UNIVERSITY OF MALTA

SECONDARY EDUCATION CERTIFICATE
SEC

MATHEMATICS
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EXAMINERS' REPORT

MATRICULATION AND SECONDARY EDUCATION
CERTIFICATE EXAMINATIONS BOARD

SEC Mathematics
May 2014 Session
Examiners' Report

Part 1: Statistical Information

Table 1 shows the distribution of grades for the May 2014 session of the examination.

Table 1: Distribution of Candidates by Grade

GRADE	1	2	3	4	5	6	7	U	ABS	TOTAL
PAPER A	289	397	538	378	356			109	20	2087
PAPER B				215	563	559	515	817	293	2962
TOTAL	289	397	538	593	919	559	515	926	313	5049
% OF TOTAL	5.72	7.86	10.66	11.74	18.20	11.07	10.20	18.34	6.20	100

The total number of registered candidates was 5049. Compared to last year, there were 12 more candidates registering for the SEC examination with 10 fewer candidates registering for the IIA and 22 more candidates registering for the IIB paper. This year the number of absentees reached 6.2%, a very high figure when compared to May 2013 when only 3.3% were registered as absent.

Candidates need to be guided in their decision as to whether to sit for the IIA or the IIB paper. As previous examiners' reports have stressed, the 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 Paper I and 98% in Paper IIA. In the case of the IIB candidates, the highest marks on both Paper I and Paper IIB were 91% and 94% respectively.

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 14.1. However, the IIB candidates gave a much weaker performance and only achieved a mean mark of 7.0 marks overall. Some comments about candidates' performance on each individual question in this paper follow.

Q1. Although this was intended to be an easy question, the majority failed to find the order of rotational symmetry of the given shape. Indeed the most common answer for this question was "anticlockwise" or "rotate left".

Q2. Most candidates worked out the LCM of the three numbers correctly. However, a good number of candidates gave 2 as an answer, indicating that they confuse the LCM with the HCF.

Q3. The vast majority of candidates answered this question correctly.

Q4. Most candidates answered this question correctly.

Q5. The question was generally suitably answered by the IIA candidates. However some lost the mark allotted to this question by not simplifying their otherwise correct answer $\frac{10a}{5}$. On the other hand, there were very few correct answers for the IIB candidates.

Q6. The vast majority of candidates answered this question correctly.

Q7. The vast majority of candidates answered this question correctly.

Q8. A good number of candidates chose the correct answer. .

Q9. The question was generally suitably answered by the IIA candidates and many IIB candidates. The most common correct response was $\frac{1}{2}$ or its equivalent.

Q10. Multiplication and division of indices proved to be very difficult for the IIB candidates. The question was either not attempted or a wrong method followed by a wrong answer was written. Few of these candidates gave a correct answer. Failure to apply index laws or to do so inappropriately was often observed even amongst IIA candidates.

Q11. Generally candidates seemed to know how to determine the percentage amount represented by the given sector of the pie-chart. However, many IIB candidates stumbled in their evaluation of the expression $\frac{72\times 100}{360}$.

Q12. The vast majority of IIA candidates gave the correct answer. Many of these used the more efficient method of first factorising the given expression. Others however still managed the correct answer using the longer method of evaluating directly the given expression. On the other hand, few of the IIB candidates realised that they could factorise the expression to make it simpler. Indeed most of the latter candidates did not attempt the question or worked it out incorrectly.

Q13. Most managed a correct response. This was also true for IIB candidates. However a considerable number of candidates did not attempt this question.

Q14. Only a small number of the IIB candidates showed a meaningful attempt to find the gradient of the line generated by the two given points on the Cartesian plane. However, most IIA candidates gave the correct answer, namely 1. A considerable number of candidates were however seen to find difficulty in working with directed numbers. The answer 1*x* given by some candidates suggest that these may know a rote method for working out the gradient of a line, without understanding what a gradient of a line is.

Q15. The question was very difficult for the IIB candidates and moderately so for the IIA candidates. Hardly anyone of the IIB candidates managed to get a correct response using Algebra and, those who got a correct response usually applied the trial and error method.

Q16. The vast majority of candidates answered this question correctly. The most common mistake was to give the cost of the laptop including VAT, whereas the question required the VAT amount to be paid.

Q17. In this multiple choice item, the most common mistake was to choose 1/5 as the number which is not equal to 0.2. Presumably this response proved to be a good distractor because it was the only option that did not include the digit 2.

Q18. Many IIA candidates managed to answer this question correctly. However this was not the case for IIB candidates who were usually not able to multiply the two numbers in standard form. In many IIB scripts there were attempts at changing the numbers into ordinary numbers first and, in most cases, candidates arrived at a wrong answer

Q19. The correct method for working out the percentage loss was seen in many scripts, including those of the IIB candidates. This was followed by a correct answer (40%) for most cases. However, some worked out 12 000 as a percentage of 20 000 correctly but failed to subtract from 100%, thus giving an answer of 60% instead.

Q20. As commented previously for Q12, the IIB candidates did not attempt to simplify the given expression before evaluating. The result was that very few of these candidates managed to get the correct answer and those who did usually used a very long method. The IIA candidates were more apt at simplifying the expression and many gave a correct response. However, a considerable number of candidates were observed to give 50 as an answer instead of 1/50.

2.3 COMMENTS REGARDING PERFORMANCE IN PAPER I – SECTION B

The overall facility of each question in 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 J Section B for the IIA candidates *n* =2067*

Question No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Facility	0.76	0.85	0.85	0.79	0.44	0.49	0.71	0.73	0.42	0.56	0.82
IIA Candidates achieving full marks (%)	42.2	48.8	56.0	58.5	6.7	19.4	17.5	70.4	20.9	38.3	40.3

****n*** stands for the number of candidates who actually sat for the IIA paper

Table 5: Facility of the questions in the Paper I J Section B for the IIB candidates *n* =2669*

Question No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Facility	0.35	0.48	0.40	0.31	0.19	0.16	0.38	0.33	0.18	0.40	0.50
IIB Candidates achieving full marks (%)	4.5	5.4	10.3	7.9	0.4	1.7	2.1	27.1	0.6	13.7	7.8

****n*** stands for the number of candidates who actually sat for the IIB paper

Q1: Generally this question about transformations was suitably answered by the majority of the IIA candidates but many difficulties were evident from the IIB scripts.

In part (i), the candidates were required to enlarge a given shape by 3 about (0 , 0). The majority of candidates managed to enlarge the shape successfully by 3, however, a good number of IIB candidates did not give an enlargement about the required point.

For part (ii) candidates needed to reflect the given shape in the y axis. This proved to be the easiest part of Q1 and was managed correctly by the vast majority of the candidates.

Part (iii) required the students to reflect a shape in the line $y = -x$. The majority of the less achieving candidates found difficulty in identifying the $y = -x$ and could not therefore effect the required reflection.

Part (iv) was the more difficult item. Some of the better achieving candidates lost one of the marks allotted to this question because they gave an incomplete answer. When they came to describe a rotation, they only mentioned the angle of rotation and ignored the centre of rotation.

Q2a: The vast majority managed to solve the equation $3x + 7 = 24$ successfully.

A good number of candidates solved the equation $3(x + 1) - (x - 5) = 10$ successfully; the most common mistake was in the expansion of the second bracket.

The equations $3x = {}^{1}/_{27}$ and $3^x = {}^{1}/_{27}$. proved to be even more difficult to solve.

Q2b: This part question required candidates to solve a pair of simultaneous equations. Many candidates, including a good number of IIB candidates, managed this successfully. Mistakes in the manipulation of algebraic expressions were common, especially when the equations were solved by first making x or y the subject of one equation and then substituting in the other equation.

Q3i: Candidates were asked to find the area of the rectangular base of a reservoir shown in a given diagram. This was an easy question which involved the finding of the area of a rectangle with given measurements. The vast majority worked out the correct answer.

Q3ii The surface area of the four vertical walls of the reservoir was required in this part. Although most candidates found no difficulty, a number of IIB candidates failed to understand what was required and included the area of the base with the four vertical walls. There were others who gave the area of just **two** instead of the required **four** walls.

Q3iii: The first part required the use of Pythagoras Theorem to find the diagonal of the rectangular base of the reservoir. There was a good response; however some of the lower achieving candidates took the wrong side as the hypotenuse.

The second part required the use of trigonometry to find the angle between the diagonal and a side of the rectangular base. Again there was a good response to this part question, even amongst IIB candidates. Indeed the markers noted that some candidates found difficulty with the preceding parts of Q3 but managed the trigonometry part successfully.

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Q4: Part (a) of this question involved geometry and candidates needed to find missing angles in a given diagram using basic angle properties for the triangle and for parallel lines. Many candidates, including most sitting for IIA gave correct answers, showing all working and giving valid reasons for all the steps involved in finding the angles. On the other hand, it was a common mistake to assume that angles AQP, PQC and QCB are right angles, which then led to wrong conclusions. Very often these candidates ignored the fact that PQ bisects angle APC or that angle APQ is equal to angle QPC, even if these angles were both marked in the diagram as "*x*" .

In part (b), most IIA candidates and a good number of the IIB candidates used the appropriate condition (equal angles) to prove the similarity of the two given triangles. A few candidates from the IIA route and many more from the IIB route showed that they did not distinguish between similar and congruent triangles when they tried to use SAS, SAS or SSS as a condition for similarity of triangles.

Q5: This question on statistics proved to be one of the most difficult questions in Paper I. There were three parts to this question which were all based on the same context: a test which was taken by a class of 12 girls and 8 boys and where the mean mark for the girls was 65% and the mean mark for the boys was 55%.

In part (i), candidates needed to find the overall class average mark on the above test. The performance was very disappointing, even for IIA candidates. The most common incorrect method used was just to work out (65 + 55) ÷ 2. A number of candidates were also observed to find 65% of 12 and 55% of 8, add the results and divide by 20. Both methods suggest a procedural approach where candidates plug in numbers into remembered formulae without checking out whether their answers make sense

In part (ii), candidates needed to explain whether the following statement is true within the given context: "The mode for the boys' marks **must be** lower than the mode for the girls' marks." Few candidates gave a correct response, even amongst IIA candidates.

When "No" was given as an answer correctly, very rarely was it followed by a valid explanation. It seems that meaning of "mode" is not fully understood and not much distinction is made between mode and mean. The mode was rarely referred to in the explanation and reference was made only to the mean. The few candidates who gave a valid explanation also gave numerical examples of boys' and girls' marks to substantiate their conclusions.

In part (iii), candidates needed to explain whether the following statement is true within the given context: "A girl **must** have got the highest mark." The explanations given were much better than for Q5ii. A large number of candidates answered "No" correctly. A good number of

IIA candidates and fewer IIB candidates gave valid explanations, mentioning that the lower mean for the boys did not necessarily imply that a boy could not have obtained the highest mark. Quite often these candidates mentioned the fact that one or more of the other boys could have obtained very low marks, thus lowering the mean for the boys.

Q6: This question on household finance turned out to be the most difficult question of Paper IB for the IIB candidates. The facility was relatively low even for the IIA candidates.

The income tax rates for single persons for different earning brackets was given as a table. In part (i), candidates were required to work out the annual tax of a person with €24 700 gross annual pay. For most cases, candidates showed they have no idea of how income tax computation is worked out. This was also true for the IIA candidates.

In part (ii), candidates needed to find the weekly national insurance contribution for a person with €24 700 gross annual pay, given that NI is worked at 10% of the gross pay. This part of the question was answered correctly by a good number of IIA candidates who were, thus, saved from not scoring any marks at all for the whole question. Quite a number of these candidates showed that they were at a loss as to the number of weeks in a year. A whole range of numbers was used such as 48, 56 and 53. The IIB candidates were also prone to difficulties of a linguistic nature; the markers noted a number of cases where the candidates worked out the NI as 10% of the gross salary less tax, even though the question clearly stated that NI is worked out as 10% of the gross salary.

In part (iii), candidates were asked to find the gross **weekly** salary for an income of €24 700 gross annual pay. The question indicated that the **weekly** net salary is the amount that remains after income tax and national insurance are deducted from the gross **weekly** salary. Many IIA candidates managed to score the method marks for this part question even though the numbers from the previous parts of Q6 were incorrect. However few IIB candidates used a correct method for this part question and a considerable number of these candidates did not even attempt the question.

Q7: Although the overall facility for this question was relatively high for both the IIA and the IIB populations, the candidates obtaining full marks on this question was relatively low. This arose because although some parts of the question were easy, others were much more difficult. The question was about determining the cost of printing newsletters at two printing presses where this cost was given in the form of a fixed cost plus a cost for each newsletter printed. One of the printing presses was also offering a 5% discount on the total price.

Parts (i) and (ii) were about finding the costs of printing 560 newsletters at the two printing presses. Most of the IIA candidates and many of the IIB candidates gave a correct response to these part questions. In part (ii), a common error was that the discount offered on the total price by one of the printing presses was ignored.

Part (iii) required candidates to find out how many newsletters can be printed at one of the printing presses for €300. This required more reasoning than the previous parts of the question. However, the majority of the IIA candidates and some IIB candidates managed this part successfully. In a number of cases, IIA candidates tried to use algebra to solve this question but without success.

In part (iv), the candidates were presented with four graphs, each graph depicting the cost of printing newsletters at two printing presses against the number of newsletters to be printed. The candidates needed to explain which of the four graphs represented the data that had been given earlier in the question. This was not an easy question, especially where it came to the justification of their choice. However around 18% of the IIA population and 2% of the IIB population managed this successfully.

Q8: This question required candidates to determine which two of the four given triangles were congruent. They were also expected to justify their choice. From Tables 4 and 5, it is clear that this question registered the highest percentage of candidates obtaining full marks for both types of candidates.

Many candidates made the correct choice of congruent triangles. The IIA candidates usually gave correct justifications for their choice, but fewer of the IIB candidates did so. Indeed for the latter candidates, there were many instances where the candidates appeared to be confusing congruency with similarity and were trying to establish congruency by saying that the angles of the two chosen triangles were equal.

Q9: Many candidates answered part (i) successfully showing that they could follow simple computational instructions written verbally.

In part (ii), candidates were expected to justify the truth of a given relationship for all numbers. A considerable number of IIA candidates correctly applied algebraic notation to do this. However, a number of these candidates incorrectly expanded $5(x + 6)$ as $5x + 6$ and they could not complete the required justification. The majority of the IIB candidates and a good number of IIA candidates did not realize they needed to use Algebra to prove the relationship for all numbers.

Q10. In this question, candidates needed to order the following price reduction options**:**

Four for the price of three; Three for the price of two; 30% reduction; Half price.

Generally the largest reduction was the easiest to identify, next came the smallest reduction. The middle options were more difficult to order and to justify. Even candidates from the IIA route found considerable difficulty in changing between the representations of ratio, fraction and percentage and ended by not comparing like with like. Indeed from Tables 4 and 5, considering the questions in Paper IB, Q10 registered the least difference in performance between the IIA and IIB candidates.

Q11: This question was about probability. Part (i) required candidates to find the probability that when a dice and a coin are tossed together, the result is a head and an even number. Generally IIB candidates found this part very difficult. Although the responses showed they knew the probability of obtaining a head on the toss of a coin and of obtaining an even number on the toss of a dice, they did not know how to use these to find the probability of the combined event. Moreover, few of these candidates used the set of possible outcomes to determine the probability of this compound event. On the other hand, the majority of the IIA candidates managed a correct response to this part.

In Part (ii) of this question, 7 statements about probability were given. The candidates were required to decide whether each of the statements were true or false. The candidates did better on this part question than on the previous part.

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 the Paper IIA ***n*** **=2067***

Question No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Facility	0.5	0.8	0.8	0.6	0.7	0.6	0.4	0.4	0.6	0.5	0.5
IIA Candidates achieving full marks (%)	5.6	46.9	26.0	11.3	13.3	7.1	3.2	9.6	5.7	1.3	8.6

****n*** stands for the number of candidates who sat for the IIA paper

Q1: Part (a): Candidates needed to remove brackets for three different algebraic expressions. The first of these was $3x + 5 \quad 4x - 2$. Most candidates managed the removal of brackets successfully. Some of these lost marks when then went on to equate their result to zero, suggesting that they do not distinguish between an algebraic expression and an equation. The two other expressions to be expanded were $2x^{\frac{3}{2}} + 1 \quad 2x^{\frac{3}{2}} - 1$ and $x - 1 \quad x^3 + x^2$. Few candidates expanded these expressions properly. In the case of the third expression, some candidates who had expanded the brackets correctly obtaining $x^4 - x^2$, then wrote their final answer as x^2.

Part (b): Very few candidates managed to complete the addition of the two algebraic fractions as a single fractions correctly.

Q2: The vast majority gave a correct response to part (a) requiring candidates to change the subject of the given formula. Similarly most candidates gave correct answers to the question involving the solution of a quadratic equation using the formula.

Q3: Many candidates gave a correct response for part (a) involving the computation of compound interest on a sum of money.

Part (b) asked candidates to write the shortest and longest possible length of a shelf which measures 91 cm to the nearest cm. Here candidates did very well. However, part (b) involved another question, this time requiring reasoning about situations where there may be error in measurement. The latter question was found to be more difficult, with candidates at times finding it difficult to explain their reasoning.

Q4: In general, most candidates answered parts (a), (b) and (c)(i) correctly. A few candidates left out the units or used the wrong units in part (a). In part (b), some candidates did not divide the diameter by 2 to get the radius. Quite a number also failed to identify the top surface area of a cylinder as a circle and such candidates usually used the total surface area of the cylinder instead. By using the wrong formula for the top surface area, these last candidates were also unsuccessful in part (c)(i).

Part (c)(ii) was poorly answered. The majority referred to the increase in the overall surface area but only a few referred to the constant height. In addition, a lot of students quoted the wrong formula for the volume of the cylinder. The majority of the students who successfully answered this question, considered a specific value for the height *h* and correctly worked out the change in volume using this fictitious value.

Q5: In part (i), candidates used correctly the conditions for congruency ie. SAS, AAS, RHS or SSS and the majority answered the question successfully. However, many attempting to show congruency using SAS show that they do not appreciate that the condition can only be applied when the angle is included between the two sides.

Part (ii) was generally well answered but a good number of candidates only named one other pair of congruent triangles in the given figure rather than two pairs as requested.

There were many good attempts at part (iii). Few candidates used the easiest method, involving the use of the tangent ratio to find the length of the side of the triangle. Some opted to use other more difficult methods: the sine formula, the cosine formula and the sine ratio followed by Pythagoras theorem. Others used the given diagram as a scale diagram and used this to calculate the required length. Interestingly, quite a few knew that the centroid of a triangle is exactly two-thirds the way along each median, so the radius of the given circle turned out to be 1/3 of the height of the triangle. Such candidates simply multiplied 6 by 3 to find the height and found the side of the triangle using the sine or cosine ratio. A few candidates found the total perimeter of the triangle rather that the length of just one side.

Q6: Part (i) involved the use of the cosine formula on a triangle with sides $x - 2$, $x + 1$ and x. In general, candidates substituted correctly in the cosine formula. They further expanded $(x + 1)^2$ or $(x - 2)^2$ successfully although some simply squared the first and the last term and forgot about the middle term. Mistakes were often made with expanding brackets where two negatives were involved.

For part (ii), most candidates tried to use the formula $A = \frac{1}{2}ab\sin C$ to find the area of the triangle requested. The known angle was angle *A* in this case, so the formula to be used needed to be adjusted to $A = \frac{1}{2}cb\sin A$. Many candidates using this method failed in this step. Some candidates found out the area requested in part (ii) by first working out the perpendicular height using the sine ratio and then proceeded using $A = \frac{1}{2}bh$. The candidates using this method generally gave a fully correct answer to this part question.

Most candidates managed to get full marks on part (iii). They managed to calculate the value of the requested angle usually through using the sine formula. Others used their previous answer for the area of the triangle and found angle *B* by equating to $\frac{1}{2}\ ac\sin B$.

Q7: Most of the candidates worked out correctly part (i) of the question. Using that the amount of water in the mushrooms was 92% of their weight, they calculated 92% of 5kg, 4.6kg, and then subtracted the weight of the water from 5 kg to determine the weight of the dried mushrooms. A few candidates found the weight of the water correctly but then did not subtract from 5kg to obtain the weight of the dried mushrooms when all the water was removed.

The question in part (ii) was one of the most difficult items in Paper IIA and only 3.2% of the IIA population managed a correct solution. This question followed from part (i) and asked for the weight of the same batch of mushrooms when they were partially dried so that their water content is 60% of their total weight. This question was non-routine and needed clear reasoning to identify the correct solution method. Indeed there were many incorrect methods used for the question where the necessary condition about the relative amount of water of the partially dried mushrooms was not respected.

Q8: In finding the length of arc of sector required in part (i) of this question, some candidates worked with a fraction of πr^2 instead of $2\pi r$. Instead of using the given angle of the major sector, some inappropriately used the angle of the minor sector, that is, 144^{o}. Additionally, some candidates ignored the fact that in the question they were asked to give the answer of the arc length in terms of π.

A good number of candidates did not manage to complete part (ii) successfully and appeared to be trying to apply formulae at random to solve the items in this part. However, a good number of candidates gave a correct response to part (ii) (a) where they were requested to find the radius of the cone formed by the sector presented in this question. Usually the method used was to equate the length of sector found in part (i) to $2\pi r$ and solve the resulting equation for *r.* Others found the area of the shown sector and appropriately determined the radius of the cone formed by this sector by using the equation $A = \pi rl$ for the curved surface area of the cone. For part (ii)(b), candidates were required to find the vertical height of the cone. A common mistake here was to confuse the vertical and slanting height of the cone.

In part (iii), the sector presented earlier in the question was cut further and shaped into a frustum of given height. The question here asked for the radius of the smaller circular section of the frustum. This part of Q8 resulted to be much more difficult and only around 10% of the IIA population gave a fully correct solution. For this question, it was necessary to appreciate the geometry of the shape formed when a cross-section is drawn parallel to the base of a cone. Most candidates did not manage this and tried aimlessly at using various formulae which could not help.

Q9: This question was about cutting out the net of an open box with a square base from a piece of cardboard. In part (i), candidates needed to use the given figure to derive the height of the box (*h*) in terms of *x*, the base of the box. Many of the candidates did not manage this part showing an inability to operate with unknowns – even though these same candidates managed successfully other routine algebra items.

In part (ii), candidates needed to derive the formula for the volume of the open box in terms of the unknown base, *x.* Most candidates know that $V = l \times b \times h$ and wrote $l \times b$ as x^2 but failed to complete their answer successfully because in part (i) they did not get a correct value for the value of *h* in terms of *x.* In a number of cases, candidates attempted to justify the equation they were asked to derive, namely $V = x^2\left(15 - \frac{x}{2}\right)$ by plugging in numbers to show that the equation worked in these particular cases.

In part (iii), the great majority of candidates filled the table of values for the graph of $V = x^2\left(15 - \frac{x}{2}\right)$ correctly. The most common mistake was stating that V = 900 instead of $V = 0$ when $x = 30$. Candidates also did very well where it came to plotting this graph.

In part (iv), the majority managed to use their graph successfully to determine the largest possible value of the box. However, many were unsuccessful in part (v) when they came to determine the height of the box where the box had maximum volume. They wrote 20cm which was the value of *x* and not the value of the height *h* requested.

In part (vi), candidates needed to use their graphs to determine the values of *x* which gave a value of *V* that is greater than 1000. Mistakes were sometimes made in writing the inequalities. Many candidates wrote particular values of *x* instead of an interval of values of *x*, the most popular being x = 15cm, 20cm and 25cm.

Q10: This question on statistics with an overall facility of 0.5, registered the lowest percentage of candidates obtaining full marks. Indeed only 1.3% of the candidates attained all the marks allotted to the question.

A cumulative frequency graph representing the total amount in euro spent by 100 teenagers in November was given. Part (i) required candidates to use the given cumulative graph to determine the median, first and third quartiles. Many made mistakes in reading the median, first and third quartiles accurately from the cumulative frequency graph. A good number of candidates decided that there were 120 teenagers presumably because the axis for the cumulative frequency was marked to the value of 120.

In part (ii), most candidates were able to plot the median and quartiles they had found in part (i) on a box-plot. They got marks for this even when their values were inaccurate. However, the vast majority of the candidates made mistakes in representing the extreme values of the distribution on the box-plot. Instead of using the smallest and the least value of the amount spent, they used 0 and 80, the smallest and least value represented shown on the grid where they were expected to draw their box-plot.

In part (iii), candidates needed to compare the box-plot they had produced in part (ii) with another box-plot, drawn on the same grid which represented the amount spent by the same group of teenagers in December. Almost all candidates correctly concluded that the group spent more money in December, with many candidates suitably comparing the means and the quartiles of the two distributions. In their explanations however, a number of candidates appeared to be confusing the range with the interquartile range.

Q11. In question 7, the candidates were presented with two number patterns given in a visual form. The patterns were constituted by successive arrays of black and white dots, a first array, a second array and a third array. Thus, three number sequences arose coming from the distribution of the black dots, white dots and the total number of dots in successive arrays.

In part (i), candidates were required to determine the number of black and white dots in the fourth array. The majority of candidates managed this part correctly.

In part (ii), candidates were asked for the total number of dots in the n^{th} array and to determine how many of these were black. Quite a few candidates did not successfully manage to name *n*th term, but most correctly noted that half of the dots in each array were black.

Part (iii) asked for the value of *n* for which there are 4950 black dots in the array. Most candidates appropriately equated the expression for black dots found in part (ii) to 4950. A considerable number of candidates made mistakes as they attempted to solve the equation using the formula. A few candidates also gave fully correct responses using the completion of the square method or using the factorization method. Most candidates used trial and improvement to get to 99. Some candidates who were not able to work out part (ii) successfully realized that the total number of dots is 4950 × 2 = 9900. Then, since each array had n rows and n + 1 columns of dots, they realised that 9900 = 99 × 100 and concluded appropriately that the value of n must be 99.

Part (iv), carrying 1 mark, was a simple question. This was more intended to help candidates understand the term "sum of integers" used in part (v) of the question. The majority of the candidates gave a correct solution.

In part (v) candidates needed to realise that the 1000th array included 1+ 2 +... 1000 black dots and to use their answer to part (ii) to deduce that the summation of these terms was $\frac{1000(1000+1)}{2}$. Not many candidates managed this question, and many left this part out. By working out the total number of dots instead of only black dots for the 1000th array, some showed a good understanding of the problem but did not manage it completely.

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* = 2670***

Question No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Facility	0.60	0.74	0.39	0.55	0.46	0.30	0.55	0.44	0.26	0.47
IIB Candidates achieving full marks (%)	19.3	47.9	16.0	33.1	17.8	6.7	28.5	22.7	6.6	36.6
Question No	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Facility	0.45	0.14	0.34	0.37	0.41	0.44	0.48	0.55	0.16	0.23
IIB Candidates achieving full marks (%)	23.8	0.4	10.9	34.1	5.9	6.3	10.5	40.7	3.4	0.9

****n*** stands for the number of candidates who sat for the IIB paper

Q1: This multiple choice question involved four parts. The majority answered part (b) correctly, identifying the correct choice of value between –1 and 1. Parts (a) and (c), requiring the conversion of units, were frequently answered incorrectly. Part (d) also proved to be difficult and many candidates did not choose the appropriate option for the area of a football pitch.

Q2: From Table 7, this question turned out to be the easiest question in the IIB paper.

In part (i), candidates were asked to read a scale on a balance. The vast majority gave the correct reading, but a good number of candidates included incorrect units.

In part (ii), most managed the division required to solve the question. However many did not appreciate that, in the given context, the answer needed to be rounded to 3.

Many candidates also managed a successful response to part (iii).

Q3: Part (i) involved the construction of a quadrilateral ABCD. Many did not gain any marks on this question. However, the majority managed the initial part of the construction correctly, starting with drawing a line AB 10cm long, constructing ∠ BAD = 60° and locating D so that AD = 5 cm. Many however got stuck at the stage when they needed to locate the point C so that BC = CD = 7 cm, and appeared not to figure out the need to use compasses to do this.

Another common mistake in this question was observed in part (iii) where many candidates bisected a side of the quadrilateral rather than the required angle.

Q4: From Table 7, this question resulted to be one of the easiest questions in Paper IIB. However, only around 30% achieved full marks on the question overall.

The majority managed correctly part (i) where they needed to find the duration of a given time interval, given the start and end time.

In part (ii), candidates were told that Malta was six hours behind Beijing. They needed to work out the time in Beijing when the time in Malta was 23:30. Most candidates subtracted six hours from the Malta time rather than adding them.

Q5: In part (i), candidates were required to find the speed in km/h where the distance was given in km and the time in minutes. Two common mistakes in this question were to apply the formula for speed incorrectly and to use the time in minutes rather than hours.

Part (ii) was more difficult and some candidates appeared not to have understood the question properly as they were using data from part (i) when this was a completely separate question.

Q6: Candidates were given a map. In part (i), they needed to use the graphic scale on the map to find the distance on the ground represented by 1 cm on the map. A mark was often lost when candidates left their answer as 2.5 cm corresponds to 50 m but did not find the distance corresponding to 1 cm as requested.

In part (ii), many candidates used the map correctly to find the required distance.

As in Q5, many candidates used the speed = distance/time formula incorrectly in their answers for part (iii).

Q7: From Table 7, this question resulted to be one of the easiest questions in Paper IIB. However, only around 30% achieved full marks on the question overall.

In part (a), many candidates used the given diagram correctly to find angle ABC. However some appeared not to understand the notation for angles when they found angle ABD instead of angle ABC.

In part (b), many candidates scored full marks using different correct methods to find the interior angles of the 12-sided polygon. A good number of candidates used an incorrect formula, consequently standing no chance of a correct solution.

Q8: This question presented a context where there were 1000 bulbs and $\frac{1}{25}$ of these bulbs were defective. They were asked to name the ratio of defective to non-defective bulbs. Many candidates correctly found that 40 bulbs was the number of defective bulbs. In determining the requested ratio, a good number of candidates compared the 40 defective bulbs to the total number of bulbs rather than to the non-defective ones as requested.

Q9. In this question candidates needed to draw the net of a prism, shown in a diagram. They were also required to label the diagram with enough measures so that the net, when cut can be folded into the prism.

About half the candidates gained zero marks on this question overall.

For those making a reasonable attempt, mistakes in the relative positioning of the faces were very common. In order to complete this question successfully, candidates also needed to determine the length of one of the edges of the prism through Pythagoras Theorem. Many candidates who managed to draw a reasonable net did not appear to realise this.

Q10: A large number of candidates did not attempt this question. However, many answered this part correctly and used simultaneous equations to find the cost of a cheesecake and a muffin. A good number obtained correct values by using trial and error methods.

Q11: The candidates were given a diagram of a rectangle, the length of whose sides were written in terms of *x*. They were asked to find the perimeter of the rectangle in terms of *x* and to determine the value of *x* when the perimeter is 32. Again many did not attempt the question. However, the majority of those who did gave a correct answer. There were a number of candidates who worked correctly but then stopped once they had found the value of $x = 2$, leaving out the final substitution to give the length of the sides of the rectangle.

Some candidates appeared to be attempting the question in a very procedural manner without having sufficient understanding of algebraic expressions. This occurred when although a correct expression was found for the perimeter, this was equated to something which was completely irrelevant, for example 0 or *x*.

Q12: As can be seen from Table 7, this question was the most difficult question in the IIB paper with fewest candidates getting full marks.

This question involved two similar rectangular pictures. The sides of one rectangle and one side of the other rectangle were known. In part (i) of the question, a good number of candidates realized the need to use ratios to find the missing side. However, there were many candidates who did not use ratios and used inappropriate adding strategies for finding the unknown side.

Part (ii) required candidates to find the length required to frame one of the rectangular pictures. The question required geometric reasoning about how to mount the frame before actually attempting to find the length of framing required. Very few candidates managed to do so appropriately and many did not even attempt to answer the question.

Q13: For this question, candidates needed to compare the steepness of two ramps by deciding which of the two ramps were steeper and to explain their reasoning.

A good number of candidates did not get any marks for this question. However a bigger number of candidates obtained one mark, since they correctly identified ramp B as the steeper ramp but failed to give a good explanation for their choice. Incorrect explanations often involved the use of Pythagoras Theorem. In another common incorrect explanation, the candidates considered that since both the vertical rise and ramp length for ramp B were larger than those in A, then B was steeper.

Some candidates did however come to the conclusion that the vertical rise in B was double that in A, however the ramp length was not, and explained this in words or using ratios. Few candidates attempted to find the angle of elevation of the two ramps to compare their steepness. However, some of those who did attempt this made mistakes in their angle calculations by not considering that the vertical rise of the ramp was in centimetres and the ramp length was in metres.

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Q14: As can be seen in Table 7, 34.1% of the candidates obtained a fully correct response on this probability question. However, most of the others obtained a zero mark, usually by not attempting the question. A few candidates got a partially correct solution by finding the total number of beads, thus missing the last step where they needed to find the number of green beads.

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Q15: This question presented a Bar Chart showing the annual sales of a shoe shop over a number of years and a Pie-Chart showing the distribution of sales for the year 2013 into five categories. Candidates needed to read and interpret information from the two representations.

In part (i), most candidates identified the year when the shop registered the lowest annual sales by using the bar-chart. However, when it came to determining this amount, many made the mistake of ignoring that the Sales axes was labelled in thousands of euro rather than euro.

In part (ii), a good number of candidates worked out the mean annual sales over the requested period from the Bar Chart appropriately. Incorrect answers were attributed to incorrect units for the sales or when candidates determined the mean over all the five years, rather than just the requested period.

In part (iii), candidates needed to use both the Pie-Chart and Bar Graph to work out the amount of sales of women's shoes in 2013. Unlike in previous parts, very few students obtained full marks in part (iii). A number of candidates simply gave the angle from the pie chart and the number of sales in 2013 from the bar chart, but failed to connect the two.

In part (iv), most candidates managed to use the Pie-Chart to work out the percentage of the 2013 sales coming from bags appropriately. However, some candidates were observed to find the total amount of sales for bags in 2013 rather than the requested percentage amount.

Q16: Most candidates managed the substitution in the given formula successfully for part (i).

In part (ii), candidates needed to use the equation of the volume of a sphere to find the radius when the volume was 2000 cm^3. Some did not manage to change the subject of the formula of the given equation appropriately. Others made mistakes in using the calculator to find out the cube root of a number. Indeed some candidates were observed to have found out the square root rather than the cube root.

Q17: This question dealt with successive reductions in the price of a suit originally costing €150.

Part (i): candidates were asked for the cost of the suit when the price is reduced by 40%. Most candidates managed this part successfully.

Part (ii): At a later stage, the cost of the suit was reduced by 30% of the sale price determined in previous part. In this part, candidates were asked to determine the new sale price. Less candidates managed this part successfully, still a good number of candidates did so.

Part (iii): Candidates were here asked for the percentage reduction on the original price of the suit of the final cost of the suit. A good number of candidates managed this part of the question successfully. A common mistake was to consider that the 40% reduction followed by the 30% reduction contribute to a 70% reduction on the original price. These candidates do not appreciate that the whole has changed from the first sale to the second sale and therefore the percentages cannot be added.

Q18: This question tested basic trigonometry procedures; the use of the tangent ratio to find an unknown angle in part (i) and the use of Pythagoras Theorem in part (ii).

As can be seen from Table 7, more than 40% of the candidates achieved full marks on this question. At the same time a very good number of candidates got zero marks, usually leaving the question unattempted.

Part (ii) proved easier than part (i) with more candidates achieving a correct solution.

Q19: The question was about similar triangles. The triangles were drawn within a circle and their angles were not given but could be compared using the circle theorems. It turned out to be a very difficult question with the majority gaining zero marks and very few candidates achieving full marks.

Marks were mostly gained in part (i), where some candidates managed to use the circle theorems to identify one or more pairs of equal angles in the given triangles. However, even these candidates often failed to prove the similarity of the two triangles.

Part (ii) required complex reasoning and proved to be even more difficult than part (i) and very few candidates gained any marks on this part.

Q20: Part (i) required candidates to find the volume of a cylindrical water tank, given its diameter and height. A good number gave fully correct responses to this part but many gave partially correct responses.

The question also explained that this tank is filled from rainwater coming from a rectangular roof of given measurements. Part (ii) asked for the rainfall height which just fills the water tank. Few candidates appeared to understand this question.

2.5 CONCLUDING COMMENTS

Overall, candidates were seen to be much more adept at working on procedural questions, even when these involved work with complex procedures like in using Trigonometry to find unknown sides and angles. The papers included a good number of questions that required making connections, for example by reasoning about the given situations, by connecting results from different topics and by demanding explanations from the candidates. Generally, the performance of most candidates was disappointing on these items involving more reasoning compared to their performance on the more procedural questions involving the application of skills and procedures. Candidates should be exposed to many situations where they can be encouraged and supported to reason about mathematical situations and, hence, better understand the subject.

Chairperson
2014 Examination Panel