} toddler and to the 45^{th} / 45.75^{th} toddler to find the interquartile range, but many made mistakes in trying to apply the procedures they had learnt. In fact, quite a few candidates subtracted 15 from 45 rather than the corresponding height measurements!

Few candidates managed a successful response to part (v) with appropriate reference to the cumulative frequency curve they had drawn. Many, in fact did not appear to be making use of this curve in their estimate of the number of toddlers who were shorter than 87 cm. Instead, candidates often ended up making an estimate of 26 candidates for this value. Such candidates were presumably finding the number of toddlers shorter than 85cm from the given table of data but may not have realised that a more precise estimate could be found through using their cumulative frequency curves.

Q3: **Part (a):** Many candidates gave a correct response. However, a considerable number showed difficulties with performing the requisite calculation. Others did not even attempt to use the formula for solving quadratic equations; instead they tried to make *x* subject of the formula.

Part (b): In question 3(b) part (i), many concluded appropriately that Xandru's working is a correct way to determine $f^{-1}(x)$. Candidates seemed to find it difficult to explain why Xandru's rather than Maria's method was correct often giving incoherent explanations. Few candidates seemed aware of a simple explanation like the following to show that Xandru's, rather than Maria's method was correct.

"In *f*, division by 5 is done last, so this needs to be reversed first to find f^{-1}. So Xandru's working is correct."

In part (ii), many managed to work out $f(10)$ and $f^{-1}(4)$ correctly.

In part (iii), it was quite disappointing that so many candidates failed to "read" the answer from the previous parts of the question itself! Instead many worked the inverse of *f* again using the method where $f(x)$ is denoted by *y*, followed with making *x* subject of the formula; often making incorrect or vague statements. For example, many failed to specify clearly which of the algebraic expressions they wrote referred to *f(x)* and which referred to $f^{-1}(x)$.

Generally, the responses show that many candidates may not be sufficiently exposed to the "undoing" method for finding the inverse function, exemplified in this question by Xandru's solution. Instead, they are immediately exposed to the more cognitively demanding method where they equate $f(x)$ with *y* and proceed to make *x* the subject of the formula. The mistakes made in this process however show that many were following meaningless procedures which they could not articulate properly.

Q4: On the whole the students did well in this question.

Mistakes were sometimes made in quoting the formula for the volume of a cone, instead using expressions for the area of a circle or the curved surface area of a right circular cylinder or the curved surface area of a right circular cone and sometimes also for the surface area of a sphere or the volume of a sphere.

There were quite a number of candidates who added the volume of the small cone to the volume of the large cone instead of subtracting these two values in order to work out the volume of the frustrum.

A common mistake was that candidates sometimes worked out the volume of the large cone and the volume of the small cone using the same height of 12cm.

It was noticed that there were candidates who were rounding the values obtained at each stage in their calculations, that is, they rounded prematurely, instead of rounding at the end.

Also a small minority of candidates rounded to the nearest 10 instead of giving their answer correct to the nearest cm^3.

Q5: **Part (a):** Most students managed to write down the two linear equations that sufficiently described the two given constraints and to use a correct strategy to eliminate one of the unknowns. However, problems were often encountered when they came to the manipulation of algebraic fractions. There were quite a number of candidates who managed to solve the two equations by trial and error since the solution involved two simple positive numbers, 2 and 6. Such candidates still obtained full marks for their solution, once they showed their working.

Part (b): In this part of the question, generally candidates either obtained a complete correct solution or they obtained only one correct value that is when $q = 0$, $p = 0$. When candidates filled the table wrongly, it was noticed that most of them did not find the constant of proportionality but they just worked the square roots of the values of q to obtain the corresponding values of p and squared the value of p to obtain the corresponding value of q.

Q6: Of the ten questions in Paper IIA, question 6 resulted to have the highest facility. Generally most marks were gained on part (i), which was answered correctly by many candidates. But very few managed to give a correct response for the explanation required in part (ii). Consequently very few candidates acquired all the marks allotted to this question.

The following are the most common mistakes made in part (i). Some candidates assumed that AD and BC were parallel and they mentioned alternate angles in their explanations. Also some assumed that ABCD is a cyclic quadrilateral, and after finding the correct value of q (80°), they went on to conclude that the opposite angle of the quadrilateral, r, is equal to 100^o.

Part (ii): Almost all of the students answered correctly that Joanna is right.

A small minority left the explanation out. All kinds of reasons were given but few were correct. Some explanations were rather odd, like for example when some candidates wrote that the circle could only pass from two of the points A, B, C and D; but not from four points. This was rather surprising since the diagram given in the question already showed a circle passing through the three points B, C and D.

Q7: The first two parts involved simple applications using bearings and most candidates gave a good response.

In order to answer part (iii) satisfactorily, candidates needed to find the size of BV. Many gave a correct response, usually by drawing a scale diagram rather than using the cosine formula to determine BV.

Q8: The first three parts of this question were quite straightforward and many candidates worked them out correctly. But very few gave a correct response to part (iv). In fact most candidates did not attempt to use the equation of the graph determined in part (ii) in order to solve the inequality presented in part (iv).

Q9: There were various correct methods for calculating the yearly rate of interest required in part (i). Many found the interest on the second year and used the simple interest formula successfully to calculate the rate of interest of the investment. It was also common for candidates to quote the correct formula for computing the Amount accrued on investing a Principal at compound interest. In such cases, a number of candidates did not substitute correctly for the number of years in their formula.

Those candidates who gave a correct response in part (i) were usually also successful in part (ii). Those using the compound interest formula often confused the Amount with the Principal in their responses to question 9(ii).

Q10: This question, with an overall facility of 0.36, had the lowest facility in Paper IIA and only 7.4% of the candidates attained all the marks allotted to the question.

The majority of candidates found no difficulty with part (i). Marks were sometimes lost for quoting the wrong reasons to support correct answers. Moreover, some candidates may have faced difficulties in understanding what was required seeing that they gave answers which were not in terms of the unknown x, as requested.

Part (ii) was the most difficult part and few candidates answered this part correctly.

In part (iii), many candidates did not use the value of x already found in part (ii). Some proved that HCK = CKH correctly just the same, but many attempted to prove triangles ABC and CKH congruent inventing reasons for this claim. Others used the properties of angles in a circle, ignoring the fact that there was no circle!

2.5 COMMENTS REGARDING PERFORMANCE IN PAPER IIB

The overall facilities of the questions in Paper IIB are set out in Table 7 below. These facilities were worked out in the same way as described in Sections 2.3 and 2.4 for the questions in Paper I Section B and in Paper IIA. Table 7 is followed by the examiners' comments about the individual questions in this paper.

Table 7: Facility of the questions in the Paper IIB
N = 3230

Question No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Facility	0.48	0.44	0.48	0.55	0.60	0.52	0.52	0.37	0.48	0.53
IIB Candidates achieving full marks (%)	9.3	5.4	26.0	39.0	31.0	8.0	13.4	24.4	15.2	30.5
Question No	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Facility	0.45	0.60	0.45	0.33	0.41	0.72	0.29	0.18	0.47	0.29
IIB Candidates achieving full marks (%)	3.7	14.2	28.7	7.4	29.5	53.5	3.8	3.2	34.4	7.2

Q1: This question involved changing units within the same system. Most candidates gave a correct response to the first two parts; converting appropriately 1 hour to seconds and 0.1 kilogram to grams. In part (iii), changing $^1/_8$ kilometre to millimetres proved to be more difficult. In part (iv), many expressed 5 minutes appropriately as $^1/_{12}$ hours. Of those who chose to express the latter in decimal form, very few wrote down the correct recurrent decimal, $0.08\dot{3}$.

Q2: This question required candidates to reflect a number of shapes in different mirror lines. In general there was no difficulty in completing the reflections required in the first two parts; in a vertical and slanting mirror line respectively. On the other hand, few candidates gave a correct response in the last part when they were required to complete the figure so as to symmetrical about the two given orthogonal lines.

Q3: In this question, many candidates figured out the right time in different time zones. A common error in part (i) was to write the time in Canada as 3:45 hours instead of 03:45 or 0345 hours. Although this error was not penalised, many candidates making this mistake lost marks in part (ii) where they gave the time as 4:00 instead of 16:00 hours or 4pm or 4:00pm. Many candidates failed to figure out that it is still Sunday in Canada when it is 1:00 am on Monday in Malta.

Q4: The candidates were given the ingredients for a carrot pie. They were asked to find the largest number of carrot pies that could be made from 3kg flour, 2kg margarine, 24 eggs, 2kg carrots, and 4kg potatoes. The question turned out to be of moderate difficulty and a good number of candidates gave a fully correct response. Some candidates worked out appropriately the ratio of the amount in stock to the amount required for one carrot cake for each ingredient. However, some of these candidates took the maximum or even the average of the ratios obtained rather than the minimum value at this stage thus loosing some of the marks allotted to the question. A good number of candidates gave a completely inappropriate solution, starting off by adding all the weights together with the number of eggs.

Q5: Many candidates scored full marks part (i) where they converted €2000 to dollars appropriately by multiplying by the exchange rate for €1.

In part (ii), candidates needed to divide by the given conversion factors (€1 = $1.8946 and €1 = $2.0387) to convert $450 to euro at different times; before and after Margaret's holiday. In this part, many candidates were observed to multiply, rather than divide, by the given conversion factors. Others successfully exchanged the dollars to euro using the two given rates, but then did not subtract to find the amount of money lost due to the difference in exchange rates.

Q6: Many candidates managed to find the angles requested but very few candidates gave suitable explanations involving the use of the circle theorems to support their answers. Consequently only 8% of the candidates gained all the associated marks.

Q7: In part (i) many candidates worked the daily average number of hours of sunshine correctly. The following were the most common mistakes encountered. Some made mistakes in adding the hours of sunshine during the week, others divided this total by 2 instead of 7 and others found the median rather than the mean.

Part (ii) was more difficult and many candidates did not make a meaningful attempt at finding how many more hours of sunshine there were in the second week. A good number of candidates did not use the data given for the first week. Others just subtracted the average hours of sunshine of the two weeks.

Q8: A good percentage, 24.4%, scored full marks. Such candidates used the symmetry properties of the shape appropriately and used various valid methods to determine angle BAE. Usually, the rest of the candidates scored few or no marks. Various mistakes were evident. Some confused the exterior and interior angles of a polygon. Others considered the given shape as a cyclic quadrilateral while many did not consider the symmetry of the shape.

Q9: The responses on part (i) show that most IIB candidates have not mastered some of the most elementary algebraic procedures. In fact marks were often lost for simplifying $2x-8$ to $-6x$ or else for considering $3x-3(2x+9)$ to be $(3x-3)(2x+9)$.

The most common mistake in part (ii) was to work out $3(-1)^2$ as –3 rather than 3.

Q10: A good number of candidates gave a fully correct response and gained all the marks allotted to the question. But many of the rest gave very poor responses, especially in part (i), suggesting that these candidates have not grasped very basic ideas about volume.

A considerable number of candidates performed well in part (ii).

Q11: Most candidates drew a correct scale diagram in part (i).

In part (ii) only a few candidates managed to read the bearing correctly from their scale diagram.

In part (iii) many candidates made mistakes in changing from cm to km.

Q12: Generally speaking, candidates did well in this question, indicating that they are quite confident in plotting points from a given table. Some candidates had difficulty in plotting a smooth curve.

Part (iii) was more difficult. In their responses, a good number of candidates gave appropriate responses by considering how the graph was changing at birth and after 50 days to find out when the kitten was gaining more weight. However, most candidates did not give suitable explanations.

Q13: A good number of candidates found this question rather easy and managed to obtain full marks. The question involved determining which of two shapes A and B had the larger area.

For shape A the candidates had to divide the area in two or more rectangles so that the rectangles would fill the whole space. Most candidates found no difficulty in working out correctly the area of this shape, but there was a considerable number who used overlapping rectangles, thus obtaining a wrong area.

The area of shape B could be partitioned into a trapezium or into a triangle and a rectangle. Again there was a good response to this part of the question. However a considerable number could not find correctly the area of the trapezium or the triangular part of the area.

Since the question did not specifically ask the candidates to find the required area but simply asked to find out which is the larger of the two areas and to give reasons, there was a considerable number, mostly among the weaker ones, who took a short cut and tried to reason the thing out without doing any number work usually ending up by giving some irrelevant answer.

Q14: The first part of the question involved the finding of two missing values in the spreadsheet. There were a considerable number of good responses to this part of the question but there were many who left out the negative sign in front of one of the missing values.

For the second part the students were asked to write down a formula that can be written in a particular cell. It simply involved the addition of two cells. Very few wrote down a correct formula.

Q15: Most candidates found this trigonometry question rather easy and a good number of students managed to obtain full marks.

Many candidates who did not manage to work out the question correctly had difficulties in using the correct trigonometric function. Mistakes were also observed in rearranging the resulting the resulting formula to determine the unknown side of the triangle.

There were also a number of cases where candidates lost one mark for failing to give the answer correct to one decimal place as required.

Q16: This question turned out to be the easiest question in the IIB paper.

Part (i) involved a simple subtraction everyday problem and the vast majority gave a correct answer.

Most candidates managed to draw the pie chart requested in part (ii) correctly. The examiners noted that some candidates managed to find the correct angles but failed to draw the pie chart correctly, suggesting that these candidates may not know how to use a protractor.

Q17: This question targets very basic understanding of linear equations in one unknown.

Candidates were asked to consider the following three equations: $4(n+20)=4n+80$, $4(n+20)=4n+20$ and $4(n+20)=100$.

In part (i), candidates were required to determine which of the three equations is true for only one value of *n* and to determine this value. In part (ii), they were to choose the equation that is true for many values of *n* and were asked to say something about the values which *n* can take for this equation.

The results were very poor. Very few candidates gave correct responses to this question. Many in fact considered the equation $4(n+20)=4n+80$ to be true for only one value of *n* while they claimed that the equation $4(n+20)=100$ can take more than one value of *n*. Others chose the same equation for both parts (i) and (ii). A substantial number of candidates did not realise that the equation $4(n+20)=4n+20$ does not hold for any value of *n* and somehow they invented a solution to it.

The examiners were pleased to encounter some correct responses, some of them showing trial and error to try to solve the equations in part (i), and substituting various numbers for *n* to show that $4(n+20)=4n+80$ is true for more than one value of *n*.

Q18: Even though this is a standard question about similar triangles, candidates found this question quite hard. Some left the question out completely. In fact, from Table 7, this question ended up having the lowest facility and the lowest number of candidates achieving full marks.

In part (i), many candidates were not able to explain why the two triangles are similar. Some repeated what was given in the first part of the question and then concluded that the two triangles are similar by SAS or ASA. Clearly these candidates are confusing similarity and congruence. Others simply stated that the angles are equal without any further explanation. Candidates sometimes claimed correctly that ∠ABC and ∠AXY or that ∠ACB and ∠AYX but lost some of the marks for not giving reasons to support their claim.

The most common mistake in part (ii) was the use of the length YC (18cm) instead of the side YA (30cm) when using the ratios of sides.

Q19: This question involved a very authentic real life application of percentages; finding the value of a car bought for €8500 after two years, given also that its value decreased by 8% during the first year and by 15% during the second year. It resulted to be of moderate difficulty for the IIB candidates and slightly more than a third of the candidates achieved full marks. The examiners feel that this aspect of the syllabus should continue to be given due importance given its many applications in real life.

A very common wrong method involved using 23% of €8500 (i.e. adding the two percentages together). Others worked out the depreciation for the first year properly, but then worked out the depreciation for the second year as 15% of €8500; that is they depreciated the original value rather than the value at the start of the second year.

Q20: Even though this was quite an original question for IIB candidates, a good number managed to complete it successfully.

In part (i), a common incorrect response was just to join the two points A and B. Instead candidates needed to construct a line which is equidistant from A and B; namely the perpendicular bisector.

Part (ii) involved two questions. In Q20 (ii) (a), candidates were required to find the width on a scale diagram of a path that is 0.80m on land, given also that 1.5cm on the diagram represents 1m of land. The vast majority managed this part question successfully.

Part (ii)(b) involved using the line drawn in part (i) to construct a path 0.8m wide that is equidistant from the two points A and B. Even if part (i) was wrong, many candidates understood that the path must be parallel to the line obtained in (i).

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