Aga Khan University Examination Board
Notes from E-Marking Center on SSC I Mathematics Examination
May 2013

Introduction

This document has been produced for the teachers and candidates of the SSC Part I (Class IX) course in Mathematics. It contains comments on candidates' responses to the 2013 Secondary School Certificate (SSC-I) Examination, indicating the quality of the responses and highlighting their relative strengths and weaknesses.

This document should be read along with the AKU-EB Mathematics Examination syllabus based on the National Curriculum (2006).

General Comments

Teachers and candidates should be aware that examiners may ask questions that address the Student Learning Outcomes (SLOs) in a manner that requires candidates to respond by integrating knowledge, understanding and application skills they have developed by studying the course.

Candidates need to be aware that the marks allocated to the questions are related to the answer space provided on the examination paper as a guide to the length of the required response. A longer response will not in itself lead to higher marks. Writing far beyond the indicated space may reduce the time available for answering other questions.

Candidates need to be familiar with the command words in the Student Learning Outcomes which contain terms commonly used in examination questions. However, candidates should also be aware that not all questions will start with or contain one of the command words. Questions such as 'how?', 'why?' or 'to what extent?' may also be used.

Candidates are recommended to read the questions carefully and write all essential steps clearly. Generally, candidates who write all necessary steps, make fewer mistakes. It is also recommended that rough work related to a particular question should be included in the answer booklet because it enables the examiner to assess or to get an insight of the candidates' thinking process.

Detailed Comments

Question 1

The question offered a choice between part a and b. Candidates chose to attempt both parts equally.

Question 1ai

If $\overline{w} = -2 - i$ is a complex number, then find w

This is purely a knowledge based question.

Better responses exhibited that the candidates had clear concept of conjugate of a complex number.

Average responses showed that even though the candidates had changed the sign of imaginary number; they also changed the sign of real number, which was unnecessary and as a result they were unable to reach the required answer.

Weaker responses exhibited that some of the candidates were unable to comprehend how to write a complex number if it's conjugate is given.

Question 1aii

$\overline{w} \div w$

The question was related to the division of complex numbers.

Better responses showed that the candidates correctly divided the complex numbers in order to get the correct answer.

Average responses exhibited that even though the candidates had attempted to solve the question but because of mistakes committed in part i, they were unable to get the correct answer.

Weaker responses showed that the candidates could not solve the question as they were unable to comprehend the question in part i.

Question 1b

Evaluate $\sqrt[3]{512} + \frac{64}{\sqrt{64}} \times \sqrt[3]{10^6} - 16$

Better responses showed that the candidates applied the law of exponent because of which they calculated the correct answer.

Average responses showed that the candidates even though applied the law of exponent correctly but made mistakes in simplification and hence they were unable to reach the required answer.

Weaker responses exhibited that the candidates made mistakes in applying the laws of exponent as well as in simplifying the terms and wrote $\sqrt[3]{512} = \left(8^3\right)^3$ instead of $\left(8^3\right)^{1/3}$ which led to the incorrect answer.

Question 2

The question offered a choice between part a and part b. Most of the candidates attempted part b.

Question 2a

Given that $A = \{x \mid x \text{ is an integer greater than or equal to zero}\}$.
Write set B whose elements are x^2, where $x \in A$. Also find $A \cup B$ and $A \cap B$.

Better responses reflected that the candidates understood the question and hence they were able to get the correct answer.

Average responses showed that some of the candidates wrote the set *A* however others only mentioned $\{0,1,2,3,4,5,6,7,8,9,10\}$ instead of $\{0,1,2,3,4,.....\}$ which was incorrect and as a result they could not match the desired result.

Weaker responses showed that the candidates could not comprehend the question and were unable to go further in order to get the correct answer.

Question 2b

If $T = \{0, \phi\}$ and $R = \{\phi\}$, then find $[T \cup (T - R)] \cap (R - T)$.

Better responses reflected that the candidates had clear concept of operations of union, intersection, difference so that they were able to get the correct answer.

Average responses showed that the candidates attempted to solve the question but unfortunately committed a mistake and wrote $R - T = \{\phi\}$ instead of $R - T = \{\ \}$and as a result they could not reach the correct answer.

Weaker responses demonstrated that the candidates had a lack of conceptual understanding in difference of sets. It was also seen that candidates were confused in writing the empty or null set as they wrote $\{\phi\}$ instead of $\{\ \}$which led to an incorrect answer.

Question 3

If $\log_a \sqrt{(m - 2)} = 1$, then find m in terms of a, where $a > 0$ and $a \neq 1$.

The question was simple and majority of the candidates attempted the question very well. They converted the logarithmic form into exponential form and also showed the relationship between *a* and *m*.

Better responses exhibited that the candidates had good conceptual understanding and hence they solved the question to arrive at the correct answer.

Average responses showed that even though the candidates successfully converted the logarithmic form into exponential form i.e. $\sqrt{m - 2} = a$ but after that it was seen that fewer candidates were able to make the relationship between *a* and *m*.

Weaker responses reflected that the candidates made mistakes in converting the logarithmic form into exponential form as they wrote $\sqrt{m - 2} = 1^a$ which was incorrect, some of them wrote $1^a = a$ which was also incorrect.

Question 4

There was a choice available in part a and part b. Most of the candidates opted part b.

Question 4a

Show that $1 - \dfrac{\sqrt{a}}{1+\sqrt{a}}$ can also be written as $\dfrac{1-\sqrt{a}}{1-a}$.

Better responses showed that the candidates did well to simplify the expression first and then took the conjugate correctly, thus they were able to reach the required answer.

Average responses showed that some of the candidates made mistakes in simplifying the expression as they wrote $1 - \dfrac{\sqrt{a}}{1+\sqrt{a}} = \dfrac{1-\sqrt{a}}{1+\sqrt{a}}$ instead of $1 - \dfrac{\sqrt{a}}{1+\sqrt{a}} = \dfrac{1}{1+\sqrt{a}}$ which was incorrect, hence they managed to take the correct conjugate for rationalizing the expression but as they committed a mistake earlier so they could not reach the desired result.

Weaker responses showed that the candidates did not understand the question and hence they were unable to reach the correct answer.

Question 4b

If $3pq = -15$ and $(p-q)^3 = 216$, then find the value of $p^3 - q^3$.

Better responses showed that the candidates used the formula $(p-q)^3 = p^3 - q^3 - 3pq(p-q)$ correctly in order to achieve the value of $a^3 - b^3$. It was also seen that some candidates used very different and innovative method to solve the question which was very appreciable.

Average responses reflected that the candidates even though used the formula correctly but made a slight mistake in writing the formula as they wrote $(p-q)^3 = p^3 - q^3 + 3pq(p-q)$ instead of $(p-q)^3 = p^3 - q^3 - 3pq(p-q)$ so that they were unable to get the correct answer although completed the solution accordingly.

Weaker responses showed that the candidates were unable to use or apply the formula correctly and made mistakes in expanding the formula as they wrote $(a-b)^3 = a^3 - b^3$ which led to the wrong answer.

Question 5

There was a choice available between part a and part b. Majority of the candidates opted part a.

Question 5a

Find the possible values of p, if $(px - p)$ is divided by $\left(x - \frac{4}{p}\right)$ and the remainder is $p^2 - p$.

Better responses demonstrated that the candidates understood the question and then solved accordingly in order to achieve the required values of *p*.

Average responses showed that the candidates were able to formulate the equation $p^2 - p = 4 - p$ but were not able to write the possible values of *p* as they just managed to write only one value of *p* i.e. the equation they achieved $p^2 = 4$ and wrote $p = 2$ instead of $p = \pm 2$ which led to an incomplete answer.

Weaker responses reflected that the candidates had lack of understanding of the concept in remainder theorem, so that they were unable to go further.

Question 5b

Factorize $25a^6 - 25b^6$ completely.

Better responses showed that the candidates had taken 25 as common from $25a^6 - 25b^6$ and then correctly applied the formula of $(a^3 \pm b^3)$ and $a^2 - b^2$, thus they were able to achieve the required result.

Average responses showed that the fewer candidates had taken 25 as common from $25a^6 - 25b^6$ but were unable to use the formula of $(a^3 + b^3)$ effectively as they made mistake in writing i.e. $a^6 - b^6 = (a^3)^3 - (b^3)^3$ which was incorrect and as a result could not go further.

Weaker responses showed that the candidates could not comprehend the type of factorization so that they were unable to get the answer correctly.

Question 6

The question offered a choice between part a and part b. Majority of the candidates attempted part a.

Question 6a

If $\sqrt{y} \propto \sqrt{x}$ and $y = x = a^2$, then find the equation connecting x and y. Hence, find the value of y when $x = \frac{a^2}{4}$.

Better responses showed that the candidates correctly wrote the relationship between the variables so that they were able to get the required value of y.

Average responses exhibited that the candidates even though wrote the correct relationship between the variables but did not find the value of *y*.

Weaker responses showed that the candidates were unable to formulate the relationship between the variables and just managed to substitute the value of *x* in the equation to get the value of *y* which led to an incomplete solution.

Question 6b

If $\frac{c}{p} = \frac{d}{q} = \frac{e}{r}$, then show that $\frac{c+e}{p+r} = \frac{c+d}{p+q}$.

Better responses showed that the candidates applied K-method very effectively in order to prove the required result.

Average responses showed that the candidates started by using K-method but later on it was seen that some of the candidates substituted a numerical value in place of K in order to get the required proof, although candidates gained the marks but in such type of questions they needed to prove in terms of K rather than to take any numerical value.

Weaker responses showed that the candidates could not understand the question and as a result they were unable to go further in order to prove the required result.

Question 7i

Given that the matrix $M = \begin{bmatrix} \frac{3}{2} & -1 \\ P & 2 \end{bmatrix}$ and $N = \begin{bmatrix} 1 & 3 & 1 \\ 2 & 3 & 2 \end{bmatrix}$.

Find the determinant of the matrix *M* in terms of *p*.

Better responses showed that the candidates understood the question and found the correct determinant in terms of *p* which led to the required answer.

Average responses exhibited that some of the candidates even though found the determinant in terms of *p* but made sign mistake as they wrote $3 - p$ instead of $3 + p$ and as a result they were unable to gain marks. It was also seen that very few candidates did not write anything in the answer space.

Weaker responses reflected that the candidates even though found the determinant in terms of *p* but had mistakes in simplification as they wrote $3 + p$ equals to $3p$ which was incorrect so that they could not get the required answer.

Question 7ii

If *M* is a singular matrix, then find the value of *p*.

Better responses exhibited that the candidates had good concept of singular matrix and also found correct determinant in part i so that they were able to get the required value of *p*.

Average responses reflected that the candidates even though found the value of *p* but just because of sign mistake in part i, they were unable to find the value of correct value of *p*. As mentioned in part i, very few candidates did not write anything in the answer space but they successfully found the determinant and the value of *p* in this question.

Weaker responses showed that the candidates could not find the correct value of *p* as they were unable to get the correct determinant in part i.

Question 7iii

Find if possible the transpose of the matrix $N \times M$ .Give a reason to support your answer.

Better responses reflected that the candidates had good concept of matrix multiplication and transpose of a matrix so that they easily managed to get the correct answer.

Average responses showed that the candidates gave the answer i.e. matrix NM is not possible, but were unable to write a reason to support their answer which led to an incomplete answer.

Weaker responses exhibited that that the candidates neither wrote the answer nor gave the reason.

Question 7iv

Why can the determinant of the matrix N NOT be determined?

Better responses reflected that the candidates had good concept of matrix and determinant so that they were easily managed to write a correct reason.

Weaker responses exhibited that that the candidates did not give the reason.

Question 8

Fill in the missing entries in the given table. Hence, find the arithmetic mean for the given data.

Marks	**Number of Candidates**	**Class Mark (x)**	**f x**
1 – 5	9	3	
6 – 10	13	8	104
11 – 15		13	195
16 – 20		18	
21 – 25	27	23	621
Total	**100**		**1595**

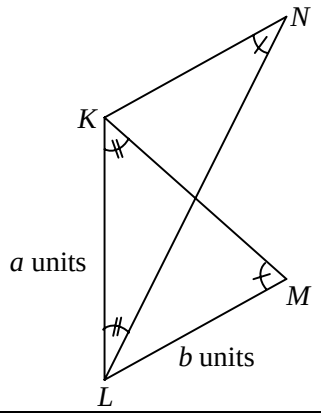
Better responses showed that the candidates completed the given table correctly and thus they were able to find the mean of the given data.

Average responses showed that some of the candidates just managed to complete the table, but were unable to find the mean of the given data which was actually required.

Weaker responses showed that the candidates although filled the table but it was seen that the entries filled by the candidates were incorrect and as a result they could not find the correct mean. It was also seen that few candidates wrote an incorrect formula of mean which definitely led to an incorrect answer.

Question 9

Given that ΔLKM is congruent to ΔKLN as shown in the diagram. Find $m\ \overline{KM}$ and $m\ \overline{NL}$ if the sum of all the sides of the ΔKLN is 15 units. Also give reasons for all the necessary steps.



Better responses demonstrated that the candidates understood the given condition and found the correct value of $m\overline{KM}$ and $m\overline{NL}$ followed by a correct reason in order to justify the answer.

Average responses reflected that the candidates even though used the given condition very effectively in order to get the correct answer but were unable to give a reason to justify the answer. It was also seen that few candidates used the numerical value of *a* and *b* to get the answer which was neither the correct way to solve nor the question demanded.

Weaker responses showed that the candidates could not grasp the question, thus they were unable to justify their answer accordingly.

Question 10

The question offered a choice between part a and part b. It was seen that the candidates equally attempted both parts.

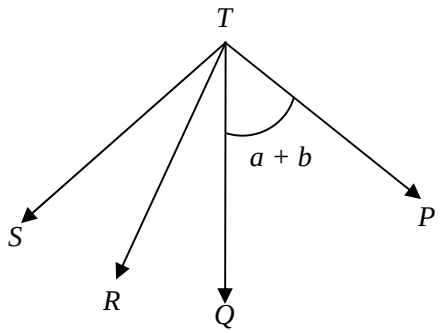
Question 10a

Given that TQ and TR are the angle bisectors of $\angle STP$ and $\angle STQ$ respectively, as shown in the diagram, find

i. $m \angle STR$

ii. $m \angle STP$

Give a reason for each of your answers.



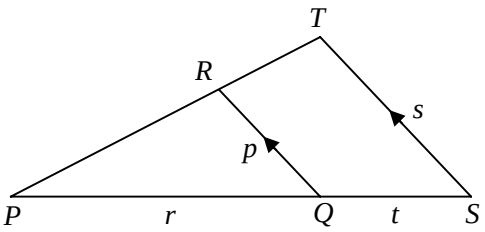
Better responses demonstrated that the candidates understood the condition of angle bisector and found the correct value of $m \angle STR$ and $m \angle STP$ followed by a correct reason in order to justify the answer.

Average responses reflected that the candidates used the condition of angle bisector very effectively in order to get the correct answer but were unable to give a reason to justify the answer. It was also seen that few candidates used the numerical value of a and b to get the answer which was neither the correct way to solve nor the question demanded.

Weaker responses showed that the candidates could not understand the concept of angle bisector so that they were unable to get the answer or reasons to justify their solution.

Question 10b

The given diagram shows $\Delta\ PRQ$ is similar to $\Delta\ PTS$.



Comprehend the diagram and complete the following statements.

i. $m\angle\ PRQ$ is equal to

ii. $\Delta\ RPQ$ is similar to

iii. $\frac{PR}{PT}$ is equal to

iv. $\frac{p}{s}$ is equal to

Better responses exhibited that the candidates comprehended the diagram so that they were able to find the correct answer.

Average responses showed that the candidates understood the question but made some mistakes as they wrote $\angle\ PRQ\ =\ \angle\ PST$ instead of $\angle\ PRQ\ =\ \angle\ PTS$ and $\frac{p}{s}\ =\ \frac{r}{t}$

instead of $\frac{p}{s}\ =\ \frac{r}{r+t}$.

Weaker responses reflected that the candidates did not have any idea about the similar triangles so they were unable to give the answer.

Question 11

Draw an equilateral triangle ABC whose one side measures 5 cm. Hence, draw any TWO altitudes of the triangle.

Better responses showed that the candidates effectively constructed the triangle and drew the altitudes of a triangle as well.

Average responses showed that the candidates even though constructed the triangle but it was seen that some of the candidates made mistakes in drawing an altitude of a triangle as they drew perpendicular bisectors instead of altitude of a triangle.

Weaker responses showed that the candidates were unable to construct the triangle with the help of the given measurements, thus they could not go further in order to get the required result. In some cases it was seen that the candidates just managed to draw a line $AB = 5$ cm.