Aga Khan University Examination Board

Notes from E-Marking Centre on SSC-I Mathematics Examination May 2018

Introduction:

This document has been produced for the teachers and candidates of Secondary School Certificate (SSC) Part I (Class IX) Mathematics. It contains comments on candidates' responses to the 2018 SSC - I Examination, indicating the quality of the responses and highlighting their relative strengths and weaknesses.

E-Marking Notes:

This includes overall comments on students' performance on every question and *some* specific examples of students' responses which support the mentioned comments. Please note that the descriptive comments represent an overall perception of the better and weaker responses as gathered from the e-marking session. However, the candidates' responses shared in this document represent some specific example(s) of the mentioned comments.

Teachers and candidates should be aware that examiners may ask questions that address the Student Learning Outcomes (SLOs) in a manner that require candidates to respond by integrating knowledge, understanding and application skills they have developed during the course of study. Candidates are advised to read and comprehend each question carefully before writing the response to fulfil the demand of the question.

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. Candidates need to be familiar with the command words in the SLOs 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.Words such as 'how', 'why' or 'what' may also be used.

Key observations:

This year candidates did not perform well in questions based on properties of similar triangles, and parallelogram.They had problems with logarithms and variations. On the other hand, candidates performed well on questions related to complex numbers, algebraic manipulation, matrices, and construction of medians of a triangle.

Detailed Comments:

Constructed Response Questions (CRQs)

Question 1:

This question offered a choice between part **a** and part **b**. Part **a** was comparatively well attempted by candidates.

> **Question 1a:**
>
> Simplify the following and express it in the lowest exponential form.
>
> i. $\dfrac{a^2 b^3}{\left(ab^3\right)^5}$
>
> ii. $a^0 \times a^{\frac{3}{4}} \times a$

Better responses used the laws of exponents $(ab)^n = a^n b^n$ and $\dfrac{a^m}{a^n} = a^{m-n}$ quite smartly which indicated the clarity of concepts. As a result they were able to simplify and got maximum marks.

Example:

i. $\dfrac{a^2 b^3}{(ab^3)^5}$

Sol

$= \dfrac{a^2 b^3}{a^5 b^{15}}$

$= a^{2-5} b^{3-15}$

$= a^{-3} b^{-12}$

$= \dfrac{1}{a^3 b^{12}}$

$= \dfrac{1}{(a b^4)^3}$

ii. $a^0 \times a^{\frac{3}{4}} \times a$

$= a^0 \times a^{3/4} \times a$

$= 1 \times a^{3/4 + 1}$

$= a^{\frac{3}{4} + 4/4}$

$= a^{\frac{3+4}{4}}$

$= a^{7/4}$

Weaker responses exhibited that the candidates were unable to use the laws of exponents in a desirable manner. It was seen that fewer candidates wrote incorrectly for $\left(ab^3\right)^5$ i.e. $\left(ab^3\right)^5 = ab^8$ instead of $\left(ab^3\right)^5 = a^5 b^{15}$. Finally, they could not find the required result. A few candidates were confused in taking LCM as well as they wrote just a instead of $a^{\frac{7}{4}}$ for $a^{\frac{3}{4}+1}$.

Example:

i. $\dfrac{a^2 b^3}{\left(ab^3\right)^5}$

$$\frac{a^2 \; b^3}{a^5 \; b^{15}}$$

$$= a^3 b^{12}$$

ii. $a^0 \times a^{\frac{3}{4}} \times a$

$$a^0 \times a^{\frac{3}{4}} \times a$$

$$a(1 \times 1^{3/4} \times 1)$$

$$a(1^{3/4}) = a^{3/4}$$

Question 1b:

Separate the real and imaginary parts of $\dfrac{(2-i)^2}{1+i}$.

Better responses correctly applied the formula of $(a-b)^2$ in order to expand $(2-i)^2$. In addition, they were able to take the complex conjugate and then simplify the rational fraction easily which led to the correct answer.

Example:

$$\Rightarrow \frac{(2-i)^2}{1+i}$$

$$\Rightarrow \frac{(2)^2-2(2)(i)+(i)^2}{1+i}$$

$$\Rightarrow \frac{4-4i+i^2}{1+i}$$

$$\Rightarrow \frac{4-4i+(-1)}{1+i}$$

$$\Rightarrow \frac{4-4i-1}{1+i}$$

$$\Rightarrow \frac{4-1-4i}{1+i}$$

$$\Rightarrow \frac{3-4i}{1+i}\times\frac{1-i}{1-i}$$

$$\Rightarrow \frac{1(3-4i)-i(3-4i)}{(1)^2-(i)^2}$$

$$\Rightarrow \frac{3-4i-3i+4i^2}{1-i^2}$$

$$\Rightarrow \frac{3-7i+4(-1)}{1-(-1)}$$

$$\Rightarrow \frac{3-7i-4}{1+1}$$

$$\Rightarrow \frac{3-4-7i}{2}$$

$$\Rightarrow \frac{-1-7i}{2}$$

$$\Rightarrow \frac{-1}{2}-\frac{7}{2}i$$

Real part $= \frac{-1}{2}$

Imaginary part $= \frac{7}{2}$.

Weaker responses failed to expand $(2-i)^2$ as they wrote $4-i^2$ instead of $4-4i+i^2$ which showed the lack of understanding. Furthermore, they were unable to take the complex conjugate correctly resulting in loss of marks. It was also seen in fewer responses that candidates started off well to expand $(2-i)^2$ and writing complex conjugate but failed to simplify the rational fractions due to which they could not reach the required answer. In addition, minor errors in simplification were also frequent.

Example:

$$\frac{(2-i)^2}{1+i} = \frac{(2)^2-2(2)(i)-(i)^2}{1+i}$$

$$\frac{4-4i+(i^2}{1+i} = \frac{4-4i+1}{1+i}$$

$$\frac{5-4i}{1+i}$$

Re $= \frac{5}{1}$ Imaginary $= 4i$

Question 2:

This question offered a choice between part a and part b. Both Part a and part b were equally and well attempted.

Question 2a:

If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ is a universal set, $A = \{1, 2, 3, 4, 5, 6\}$ and $B = \{2, 4, 6, 8, 10\}$, then show that $(A \cup B)' = A' \cap B'$.

Better responses revealed good understanding of operations of union and intersection on sets. They were able to find $A \cup B, A \cap B$ correctly and took complement of the set accordingly. Majority of the students did well to achieve the required result.

Example:

L·H·S

$A \cup B = \{1,2,3,4,5,6\} \cup \{2,4,6,8,10\} = \{1,2,3,4,5,6,8,10\}$

$(A \cup B)' = \{1,2,3,4,5,6,7,8,9,10\} - \{1,2,3,4,5,6,8,10\}$

$= \{7,9\}$

R·H·S

$A' = \{1,2,3,4,5,6,7,8,9,10\} - \{1,2,3,4,5,6\} = \{7,8,9,10\}$

$B' = \{1,2,3,4,5,6,7,8,9,10\} - \{2,4,6,8,10\} = \{3,5,7,9\}$

$A' \cap B' = \{7,8,9,10\} \cap \{3,5,7,9\}$

$= \{7,9\}$ Hence, proved L·H·S = R·H·S

Weaker responses exhibited vague understanding of taking union and intersection on sets. It was seen that the candidates failed to take the complement of sets which led to an incorrect answer.

Example:

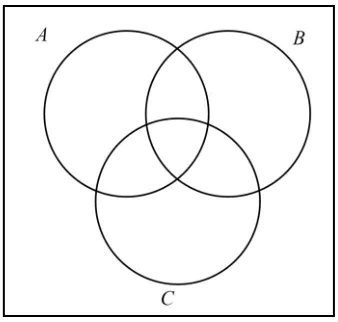
L·H·S : $(A \cup B)'$	
$[(1,2,3,4,5,6) \cup (2,4,6,8,10)]$	$= B' = [1,3,5,7,9]$
$= (1,2,3,4,6,8,10)$	$A' \cap B' = [7,8,9,10] \cap$
$= (A \cup B)' = [1,2,3,4,5,6,7,8,9,10] - [1,2,3,4,6,8,10]$	$[1,3,5,7,9]$
$= [5,7,9]$	$= [5,7,9]$
R·H·S $= A' \cap B'$	
$= A' = [1,2,3,4,5,6,7,8,9,10] - [1,2,3,4,5,6]$	
$= [7,8,9,10]$	
$B' = [1,2,3,4,5,6,7,8,9,10] - [2,4,6,8,10]$	

Question 2b:

Sets A, B and C are defined as follows.

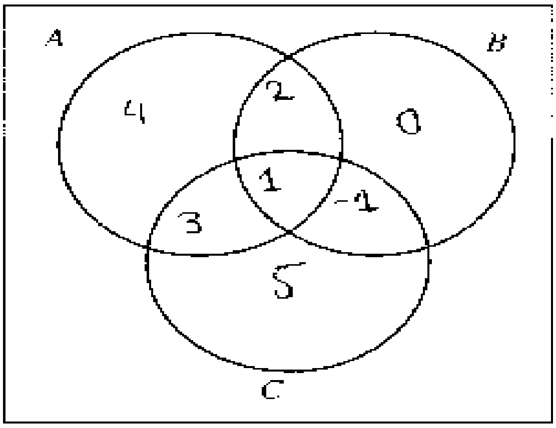
A = {1, 2, 3, 4}
B = { − 1, 0, 1, 2}
C = {−1, 1, 3, 5}

Place the elements of sets A, B and C in the given Venn diagram.



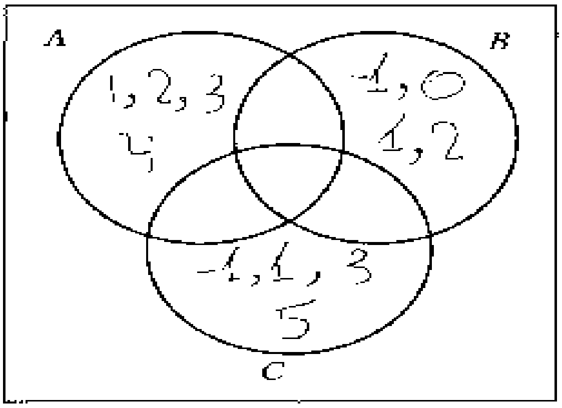
Better responses exhibited that candidates were able to understand the question and placed the elements of the given sets accordingly in the Venn diagram.

Example:



Weaker responses demonstrated that candidates did not understand the question as they were unable to place the elements of the given sets in the desired region of Venn diagram.

Example:



Question 3:

Find the value of x for $\log_6 1 + \dfrac{\log_6 216}{\log_6 36} = x$.

This was not a well attempted question.

Better responses did well to understand the question and used the laws of logarithm accordingly. As a result, they found the correct answer though very few candidates solved it correctly.

Example:

$$\Rightarrow \log_6 1 + \frac{\log_6 216}{\log_6 36} = x$$

$$= 0 + \frac{\log_6 (6)^3}{\log_6 (6)^2} = x \qquad \therefore x = \frac{3}{2}$$

$$= \frac{3 \log_6 6}{2 \log_6 6} = x$$

$$= \frac{3(1)}{2(1)} = x$$

$$= \frac{3}{2} = x$$

Weaker responses revealed it to be the most difficult and challenging question the candidates have ever faced. Most of the candidates were unable to use the laws of logarithm. As a result, they did not reach the required answer.

Example:

$$\log_6 1 + \frac{\log_6 216}{\log_6 36} = x$$

$$\log_6 1 + \frac{3\log_6 6}{2\log_6 6} = x$$

$$\log_6 1 + (6)^3 \div (6)^2 = x \quad \text{Ans}$$

Question 4:

This question offered a choice between part **a** and part **b**. Majority of candidates chose part **b**. Both parts were well attempted.

Question 4a:

If $x + \frac{1}{x} = 5$, then find the value of $x^3 + \frac{1}{x^3}$.

Better responses started off well to cube the equation $x + \frac{1}{x} = 5$ first and then applied the formula accordingly. This helped the candidates in the right path to get the correct answer.

Example:

$$x + \frac{1}{x} = 5$$

Cubbing both the sides

$$\left(x + \frac{1}{x}\right)^3 = (5)^3$$

$$(x)^3 + 3(x)\left(\frac{1}{x}\right)\left(x + \frac{1}{x}\right) + \left(\frac{1}{x}\right)^3 = 125$$

$$x^3 + 3(5) + \frac{1}{x^3} = 125$$

$$x^3 + 15 + \frac{1}{x^3} = 125$$

$$x^3 + \frac{1}{x^3} = 125 - 15$$

$$x^3 + \frac{1}{x^3} = 110$$

Weaker responses initially cubed the equation $x + \frac{1}{x} = 5$ but they did not follow the steps as the expression $\left(x + \frac{1}{x}\right)^3$ was not expanded correctly. Finally, they could not reach the required answer.

Example:

$$x + \frac{1}{x} = 5$$

then, $x^3 + \frac{1}{x^3} = ??$

As, $x + \frac{1}{x} = 5$ So,

$$x^3 + \frac{1}{x} \text{ Or } \left(x + \frac{1}{x}\right)^3 = (5)^3$$

Which is $\left(x + \frac{1}{x}\right)^3 = 125$

So the value of:

$$x^3 + \frac{1}{x^3} = 125 \text{ Ans.}$$

Question 4b:

For three quantities *a*, *b* and *c*, if $a+b+c=80$ and $a^2+b^2+c^2=3000$, then find the value of $ab+bc+ca$.

Better responses used the given data $a+b+c=80$ and squared it on both sides, i.e. $(a+b+c)^2=80^2$ which was further expanded to get $a^2+b^2+c^2+2(ab+bc+ca)=6400$. After correct substitution, the answer was found. It was also seen that fewer candidates solved the question by assuming the values of *a*, *b* and *c*, i.e. $a = 50$, $b = 20$, $c = 10$ which directed to the correct answer.

Example:

$$\therefore (a+b+c)^2 = a^2+b^2+c^2+2(ab+bc+ca)$$
$$(80)^2 = (3000)+2(ab+bc+ca)$$
$$6400 = 3000+2(ab+bc+ca)$$
$$6400-3000 = 2(ab+bc+ca)$$
$$\frac{\cancel{3400}^{1700}}{\cancel{2}_{1}} = (ab+bc+ca)$$
$$\boxed{1700 = ab+bc+ca} \text{ Ans.}$$

Weaker responses observed mistakes in using the formula as they were unable to substitute the values and simplify accordingly. With these errors, they could not reach the required answer.

Example:

$$a^2+b^2+c^2 = a+b+c+2ab+2bc+2ca$$
$$3000 = 80+2(ab+bc+ca)$$
$$3000-80 = 2(ab+bc+ca)$$
$$\frac{2920}{2} = ab+bc+ca$$
$$1460 = ab+bc+ca$$

Question 5:

This question offered a choice between part a and part b. Majority of the candidates chose part **a** which was attempted better than part **a**.

Question 5a:

Two factors of the polynomial $p(x) = x^3 + mx^2 + nx - 2$ are $x - 1$ and $x + 1$. Find the values of *m* and *n*.

Better responses exhibited clear understanding of factor theorem. Candidates were able to make the equation and solve it accordingly to reach the required answer.

Example:

$P(x) = x^3 + mx^2 + nx - 2$

$P(1) = 1^3 + m(1)^2 + n(1) - 2$

$P(1) = 1 + m + n - 2$

$P(1) = m + n - 1$ — (i) $= m + n = 1$

$P(x) = x^3 + mx^2 + nx - 2$

$P(-1) = (-1)^3 + m(-1)^2 + n(-1) - 2$

$P(-1) = -1 + m - n - 2$

$P(-1) = m - n - 3$ — (ii) $= m - n = 3$

$m + n = 1$

$m - n = 3$

From i eq

$m + n = 1$

$m = 1 - n$.

Put the value of m in eq ii

$m - n = 3$

$1 - n - n = 3$

$-2n = 3 - 1$

$-\cancel{2}n = \cancel{2}$

$n = -1$

Put the value of n in eq ii

$m - n = 3$

$m - (-1) = 3$

$m + 1 = 3$

$m = 2$

Weaker responses initially found the values of x but it was reflected that they were not aware of the rule of factor theorem. Although, they had substituted the values of *x* but could not manage to follow the necessary steps. As a result, incorrect values were seen.

Example:

x^3+mx^2+nx-2
$(1)^3+m(1)^2+n(1)-2$
$1+m+n-2$
$m=n-2-1$
$m=n-3$
x^3+mx^2+nx-2
$(1)^3+(n-3)(1)^2+n(1)-2$
$1+(n-3)(1)+n-2$
$1-3n+n-2$
$1-2n-2$
$-1-2n$
$\boxed{n=-3}$
x^3+mx^2+nx-2
$(1)^3+m(1)^2+(-3)(1)-2=0$
$1+m^2-3-2=0$
$1-3-2=m^2$
$(-4)^2=m^2$
$\boxed{m=16}$

x^3+mx^2+nx-2
$(-1)^3+m(-1)^2+n(-1)-2$
$-1+m-n-2$
$m=-1-n-2$
$m=-n-3$
x^3+mx^2+nx-2
$(-1)^3+(-n-3)(-1)^2+n(-1)-2$
$-1-3n-n-2$
$-1-2n-2$
$-3-2n$
$\boxed{n=-5}$
x^3+mx^2+nx-2
$(-1)^3+m(-1)^2+(-5)(-1)-2$
$-1-m^2+5-2$
$-1+5-2=m^2$
$(2)^2=m^2$
$\boxed{m=4}$

Question 5b:

Factorise the following completely.

i. $36a^4+12a^2b+b^2-9$

ii. $a^{15}-216b^{15}$

Better responses observed that candidates, in part i , collected the terms smartly as they were able to write $\left(6a^2+b\right)^2-\left(3\right)^2$ correctly. This helped the candidates to factorise the expression easily. Similarly, in part ii, it was seen that candidates did well to write $\left(a^5\right)^3-\left(6b^5\right)^3$ which showed the clarity of concepts. Finally, they used the formula correctly and factorised the expression.

Example:

$$(i) = (36a^4 + 12a^2b + b^2) - (9)$$
$$\because\ a^2 + 2ab + b^2 = (a+b)^2$$
$$\therefore\ 36a^4 + 12a^2b + b^2 = (6a^2+b)^2$$
$$= (6a^2+b)^2 - (3)^2$$
$$\because\ a^2 - b^2 = (a+b)(a-b)$$
$$\therefore\ = (6a^2+b+3)(6a^2+b-3) \text{ Ans.}$$

$$(ii)\quad a^{15} - 216b^{15}$$
$$= (a^5)^3 - (6b^5)^3$$
$$\because\ (a^3 - b^3) = (a-b)(a^2+ab+b^2)$$
$$\therefore\ = (a^5 - 6b^5)(a^{10} + 6a^5b^5 + 36b^{10}) \text{ Ans.}$$

Weaker responses revealed that candidates, in part i, failed to collect the terms in required manner. Because of this they faced difficulty to go further in factorizing the term. It was also seen that fewer candidates were partly able to attempt correctly and some of them left this part as well. Similarly, in part ii, they were unable to write $a^{15} - 216b^{15}$ correctly as they wrote $(a^5)^3 - (216b^5)^3$ instead of $(a^5)^3 - (6b^5)^3$ which showed the lack of understanding and got stuck in going further. It was also noticed that some of them wrote $(a^5)^3 - (6b^5)^3$ correctly but they could not manage to apply the correct formula. As a result, they were unable to factorise the expression correctly.

Example:

$$i\quad 36a^4 + 12a^2b + b^2 - 9$$
$$(36a^4 + 12a^2b + b^2) - 9$$
$$[(6a^2)^2 + 2(6a^2)(b) + (b)^2] - 9$$
$$(6a^2 + b)^2 - 9$$
$$(6a^2 + b)^2 - (3)^2$$
Applying $a^2 - b^2 = (a+b)(a-b)$
$$(6a^2 + b^2 - 3)(6a^2 + b^2 + 3)$$

$$ii\quad a^{15} - 216b^{15}$$
$$(a^{15})^2 - (216b^{15})$$
Applying $a^2 - b^2 = (a+b)(a-b)$
$$\cancel{(a^{15} - 215)}$$
$$(a^{15} - 216b^{15})(a^{15} + 216b^{15})$$

Question 6:

This question offered a choice between part **a** and part **b**. Part **b** was comparatively well attempted by candidates.

Question 6a:

The width w units of a rectangular solid with a fixed volume, is inversely proportional to its length l units and breadth b units.

Width (w units)	Length (l units)	Breadth (b units)
3	4	2
?	6	2.5

Using the table, find the missing width of the rectangular solid.

Better responses observed clear understanding of inverse proportion. Candidates formed the equation $w = \dfrac{k}{lb}$ successfully. The data given in the question was perfectly used to determine the value of k which was substituted back in the equation to find w when l = 6 and b = 2.5.

Example:

a) According to the information provided;

$w \propto \frac{1}{L \cdot b}$

$w = k/Lb$.

$3 = k/4(2)$

$3 = k/8$

$3(8) = k$.

$24 = k$.

for width: $w = k/lb$.

$w = 24/6(2.5)$

$w = 24/15$

$w = 1.6$ w units

Hence the missing width of the rectangular ~~to~~ solid will be 1.6 w units

Weaker responses exhibited that candidates were unable to translate w is inversely proportional to length l and breadth b. Some of the incorrect responses like $w \propto l\,b$ and $w \propto \dfrac{1}{l+b}$ were observed as well. Fewer candidates did not use the given data correctly and made minor mistakes in finding the answer.

Example:

$\Rightarrow W \propto \dfrac{L}{b}$

$\Rightarrow W = K \dfrac{L}{b}$

$\Rightarrow 3 = K \times \dfrac{\cancel{4}\,2}{\cancel{2}\,1} \Rightarrow 3 = K \times 2$

$\Rightarrow K = \dfrac{3}{2}$

$\Rightarrow W \propto \dfrac{L}{b}$

$\Rightarrow W = K \dfrac{L}{b}$

$\Rightarrow W = \dfrac{3}{\cancel{2}\,1} \times \dfrac{\cancel{6}\,3}{2.5}$

$\Rightarrow W = \dfrac{9}{2.5}$

$\Rightarrow W = 3.6$ Answer

Question 6b:

If $\dfrac{a}{b} = \dfrac{c}{d}$, then prove that $\dfrac{5a+3c}{5b+3d} = \sqrt[5]{\dfrac{a^5}{b^5}}$ using K-method.

Better responses revealed that candidates understood the question quite well and were able to write $a = bk$ and $c = dk$. This helped the candidates in substituting the values of a and c in the expression $\dfrac{5a+3c}{5b+3d}$ to go further in simplification. As a result, they were very much comfortable in achieving the required answer.

Example:

$\frac{a}{b} = k \Rightarrow a = bk$

$\frac{c}{d} = k \Rightarrow c = dk$

$\frac{5(bk) + 3(dk)}{5b + 3d} = \frac{a^{\cancel{5}\times 1/\cancel{5}}}{b^{\cancel{5}\times 1/\cancel{5}}}$

$\frac{5bk + 3dk}{5b+3d} = \frac{\cancel{b}k}{\cancel{b}}$

$\frac{k\,(\cancel{5b+3d})}{\cancel{5b+3d}} = k$

$k = k$

Hence proved

Weaker responses demonstrated that candidates initially failed to make the relation $a = bk$ and $c = dk$. As a result, they could not manage to get the right path in finding the answer. It was also noticed that some candidates made the relationship but made mistakes in simplification which led to an incorrect answer.

Example:

$\frac{a}{b} = \frac{c}{d} \quad a = bk \quad = 5dk$

L.H.S. $= \frac{\cancel{5}k + 1k}{\cancel{5}} = k^2$

$\frac{5a+3c}{5b+3d}$ R.H.S. $= \sqrt[5]{\frac{a^5}{b^5}}$

$= \sqrt[5]{\frac{5a}{5b}}$

$\frac{5(bk)+3(dk)}{5b+3d}$ $= \left(\sqrt[5]{\frac{5kb}{5b}}\right)^2$

$b = \frac{5k + \cancel{3}dk}{5 + \cancel{3}d}$ $= \sqrt[5]{\left(\frac{5k^2}{5b}\right)} = \frac{\cancel{5}k^2}{\cancel{5}}$

$\frac{5k + \cancel{d}k}{5 + \cancel{d}}$ L.HS $=$ R.H.S

$k^2 = k^2$

Question 7a:

Find the value of p and q for the given matrix equation.

$$2\begin{bmatrix} 2 & p \\ 1 & 5 \end{bmatrix} + \begin{bmatrix} 1 & 2 \\ 3 & 0 \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ q & 10 \end{bmatrix}$$

This question was attempted well by majority of the candidates.

Better responses reflected strong understanding of matrix operations. Candidates correctly applied scalar multiplication which was followed by addition of matrices. The concept of equality of matrices was used to form equations $2p + 2 = 2$ and $2 + 3 = q$ which were simplified to find the answer.

Example:

$$\begin{bmatrix} 4 & 2p \\ 2 & 10 \end{bmatrix} + \begin{bmatrix} 1 & 2 \\ 3 & 0 \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ q & 10 \end{bmatrix}$$

$$= \begin{bmatrix} 5 & 2p+2 \\ 5 & 10 \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ q & 10 \end{bmatrix}$$

$2p+2 = 2$ $\quad$ $q = 5$ $\quad$ $\boxed{\begin{array}{l} p = 0 \\ q = 5 \end{array}}$

$2p = 0$

$p = 0/2$

$p = 0$

Weaker responses showed a variety of misconceptions in matrices. While most of the candidates were able to do the scalar multiplication in matrices, but made mistake in adding $2p$ and 2 and they wrote $4p$ instead of $2p + 2$. With this error, they were unable to get the right answer. It was also seen that those who managed to add the matrices got stuck at $\begin{bmatrix} 5 & 2p+2 \\ 5 & 10 \end{bmatrix} = \begin{bmatrix} 5 & 2 \\ q & 10 \end{bmatrix}$ and could not solve any further which showed the lack in concept of equality of matrices. Furthermore an error, like $2p = 0 \Rightarrow p = \frac{0}{2} \Rightarrow p = 2$ was also observed in a few responses.

Example:

$$\begin{bmatrix}4 & 2p\\ 2 & 10\end{bmatrix}+\begin{bmatrix}1 & 2\\ 3 & 0\end{bmatrix}=\begin{bmatrix}5 & 2\\ q & 10\end{bmatrix}$$

$$\begin{bmatrix}4+1 & p=2\\ 2+3 & 10+0\end{bmatrix}=\begin{bmatrix}5 & 2\\ q & 10\end{bmatrix}$$

$p=2$
$q=5$

$$\begin{bmatrix}5 & p=2\\ 5 & 10\end{bmatrix}=\begin{bmatrix}5 & 2\\ q & 10\end{bmatrix}$$

Question 7b:

Given that, state the reason why these two matrices are conformable for multiplication.

This part proved to be easy as majority of the candidates attempted it well.

Better responses exhibited that candidates did well to perform in finding the reason that two matrices are conformable for multiplication.

Example:

$$\begin{bmatrix}(1)(0)+(2)(1)+(3)(5) & (1)(2)+(2)(3)+(3)(1)\\ (0)(0)+(1)(1)+(1)(5) & (0)(2)+(1)(3)+(1)(1)\end{bmatrix}$$

$$\begin{bmatrix}0+2+15 & 2+6+3\\ 0+1+5 & 0+3+1\end{bmatrix}=\begin{bmatrix}17 & 11\\ 6 & 4\end{bmatrix}$$

$(2\times 3)(3\times 2)$

The matoices are conform-
able for multiplication
becouse sows of one
matric are some in numberas
column of second matric

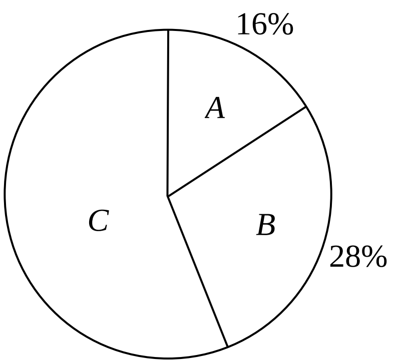
Weaker responses demonstrated that candidates got perplexed in the order of two matrices. As a result, they were unable to achieve the required reason.

Example:

The two matrices are conformable for multiplication
since no. of rows ~~into~~ and no. of columns is same.
no. of rows = 2
no. of columns = 2
answer: $\begin{bmatrix}18 & 11\\ 6 & 4\end{bmatrix}$

Question 8:

In a survey, employees of a company were asked their preferred lunch menu from choices *A*, *B* and *C*. The results are represented in the given pie chart.



NOT TO SCALE

Use the given information to complete the given table.

Menu	Percentage of Employee	Number of Employee	Angle of Sector
A	16%	64	
B	28%		
C			

Better responses reflected that candidates read the question very carefully and used the data accordingly. This helped the candidates in finding the answer as they were able to complete the given table.

Example:

Menu	Percentage of Employee	Number of Employee	Angle of Sector
A	16%	64	57.6°
B	28%	112	100.8°
C	56%	224	201.6

$A = \frac{16}{100} \times 360^\circ$

$A = 57.6^\circ$

$B = \frac{28}{100} \times 360^\circ$

$B = 100.8^\circ$

no. of B employees = $\frac{28}{100} = 0.28 \times 400 = 112$ employees

C employees = $\frac{56}{100} = 0.56 \times 400 = 224$ peoples

Total employees = $\frac{16}{100} = 0.16$

$= \frac{64}{0.16} = 400$ total people

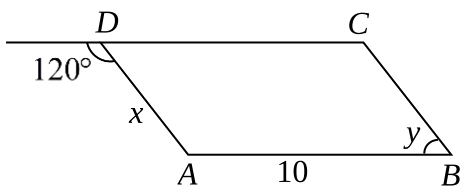
Weaker responses exhibited that candidates faced a lot of difficulty to understand the question. Lack of concept in Pie chart was observed. It was seen that although they found the angle which was actually incorrect but they could not realize that in a Pie chart the sum of all angles must be equal to 360^o.

Example:

Menu	Percentage of Employee	Number of Employee	Angle of Sector
A	16%	64	43.7
B	28%	112	76.5
C	37.7%	350.8	239.7

Question 9:

The perimeter of the given parallelogram *ABCD* is 38 cm. Find *x* and *y*.



NOT TO SCALE

Better responses displayed the knowledge that opposite angles are congruent in a parallelogram and used the concept of Perimeter as well. By applying this knowledge, they were able to find the value of *x* and of *y*.

Example:

m∠D = 180 – 120 (as supplementary angle is been formed) = 60°

m∠B = y = 60° (The opposite angles in a parallelogr-am is equal : theorum)

To find x :
P = 2(L + b)
38 = 2(10 + x)
38 = 20 + 2x

38 – 20 = 2x
2x = 18
x = 9

Weaker responses reflected lack of knowledge of angles formed on a straight line which is also included in middle school syllabus. The candidates could not work out how to use the given angles in the diagram and properties of parallelogram to find the answer. Furthermore, they used the concept of area of parallelogram rather than the concept of perimeter which led to an incorrect answer.

Example:

D = 120 − 180 (Angle on Straight line is 180°)
D = 40° => y
y = 40° (Opposite angle in parallelogram are equal)

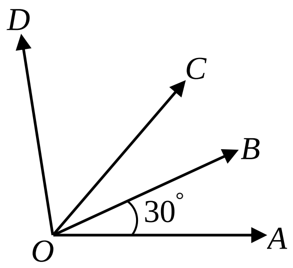
$\boxed{x = 4 \text{ cm}}$

Question 10:

This question offered a choice between part **a** and part **b**. Candidates attempted both parts equally.

Question 10a:

In the following figure, OB and OC are angle bisectors of $\angle COA$ and $\angle DOA$ respectively.



NOT TO SCALE

Find

i. $\angle DOC$

ii. $\angle DOA$

Better responses demonstrated a good knowledge of bisecting angles by the candidates. They used the data accordingly in order to achieve the required angle.

Example:

(angular bisector divides the angle into two equal parts) so
OB is angular bisector of ∠COA so it divides ∠COB and ∠COA
into two equal parts, so if ∠BOA = 30° then ∠COB = 30°
and ∠COB + ∠BOA = ∠COA = 30°+30° = 60°, ∠COA = 60°,
~~angular bisector~~ ~~So~~ OC is angula bisector of ∠DOA ~~so~~ and ∠COA
∠COA = 60° so $\boxed{\text{∠DOC is also equals to 60°}}$ and ∠DOA = ∠DOC +
∠COB + ∠BOA = 60° + 30° + 30° = $\boxed{\text{120° = ∠DOA}}$

Weaker responses exhibited that candidates did not perceive the given diagram which showed the lack of concepts in finding the angle bisector. It was observed that candidates were stuck because of whatever information is given.

Example:

∠DOC
90° − 30°
$\boxed{\text{∠DOC = 60°}}$

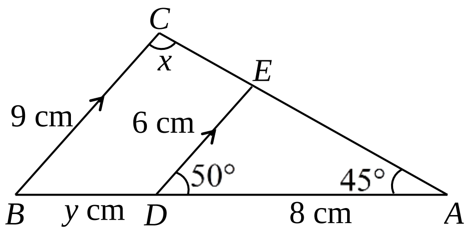
In theorm the the ∠DOC is equal to 60° and the ∠DOA is equal to 30°.

∠DOA
~~90° − 30°~~
~~∠DOA = 60°~~

90° − 60°
$\boxed{\text{∠DOA = 30°}}$

Question 10b:

In the following diagram, *BC* is parallel to *DE*. Find the values of *x* and *y*.



NOT TO SCALE

Better responses exhibited strong understanding of similar triangles and the ratios derived from them. The ratio $\frac{AD}{AB} = \frac{DE}{BC}$ was perfectly used and followed by correct substitution from diagram which led the candidates to get the values of *y*.

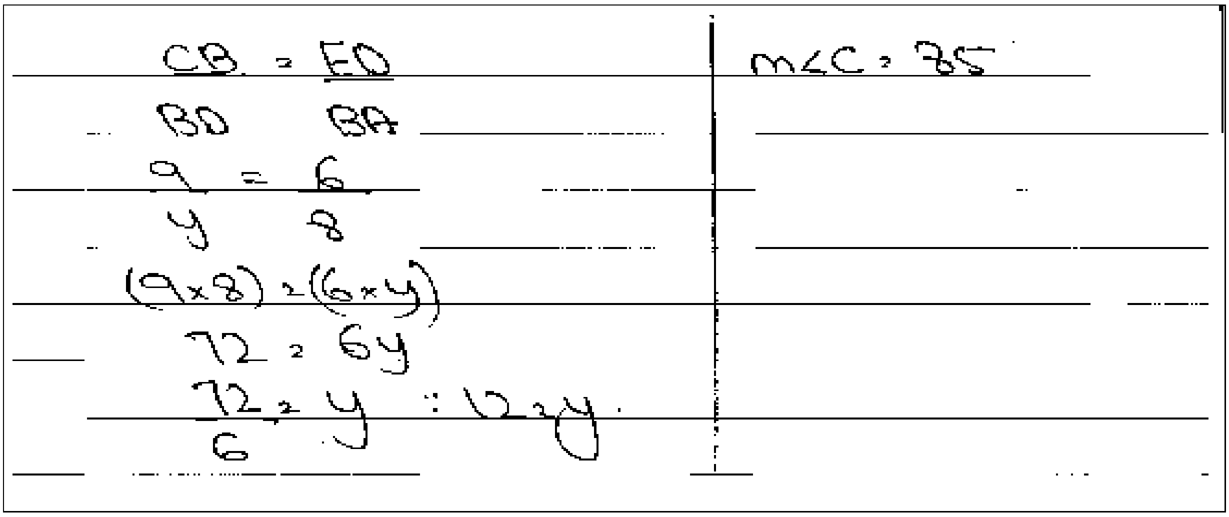
The similar knowledge assisted the candidates to find the value of *x* as well.

Example:

For x:	For y:
$\angle D = \angle B = 50°$ (Equiangular)	$\frac{AD}{AB} = \frac{DE}{BC}$
$\angle A + \angle B + x = 180°$ (whole Δ)	
$45 + 50 + x = 180$	$\frac{8}{y+8} = \frac{6}{9}$
$x = 180 - 50 - 45$	
$x = 85°$	$8 \times 9 = 6(y+8)$
	$\cancel{8}\,72 = 6y + 48$
	$72 - 48 = 6y \quad y = 4$

Weaker responses showed that although candidates had some understanding of similar triangles, they could not effectively find the relation between ratios of sides of similar triangles. Many candidates did random guess work and used addition and subtraction to find the length. With this confusion, fewer candidates could not find the required angle as well. However, it was seen that some of them were only able to find the correct angle by considering triangle *ADE* .

Example:



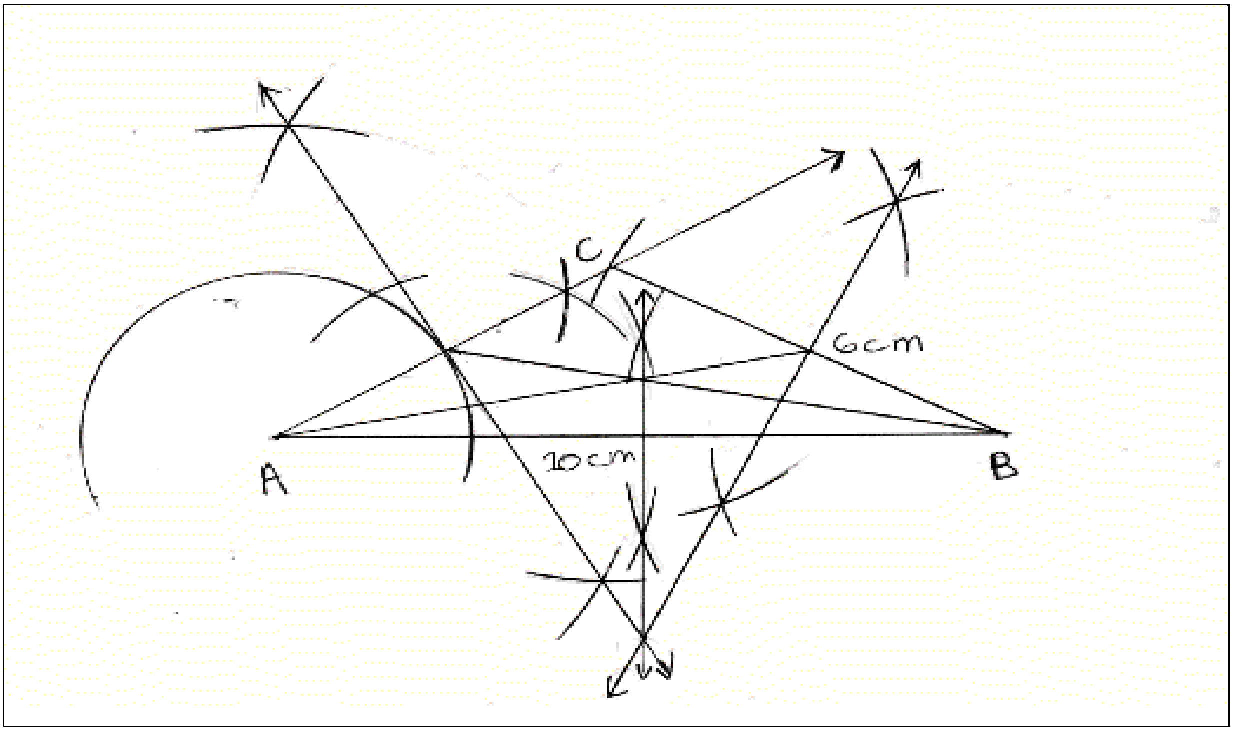
Question 11:

Construct a triangle ABC with AB = 10 cm, $\angle A = 30°$ and BC = 6 cm. Also, draw two medians of the triangle.

This was a well attempted question.

Better responses constructed the triangle ABC and displayed various methods of drawing medians. While most of the candidates used side bisector to find the midpoint, there were some that found it by measuring half length of the side using a ruler. The medians were constructed by joining the mid points to the vertices.

Example:



Weaker responses displayed that candidates were confused between median and altitude. Many candidates did not use perpendicular bisector to find midpoint. Instead, they aimlessly constructed angle bisectors. The candidates who managed to construct perpendicular bisectors did not complete the solution further.

Example: