UNIVERSITY OF MALTA

SECONDARY EDUCATION CERTIFICATE
SEC

MATHEMATICS

May 2012

EXAMINERS' REPORT

MATRICULATION AND SECONDARY EDUCATION

CERTIFICATE EXAMINATIONS BOARD

SEC EXAMINERS' REPORT MAY 2012

SEC MATHEMATICS

May 2012 Session

Examiners' Report

Part 1: Statistical Information

Table 1 shows the distribution of grades for the May 2012 session of the examination.

Table 1: ***Distribution of candidates' grades for SEC Mathematics 2012***

GRADE	1	2	3	4	5	6	7	U	ABS	TOTAL
PAPER A	312	389	593	393	327			133	18	2165
PAPER B				199	629	595	556	954	261	3194
TOTAL	312	389	593	592	956	595	556	1087	279	5359
% OF TOTAL	5.82	7.26	11.07	11.05	17.84	11.10	10.38	20.28	5.21	100

Part 2: Comments Regarding Candidates' Performance

2.1 Report on Paper 1: Non Calculator Section

Q1: Many candidates answered the first question correctly.

Q2: The majority answered this question correctly. Those who did not answer correctly did so because they did not change the number from standard form to an ordinary number.

Q3: Many of the students found this question difficult. They did not realize that the angle ADC + angle DAB were supplementary angles and all they had to do was to subtract from 180^0.

Q4: The majority of the candidates answered this question incorrectly because they did not find the reciprocal of $1/3$.

Q5: Very few of the candidates gave the correct result for this question. They forgot to multiply 24 by 5 and then subtract the total of the other four numbers from the product.

Q6: The majority of the candidates found no problem with answering this question.

Q7: Many of the students realized that the quadrilateral was in fact a trapezium. Some gave the wrong answer and wrote rhombus.

Q8: Many of the students left the answer as $\frac{x}{2x}$. They forgot to cancel and give the result as a numerical value only.

Q9: Few students gave the correct answer as 3. The majority just divided 125 by 5 and gave 25 as the final answer.

Q10: A number of students just divided 60 by 4 and forgot to multiply their result by 2 to obtain the correct answer.

Q11: Many of the students answered this correctly although a few wrote p.m. instead of a.m.

Q12: Very few of the candidates gave the correct answer. The majority of them just divided €350 by 2 instead of dividing by 5 and multiplying by 2.

Q13: A considerable number of candidates answered this incorrectly and most gave the answer as 1 instead of -1.

Q14: Many of the candidates left this question blank; a sure sign that they found it difficult and could not even attempt answering it.

Q15: The majority of the candidates answered this question correctly.

Q16: Many of the candidates answered this question correctly.

Q17: The majority of the students gave the two prime numbers 23 and 29 and forgot to find the sum.

Q18: Very few candidates answered this question correctly because they used $\pi = 3.142$ and so it was difficult for them to compute. Others used $\pi = 3$ but then left 9.6 as it is rather than approximating it to 10.

Q19: Many of the candidates gave the speed as 1 m/minute rather than per hour.

Q20: Most of the candidates could not compute the simple proportion and gave the result as 9 days rather than 16 days.

2.2 Calculator Section

Question 1:

Many of the candidates who sat for the IIB Paper found part (i) difficult. They did not know how to write a number in standard form. Many of those who attempted the question wrote -4 in the power instead of +4.
Many of those who attempted part (ii) found difficulty in changing 12.3 recurring to a fraction. A good number of the candidates ignored the word *recurring* and treated the number as simply 12.3; hence they obtained the wrong answer.
The majority of the students answered part (iii) correctly. They obtained a correct Lowest Common Denominator and hence a correct result.
Many students answered part (iv) incorrectly because they used a wrong result for $(-3)^3$ and hence they could only obtain part of the marks.

Question 2:

This was a question on Probability involving two six sided dice with the letters A, B, C, D, E and F instead of numbers on each face.

In the first part of the question the candidates were asked to complete the filling of a given diagram showing the possibility space for the occurrence of the events when the two dice are thrown together. This part of the question was made easier by the fact that the given possibility space contained enough entries that made it possible for the students to fill the required spaces, by noticing the patters of the given entries. The vast majority of the candidates managed to fill correctly the whole of the required possibility space.

The second part of the question concerned the calculation of the probability that the two dice show (i) the same letter (ii) two vowels and (iii) a vowel and a consonant. A good number of candidates managed to give the right answers to all three parts of the question while a substantial number did not give the answers as a correct fraction. Example: 6 out of 36 instead of $^6/_{36}$ or $^1/_6$.

Question 3:

Pythagoras Theorem formed the basis of all the three parts of this question.

The first part was an easy question where the candidates had to find the length of one side of a right angled triangle from a given diagram. The lengths of the sides were given as 8 cm and 12 cm for the hypotenuse. An easy question indeed $\sqrt{(144 - 64)} = \sqrt{80} = 8.94427 = 8.94$ (correct to 2 decimal places), and this was reflected in the results obtained namely that almost all the candidates managed to find the third length, correct to the required 2 decimal places.

The second part was similar to the first part where the candidates had to find the hypotenuse of another right angled triangle whose sides were of length 10 cm and the length of the side found in the first part above. Again here no serious difficulties were encountered however a large number of candidates did not obtain the correct rounded answer of 13.42 as required. This was mainly due to the fact that they used $8.94^2 = 79.9236$ instead of 80 thereby obtaining $\sqrt{179.9236}$ instead of $\sqrt{(100 + 80)} = \sqrt{180} = 13.416 = 13.42$ (correct to 2 decimal places as required.

In the third part of the question students were asked to reason out if a particular angle of a triangle in the given diagram was a right angle or not. It involved using the converse of Pythagoras by considering the length of the three sides of the triangle. Although a good number managed to say 'yes', only a considerable number gave the correct reasoning.

Question 4 :

(a) Many students correctly correlated the sides PQ, PR and QR with the perimeter of triangle PQR that is 20cm. Hence students added sides PQ,PR and QR and equated them to 20cm.
Most common mistakes were that students omitted to work out ALL denominators with the LCM. Some candidates forgot to multiply the LCM with the 20.
Another common mistake was that candidates forgot to expand all (x - 4) correctly, frequently forgetting the 4.
(b) a common mistake here was that students tried to use the sum formula to find the value of the 20th term.
(c) some students did not use the sum formula to find the sum of the first 25 squares but tried to list all 25 squares and add them all one by one.

Question 5

In part (i) the majority of candidates scored both marks to find the width of Y.

In parts (ii) and (iii) the most common mistake was in the percentages to find the width of X and to find the width of X. Many candidates mistakenly used 20/100, 80/100, 100/80 instead of 100/120.

In part (iv) candidates gained marks in the last part by using the values of (ii) and (iii).

Note that one should encourage candidates for a better presentation of their work.

Candidates are also encouraged to remember frequently-used formulae such as circumference and area of a circle, length of arc, Pythagoras theorem and to expand brackets correctly.

Question 6:

(i) The majority of students answered correctly the first part of this question. Candidates that scored no marks apparently misunderstood the question and sought to find an appropriate name for the type of symmetry instead of giving *LINE AH* as the answer as was required.

(ii) A good percentage of candidates managed to find the total of the two missing angles. However, some candidates had first calculated the missing angles separately not as was requested. These candidates lost the marks for this section of the question.

(iii) Most of the candidates did very well in this part of the question. Still, some candidates failed to give reasons for their answers failing to obtain full marks for this part.

Question 7:

Most Paper B students found this question hard to answer. They did not understand how to read a spreadsheet at all! Most got only the first accuracy mark for working out the €32. Only a few Paper B candidates worked out this question completely correct, as opposed to the Paper A candidates.

Question 8:

The majority of the students did not have difficulties with the first two parts. Some candidates failed to give both answers in part (ii), giving only $x = 1$ as their final answer. In part (iii) however, few students obtained full marks. The majority stopped at $x(x - k)$. Few students stated that $x = 0$ or $x = k$ and those who did, failed to conclude that $k = 6$. Some students obtained the value of k without factorising.

On a general note, a number of candidates used the last blank page to re-work questions, forgetting that they should not write in the top part of the booklet. As a result, any working on the last page may have been lost.

Question 9:

In part (i), although most candidates did know the formula for finding the area of sector, a considerable number presented the value '12.5cm' as the radius of the sector. They considered AO, or half the value of AB, as the radius of the sector. Other students knew which side pertained to the radius but tried to find it out by Pythagoras' Theorem in the shaded right angled triangle, inventing a value for the side which was not given in the question. Some candidates drew the perpendicular line from O to the chord formed by the sector and associated this with the radius. Others presented OD as the radius, and used Pythagoras' Theorem in triangle AOD to find its value. All these students did not deduce that the length of the side of the square is also the length of the radius of the sector i.e. 25cm.

The vast majority of the candidates presented a correct method for finding the area of the shaded part of the tile in part (ii). A good number of students obtained full marks in part (iii) either by dividing the area of the wall by the area of one tile or by multiplying the number of tiles which fit in the length of the wall by those fitting in its width. Most of those who did not work correctly, failed to convert the units of the tile or of the wall so that they become the same. Other candidates divided the area of the wall by the area found in part (ii), which is not the area of the tile.

Question 10:

This proved to be an easy question for most candidates. Part (i) and part (ii) were done by the majority and they succeeded in writing down the equation involving x and y. Part (i) was found harder to express correctly than Part (ii) although a few used n and s instead of x and y in Part (ii). Many tried Part (iii) and although they knew the method, some made a mistake when multiplying or subtracting. Thus, they lost many marks allotted to this part. Many obtained full marks in this question.

2.3 Paper 2A

Question 1:

(i) This part of the question offered no difficulty to the students.

(ii) The vast majority of candidates were awarded the first method mark for writing down the correct equation $\frac{1}{2}n(n-3)=54$.

Although the resulting quadratic equation $n^2-3n-108=0$ could have easily been solved by factorisation a considerable number of students opted to use the formula to obtain a solution. Others did not even derive the quadratic equation and applied the trial and error method. In such cases, 1 or more method marks (depending on the working shown) were lost.

Question 2:

(i) There was a small but significant number of candidates who evidently did not know how to represent the given information by means of a tree diagram. For the rest of the students full marks were normally awarded. A good number candidates did not write down the fractions in their lowest terms but changed all the probabilities to the same denominator (either 70 or 35).

(ii). Those who worked this part wrongly normally multiplied $\frac{5}{14}$ by $\frac{34}{35}$.

This indicates that although they filled up the probability tree correctly they do not really understand its significance.

(iii) A large number of those who did attempt this last part of the question subtracted the answer for the second part from 1. However, it was evident from the scripts that students find it difficult to work with fractions. A good number of students assumed that those who were not vaccinated caught the flu and thus stated that 2/7 (fraction of students who were not vaccinated) of the students numbered 150 students (those who caught flu) .

Question3:

Candidates performed well in this question. Marks were lost in the third part of the question since a number of students expressed the value of the car after four years (not the final depreciation) as a percentage of the original value, thus giving the answer as 38.4%.

Question 4:

(i) Most of the candidates managed to find the values of f(0) and g(4) but it is incredible how many wrong values were given for the addition of f(0) and g(4), that is, of - 2 + 4. There were a few candidates who equated 0 to $(x^2 - 8)/4$ and 4 to $2\sqrt{x}$.

(ii) Common mistakes for these expressions were writing $\frac{x^2}{2}$ instead of $\left(\frac{x}{2}\right)^2$ and the square root sign only on $4x$ instead of on $(4x + 8)$ and leaving the expressions in terms of y.

(iii) In this part of the question some candidates instead of substituting correctly for f(x) they substituted in x and there were others who substituted f(x) by 0.

(iv) Some candidates tried to solve the equation obtained in (iii) by factorisation.

Question 5:

In questions such as this, it would have been better if the candidates drew the diagram on the script. For example, when candidates are using a right angle and they do not say so; maybe if they draw a diagram they would mark the right angle on it. Very few candidates drew the diagram. Also sometimes the reasons were extra short and were written at random. Two such popular reasons were "alternate segment theorem" and "angles in a triangle".

Question 6:

Most of the candidates managed to write two correct simultaneous equations in x and y but not all of them solved the equations correctly due to many different mistakes in their solutions. Many candidates after obtaining the values of x and y did not write the two possible values for the given fraction.

Question7:

(i) Most candidates realized that they had to use the Cosine formula. However, a large number of them were unable to make cosine B subject of the formula, in most cases getting a value larger than 1, and therefore the angle could not be found. This automatically affected the rest of the question.

(ii) This part of the question was correct in most cases. The most common mistake was the use of Pythagoras' theorem with AB and 2.85cm, where candidates thought that BC was being bisected by the altitude from A.

(iii) A correct method was usually used in this part. Candidates used either ½ base × height or ½ ac sin B.

Question 8:

(i) The majority of the candidates evaluated the volume correctly.

(ii) Many candidates did not understand what the cross-sectional area of the tube is. Some candidates found the volume of the copper tube while others tried finding the surface area of the copper tube. In some cases the candidates added 1 cm to the external radius of the tube (instead of subtracting 1cm).
In parts (i) and (ii) the answers were not always simplified as much as possible in terms of π, or the answers were given in decimal form.

(iii) Quite a few candidates divided the answer obtained in (ii) by the answer obtained in (i), which is obviously wrong as they are dividing an area by a volume.
Many candidates did not just multiply the answer in (ii) by 20 (the length of the tube) but instead they subtracted the internal volume from the external volume. Wrong formulae or wrong methods were used in this case. When an approximation of the decimal forms is used, the

answer is not exactly 1800. Candidates were not always able to consider the correct number of spheres from their result.

Question 9:

(i) Most candidates mentioned equal angles with correct reasons. For angles EFC and EGA some candidates **assumed** that AG and CF are parallel and gave "corresponding angles" as a reason instead of "right angles between tangent and radius".

Quite often candidates showed that they do not distinguish between proofs for congruent triangles and similar triangles and tried to use proofs such as **SAS**. Others tried to use Ratio – Angle – Ratio; Quoting **RAR**, when only one ratio of corresponding sides was given:- AG : CF.

(ii) In general a large number of candidates found it difficult to handle the ratios correctly to find AE. Most of the candidates who found AE = 12cm, correctly used x as an unknown for DE or CD or AE to form an equation and solve it to find x.

Quite often marks were lost by candidates who started incorrectly by taking **AC** instead of **AE** when using ratios, together with AG : CF = 6 : 2.

Some candidates lost all marks for this part of the question as they just **assumed** that **DE= 2cm** without showing any working and went on to give AE= 6 + 2 + 2 + 2 =12cm.

Quite interestingly a few candidates managed to avoid handling the use of ratios associated with similar triangles by drawing a perpendicular line from C to AG to form a right angled triangle with hypotenuse AC = 8cm and one other side equal to (6 – 2) = 4cm. They then used cosine to find the angle at A [= 60°]; then used triangle AGE, using cosine 60° and AG = 6cm, to find AE.

(the angle at A [=60°] was then used as a corresponding angle to find ∠ ECF in (iii)).

(iii) The cosine ratio was used correctly in most cases.

(iv) Instead of finding the area of the triangle ECF directly, using ½ abSinC (the formula is **given**) a good number of candidates took the trouble of finding the length of FE from triangle ECF by using either Pythagoras' Theorem or using tangent of angle ECF.

They then used area of triangle = ½ × base × height.

Question 10:

(i) The area of the flower bed was given correctly as $(28 - 2x)(12 - 2x)$. Then mistakes were made when expanding the brackets; especially giving $4x$ instead of $4x^2$.

Quite often the area of the flower bed was incorrectly given as $(28 - x)(12 - x)$; subtracting the width of the path(x) **only once**.

A good number of candidates who managed to obtain a correct quadratic equation

[$x^2 - 20x + 19 = 0$] complicated the solution by using the **formula** instead of **factorisation** with the risk of ending up with incorrect values for x.

It was very satisfying to note that candidates who did arrive at $x = 19$ or $x = 1$ stated that 19 should be **ignored** as "the path cannot be wider than the garden itself" or other similar valid reasons. Another interesting method used rarely was using the area of the path as:

$2(28x) + 2(12x)$ **– $4x^2$** (**subtracting** the area of the **4 corners**).

(ii) In quite a large number of cases the length (26m) and the width (10m) were given without showing the subtraction of (2 × the answer found in (i)).

2.4 Paper 2B

Overall: Over the years, skills in geometrical constructions, (that had been supported by training in subjects like technical drawing) are being lost. Describing such constructions used to enable students learn how to express themselves precisely in English. In turn, this training served to enhance the students' comprehension of descriptions of structures. It is important that sufficient time is spent on practicing these skills that students usually enjoy acquiring and that cover several mathematical learning goals.

Question 1:
This question tests the number line (integers). The number of floors passed by a lift is a tangible way of understanding subtraction of integers. Errors involved excluding zero as an integer, including the 12^{th} floor and giving the number of floors as a negative integer.

Question 2:
This question involved the estimate of a length in cm. Many candidates ignored the starting point on the ruler. Others expressed the correct result in the wrong units or gave an estimate too rough to be taken into consideration.

Question 3:
This question tested the use of a calculator in working powers, square roots, subtraction and division of real numbers. The errors made in this question were repeated elsewhere in the paper. Candidates must be familiar with the way their own calculator works since differences exist. Most calculators use the BODMAS rule.

However many candidates worked out $\sqrt{(0.732^2 + 4.25)}/1.86$ or $0.732^2 - \frac{\sqrt{4.25}}{1.86}$ instead of $\frac{0.732^2 - \sqrt{4.25}}{1.86}$. Learning how to utilize brackets to isolate expressions, such as the numerator in the above expression, is essential.

Question 4 :
This question involved indices. The expressions of the terms of the form (x^{-2}) were the main sources of error. Calculators were used wrongly and returned x x10^{-2}.

Question 5:
This question involved percentages, the conversion of units of volume, namely litres (*l*) to *ml* and division. The most common errors occurred with respect to the latter concept, as many candidates multiplied instead of dividing.

Question 6:
In this and in other questions throughout the paper, there were candidates who showed no intermediate steps. No marks could be awarded even if the answer given were correct. In this question the cost of delivery had to be subtracted from the amount of money available before dividing by the price of a magnet. Rounding down was required since a full magnet cannot be bought for €1.20.

Question 7:

(i) This question was generally answered correctly by the great majority of the candidates. Amongst the incorrect answers, 280 (i.e. $40 \times 7 = 280$ recurred frequently.

(ii) This problem proved to be very difficult and very few answered it correctly.

(iii) This problem confused many candidates. From those that answered this part of the question correctly few used the algebraic expression obtained in part(ii) to find the numbers of squares needed to form the strip with perimeter 3.6m. Students instead preferred to solve the problem using the trial and error method.

Question 8:

(i) This question was generally answered correctly.

(ii) Very few answered this question correctly. The majority of the candidates either rotated the rectangle obtained in part(i) clockwise through 90^0 or else rotated the given rectangle through 90^o with a different centre of rotation.

Question 9:

(i) Many candidates either left this question unattempted or gave a wrong answer.

(ii) This question was generally answered correctly. Some students preferred to write their answer without showing ant working. A common error was that students evaluated $f(7)$ instead of solving the equation $f(x) = 7$.

Question 10:

The first two parts of this question were quite straightforward and many candidates worked them out correctly. But parts (iii) and (iv) presented some difficulty. In part (iii) few candidates multiplied the frequency with the number of pets to find the mean. In part (iv) most of the students did not divide by 40 to find the probability.

Question 11:

Many candidates left this question unattempted or gave a wrong answer. Many missed the link between parts (i), (ii0, (iii) and (iv).

(i) Few used the correct formula to find the gradient of the line. A common error was that instead of subtracting the coordinates to find the gradient, students added the coordinates.

(ii) Many students just wrote their answer without any working. It was clear, from the results given, that these pupils did not have the vaguest idea how to tackle this problem and may be they preferred to write something rather than omitting the question.

(iii) From those that answered this question correctly, few managed to obtain their answer by using the equation of the line obtained in part(ii). Instead they used the line drawn in part(iv) to find the intercepts.

(iv) Very few managed to plot the correct line.

Question 12:

Most of the candidates who tried this question were penalised because they did not know how to construct a perpendicular line to AB. In fact no construction lines were seen. Also many candidates did not know the basic properties of a rhombus.

Question 13:

Generally speaking, candidates did well in this question which was quite straight forward. In the first part the candidates had to divide €394.99 by using the conversion rate, while in the second part they had to multiply 550.50 francs by using the other conversion rate.

Question14:

This algebraic question deals with making *u* subject of the equation. Quite a large number of candidates had a problem in using the LCM. Also there were some candidates who did not change any sign when moving a letter from the left hand side of the equal sign to the right hand side or vice-versa.

Question 15:

(i) In general candidates drew the diagram of a kite but many failed to label the vertices correctly. Many marked vertex A adjacent to vertex C and vertex B adjacent to vertex D. For this reason a number of students marked 6 cm and 12 cm on the sides of the kite rather than on the diagonals of the kite. A number of candidates drew a rhombus instead of a kite.

(ii) Only a few candidates used a meaningful method to find the area of the kite. In general the candidates just multiplied the values 6 cm and 12 cm.

Question 16:

(i) Most of the candidates obtained the correct answer. Some found the fraction of fans wearing a red or white T-shirt but failed to carry out the subtraction from one whole to obtain the final answer. A significant number of students attempted to work out $\frac{2}{5}+\frac{1}{3}$ without using a common denominator thus obtaining a wrong answer.

(ii) Some candidates equated 612 to $\frac{2}{5}$ and used proportionality to find the number of fans represented by one whole. Others found the number of fans represented by $\frac{1}{3}$ (white) and $\frac{4}{15}$

(other) and added these values to 612 to find the total number of fans. A considerable number of students worked out $\frac{2}{5}$ of 612 and failed to obtain the correct answer.

Question 17:

(i) Few candidates obtained a correct diagram showing the path XY of the cruise-liner. A number of candidates marked X instead of the North rather than at the starting position, while a few did not label points X and Y at all. In some cases the 240° bearing was marked correctly but not accurately drawn. In other cases the 240° angle was measured in an anticlockwise direction.

(ii) In general candidates tried to apply the scale chosen for part (i) to answer this question; however many failed to use the scale ratio correctly to obtain the actual distance.

(iii) A significant number of candidates managed to obtain the correct answer.

Most candidates applied trigonometry correctly to find how far west the cruise linear has travelled. Others applied the wrong value for the angle inside the triangle they were using and hence failed to obtain the correct answer.

Question 18:

Few students worked out question 18 perfectly correct – using RHS or AAS for congruency. Many tried to show congruency

(i) by using SSS but failed to give a valid reason for AE = AC;
(ii) using SAS but still lack the knowledge that the angle should be an included angle – and that not any angle will do!
In addition, many students still confused similarity with congruency, attempting to show congruency using AAA.

Question 19:

(i) The students who failed this question quoted the wrong formula for the volume of the cylinder.
(ii) Many students divided the answer obtained in (i) by 5cm rather than by the volume of one cube! Also, the candidates who worked this part correctly, mistakenly rounded their answer to 38 cubes.

Question 20:

(i) In general, the students answered this question correctly, gaining 2 marks in most cases.

(ii) This question, however, was poorly answered. The few who worked out this part successfully used the *actual* radius of the pool and worked out in metres straight away. The majority however preferred to use the dimensions given in the photo and worked in centimetres instead … wrongly multiplying $\pi(2.15)^2$ by 2 so as to convert cm^2 to m^2.

(iii) Many candidates successfully worked out this part. Many others, however either failed to comprehend the meaning of perimeter or forgot to multiply 27cm by 2 so as to convert to m. In general, the vast majority multiplied by 39c but mistakenly gave their answer as €2106 or €2100.

Chairperson

Board of Examiners

July 2012