Aga Khan University Examination Board

Notes from E-Marking Centre on SSC-II Mathematics Examination May 2017

Introduction

This document has been produced for the teachers and candidates of Secondary School Certificate (SSC-II) Mathematics. It contains comments on candidates' responses to the 2017 SSC-II Examination indicating the quality of the responses and highlighting their relative strengths and weaknesses.

E- Marking Notes

This includes overall comments on candidates' performance on every question and some specific examples of candidates' 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 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. Words such as 'how', 'why' or 'what' may also be used.

General Observations:

Generally it is noted that weaker candidates are not well-versed with the hierarchy of arithmetical, algebraic operations, appropriate formulae and its application. This is generally obstructing their performance in overall paper of mathematics.

Detailed Comments:

Constructed Response Questions (CRQs)

Question 1a:

Find the least common multiple (L.C.M.) of $8a^3-1$, $4a^2-1$ and $(2a-1)^2$ and simplify the result by using appropriate formula.

Better responses indicated that candidates had command over the concept of L.C.M. Candidates factorised the given expressions by using correct formulae and were able to find the L.C.M of the given algebraic expression.

Example:

$\rightarrow \; 8a^3-1 = (2a)^3-(1)^3$

$= \cancel{a}(2a-1)(4a^2+2a+1)$

$\rightarrow \; 4a^2-1 = (2a)^2-(1)^2$

$= (2a+1)(2a-1)$

$\rightarrow \; (2a-1)^2 = (2a-1)(2a-1).$

$L.C.M = (2a-1)(2a+1)(4a^2+2a+1)(2a-1)$

$= (2a-1)(4a^2+2a+1)(2a+1)(2a-1).$

$= \boxed{(8a^3-1)(4a^2-1)}$ Ans after simplifying.

Example 2:

*$8a^3-1=(2a)^3-1^3$ $\therefore a^3-b^3=(a-b)(a^2+ab+b^2)$

$2a^3-1^3=(2a-1)(4a^2+2a+1)$

*$4a^2-1=(2a)^2-1^2$ $\therefore a^2-b^2=(a-b)(a+b)$

$(2a)^2-1^2=(2a+1)(2a-1)$

*$(2a-1)^2$

Common Factors:- $(2a-1)$

Uncommon Factors= $(4a^2+2a+1)(2a+1)(2a-1)$

LCM = Common Factors x Uncommon Factors

LCM = $(2a-1)(4a^2+2a+1)(2a+1)(2a-1)$

$8a^3-1=(2a-1)(4a^2+2a+1)$ $\therefore a^3-b^3=(a-b)(a^2+ab+b^2$

$4a^2-1=(2a+1)(2a-1)$ $\therefore a^2-b^2=(a-b)(a+b)$

LCM = $(8a^3-1)(4a^2-1)$

Weaker responses showed that candidates had lack of understanding of the concept of L.C.M. and they also made mistakes in applying appropriate formulae to simplify the given algebraic expressions.

In a few responses, factorisation was done as described below.

$8a^3-1=8a(a^2-1)$

$4a^2-1=4a(a-1)$

$8a^3-1=2\times2\times2\times a\times a\times a-1$

$4a^2-1=2\times2\times a\times a-1$

$4a^2-1=2\times a-1$

And then L.C.M. was written as $4a^2$

In few other responses, it was noted that after factorisation, the candidates added the factors instead of multiplying them to find the L.C.M.

Other weaker responses exhibited that candidates failed to factorise the given expressions and consequently, were unable to find the L.C.M. In few other responses candidates opted for the division method but failed to complete the process.

Example 1:

L.C.M:

$8a^3 - 1 = 2 \times 2 \times 2 \times a \times a \times a \quad -1$

$4a^2 - 1 = 2 \times 2 \times a \times a, \; -1$

$(2a - 1)^2 = 2 \times a \times \quad -1$

L.C.M $= 4a^2, \; 2a,$

H.C.F $= 2a, \; -1.$

Example 2:

L.C.M of $8a^3-1$, $4a^2-1$ and $(2a-1)^2$

i. $(2a-1)^2$

$= (2a-1)^2 = (2a-1)(2a+1)$

ii. $4a^2-1 = (2a)^2-(1)^2$

$= (2a-1)(2a+1)$

iii. $8a^3-1 = 2a(2a)^2-(1)^2$

$= 2a(2a-1)(2a+1)$

$\therefore$ L.C.M $= 2a(2a+1)(2a-1)$

H.C.F $= (2a+1)(2a-1)$

Formula L.C.M × H.C.F $= p(x) \times q(x) \times R(x)$

$2a(2a-1)(2a+1)(2a+1)(2a-1) = (8a^3-1)(4a^2-1)(2a-1)^2$

$\therefore 2a(2a-1)(2a+1)(2a+1)(2a-1) = (8a^3-1)(4a^2-1)(2a-1)^2$

Ans.

Example 3:

$8a^3-1 = (a-b)(a^2-2ab-b^2)$

$= (a-b)(a^2-b^2)$

$4a^2-1 = (a-b)(a+b)$

$(2a-1)^2 = (a^2+2ab+b^2)$

$= (a+b)^2$

$= (a+b)(a-b)$

L.C.M $= (a-b), (a^2-b^2), (a+b), (a+b)$

Question 1b:

Simplify the expression $\left(\dfrac{x^3 - a^3}{(x-a)(x+a)} \div \dfrac{x^2+ax+a^2}{x^3+a^3}\right) - a^2.$

Better responses displayed that candidates comprehended the question well and applied the formulae and cancelation process appropriately to simplify the given algebraic expression.

Example:

$$= \left[\frac{(x)^3-(a)^3}{(x-a)(x+a)} \div \frac{x^2+ax+a^2}{(x)^3+(a)^3}\right] - a^2$$

$$= \left[\frac{(x-a)(x^2+ax+a^2)}{(x-a)(x+a)} \div \frac{x^2+ax+a^2}{(x+a)(x^2-ax+a^2)}\right] - a^2$$

$$= \left[\frac{\cancel{(x-a)}\cancel{(x^2+ax+a^2)}}{\cancel{(x-a)}\cancel{(x+a)}} \times \frac{\cancel{(x+a)}(x^2-ax+a^2)}{\cancel{x^2+ax+a^2}}\right] - a^2$$

$$= (x^2-ax+a^2) - a^2$$

$$= x^2-ax+a^2-a^2$$

$$= x^2-ax$$

$$= x(x-a)$$

Weaker responses reflected that candidates started correctly but made mistakes in application of formulae or in the cancellation process. Eventually, they failed to simplify the given algebraic expression. The common mistakes in the application of formulae have been noted as follows:

$(x-a)^2 = x^2 - a^2$

$x^3 - a^3 = (x-a)(x-a)(x-a)$

$x^3 + a^3 = (xa)(x+a)(x+a)$

In a few responses, it is noted that candidates took L.C. M of the fractions which were being multiplied.

Example1:

b: $$\left[\frac{x^3-a^3}{(a-x)(x+a)} \div \frac{x^2+ax+a^2}{x^3+a^3}\right] - a^2$$

$$\frac{ax^2\cancel{(x-a)}}{(a-x)(x+a)} \div \frac{x^2+ax+a^2}{\cancel{ax^2(x+a)}} - a^2$$

$$\frac{x^2+ax+a^2}{(a-x)(x+a)} - a^2$$

$$x^2+ax+a^2 = a^2(a-x)\,x+a)$$

$$x^2+ax+a^2 = a^2(ax-xa)$$

$$x^2+ax+a^2 = a^2(ax-xa)$$

Example 2:

$$= \left[\frac{x^3-a^3}{(x-a)(x+a)} \div \frac{x^2+ax+a^2}{x^3+a^3}\right] - a^2$$

$$= \left[\frac{x^3-a^3}{(x-a)(x+a)} \div \frac{x(x+a)a(x+a)}{x^3+a^3}\right] - a^2$$

$$= \left[\frac{x^3-a^2}{(x-\cancel{a})(\cancel{x+a})} \div \frac{(\cancel{x+a})(x-\cancel{a})}{x^3+a^3}\right] - a^2$$

$$= \left[\frac{x^3-a^3}{x^3+a^3}\right] - a^2$$

$$= \left[\frac{x^3-a^3-a^2}{x^3+a^3-a^2}\right]$$

$$= \left[\frac{\cancel{x^3-a^3}}{\cancel{x^3-a^5}}\right] = \underline{1} \text{ Ans}$$

Example 3:

$$= \left[\frac{x^3 - a^3}{(x-a)(x+a)} \times \frac{x^3 + a^3}{x^2 + ax + a^2}\right] - a^2$$

$$= \left[\frac{(x^3 - a^3)\cancel{(x+a)^2} \times (x^3 + a^3)\cancel{(x-a)}\cancel{(x+a)}}{\cancel{(x-a)}\cancel{(x+a)}\cancel{(x+a)^2}}\right] - a^2$$

$$= \left[(x^3 - a^3)(x^3 + a^3)\right] - a^2$$

$$= (x^3)^2 - (a^3)^2 - a^2$$

Question 2:

If $\dfrac{8x - 17}{x(2x+1)} = \dfrac{A}{x} + \dfrac{B}{2x + 1}$, then find the value of B.

Better responses exhibited that the candidates correctly multiplied both sides by L.C.M. $x(2x+1)$ and substituted $x = -\dfrac{1}{2}$ in the equation to find the value of B.

Example:

Dividing $x(2x+1)$ on both the sides, we get	$\Rightarrow -21 = -\frac{1}{2} B$
$8x - 17 = A(2x+1) + B(x)$	$\Rightarrow \frac{1}{2} B = 21$
Taking $2x + 1 = 0$	$\Rightarrow B = 21 \times 2$
$\Rightarrow 2x = -1 \Rightarrow x = -\frac{1}{2}$	$\Rightarrow B = 42$
Putting $x = -\frac{1}{2}$	Hence, value of $B = 42$.
$\Rightarrow 8(-\frac{1}{2}) - 17 = A(0) + B(-\frac{1}{2})$	
$\Rightarrow -4 - 17 = B(-\frac{1}{2})$	

Weaker responses revealed that candidates made different types of mistakes, which included incorrect calculation of L.C.M., mistakes in multiplication on both sides by L.C.M. and instead of substituting $2x+1=0$, they substituted $x=0$ and eliminated B. In a few other responses, it was noted that candidates correctly wrote $8x-17=A(2x+1)+Bx$ but started substituting their own values by trial and error method to find the value of B.

A few other examples of low-scoring responses revealed that the candidates wrote $8x-17=2Ax+1+Bx$ and compared the coefficient of x and found the value of $B = 8$

Example:

$x=0$ $\qquad B=-17$

$$8x-17=\frac{B}{(2x+1)}$$

$$8(0)-17=\frac{B}{2(0)+1}$$

$$0-17=\frac{B}{0+1}$$

Question. 3a:

Solve $x-\frac{1}{5}=3\left(x-\frac{5}{3}\right)-5x$.

Generally, it was a well-attempted question and most candidates chose to attempt it..

Better responses displayed that candidates systematically solved the given linear equation by using correct mathematical steps. In a few cases, candidates opened the bracket first and then collected the terms containing x on one side and constant terms on other sides. In a few other responses, it was noted that the candidates took L.C.M on the L.H.S and multiplied both sides' sides by the L.C.M. and performed simplification process correctly to get the value of x.

Example:

a: $x - \frac{1}{5} = 3\left(x - \frac{5}{3}\right) - 5x$

$x - \frac{1}{5} = 3x - \cancel{3}x\,\frac{5}{\cancel{3}} - 5x$

$x - \frac{1}{5} = 3x - 5 - 5x$

$x - \frac{1}{5} = 3x - 5x - 5$

$x - \frac{1}{5} = -2x - 5$

$x + 2x - \frac{1}{5} = -5$

$x + 2x = -5 + \frac{1}{5}$

$3x = -5 + \frac{1}{5}$

$3x = \frac{-25+1}{5}$

$3x = -\frac{24}{5}$

$x = -\frac{24}{5\times 3}$

$x = -\frac{\cancel{24}\ 8}{\cancel{15}\ 5}$

$x = -\frac{8}{5}$

Weaker responses exhibited that candidates failed to solve the given equation. In some responses, the candidates failed to perform the algebraic operation correctly on the given equation. Few other mistakes have been presented in the following examples.

Example 1:

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

$= \frac{x}{5}\left(x - \frac{5}{3}\right) = 3 - 5x$

$= \frac{x^2 - 5x}{15} = 3 - 5x$

$= \frac{x^2 - x}{3} = 3 - 5x$

$= \frac{x}{3} = 3 - 5x$

$= x = \cancel{3} + 5x - \cancel{3}$

$= x = 5x$

$= x = -5$

Ans

Example 2:

a. Solve $x - \frac{1}{5} = 3\left(\frac{x-5}{3}\right) - 5x$.

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

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

$-\frac{3\cancel{x}}{\cancel{5}}\left(15x\right)$

$-\ 1.10\ \left(15x\right)$

Example 3:

a) $\frac{x-1}{5} = 3\left[\frac{x-5}{3}\right] - 5x$

$x + 5x = 3\left[\frac{x \times 3}{1 \times 3} - \frac{5}{3}\right] + \frac{1}{5}$

$6x = \cancel{3}\left[\frac{3x-5}{\cancel{3}}\right] + \frac{1}{5}$

$6x = 3x - 5 + \frac{1}{5}$

$6x - 3x = \frac{-5 \times 5}{1 \times 5} + \frac{1}{5}$

$4x = \frac{-24}{5}$

$4x(5) = -24$

$20x = -24$

$x = -\frac{\cancel{24}}{\cancel{20}}\ \frac{\cancel{12}\,6}{\cancel{10}\,5}$

$x = -\frac{6}{5}$

Question 3b:

Solve $|4x-1|=|3x-2|$. Also verify your answer.

Better responses showed that candidates correctly applied the concept of modulus to find the solution set of the given equation and solved the equation involving absolute value on both the sides. They rightly considered the signs $\pm$ and got the values of x correctly and finally able to verify the values.

Example:

$4x-1=\pm(3x-2)$

$4x-1=+(3x-2)$ OR $4x-1=-(3x-2)$

$4x-1=3x-2$ OR $4x-1=-3x+2$

$4x-3x=-2+1$ OR $4x+3x=2+1$

$x=-1$ OR $7x=3$

OR $x=3/7$

$\therefore$ The solution set $=\left\{-1, \frac{3}{7}\right\}$

* Verification:

$|4(-1)-1|=|3(-1)-2|$ AND $|4(3/7)-1|=|3(3/7)-2|$

$|-4-1|=|-3-2|$ AND $|12/7-1|=|9/7-2|$

$|-5|=|-5|$ AND $\left|\frac{12-7}{7}\right|=\left|\frac{9-14}{7}\right|$

$5=5$ AND $\left|\frac{5}{7}\right|=\left|\frac{-5}{7}\right|$

AND $\frac{5}{7}=\frac{5}{7}$

Weaker responses displayed that candidates were confused about applying the concept of modulus. The weaker responses also showed mistakes in performing algebraic operation. After removal of modulus the candidates incorrectly wrote $4x-1=3x-2$, $4x+1=3x+2$ or $-4x-1=-3x-2$. It was also noted that candidates made mistakes in the verification process.

Few other mistakes have been noted in the examples cited below.

Example 1:

$4n-1=3n-2$

$4n-3n=-2+1$

$\boxed{n=-1}$

verification

$4(-1)-1=3(-1)-2$

$-4-1=-3-2$

$\boxed{-5=-5}$

Hence prooved.

$, -(4n-1)=-(3n-2)$

$, -4n+1=-3n+2$

$1-2=-3n+4n$

$\boxed{-1=n}$

$, -4(-1)+1=-3(-1)+2$

$, 4+1=3+2$

$, \boxed{5=5}$

Hence prooved.

$S.S\{-1, -1\}$

Example 2:

$|4x-1|=|3x-2|$

$4x-1=3x-2$

$4x-3x=-2+1$

$\boxed{x=-1}$

verification

$4(-1)-1=3(-1)-2$

$-4-1=-3-2$

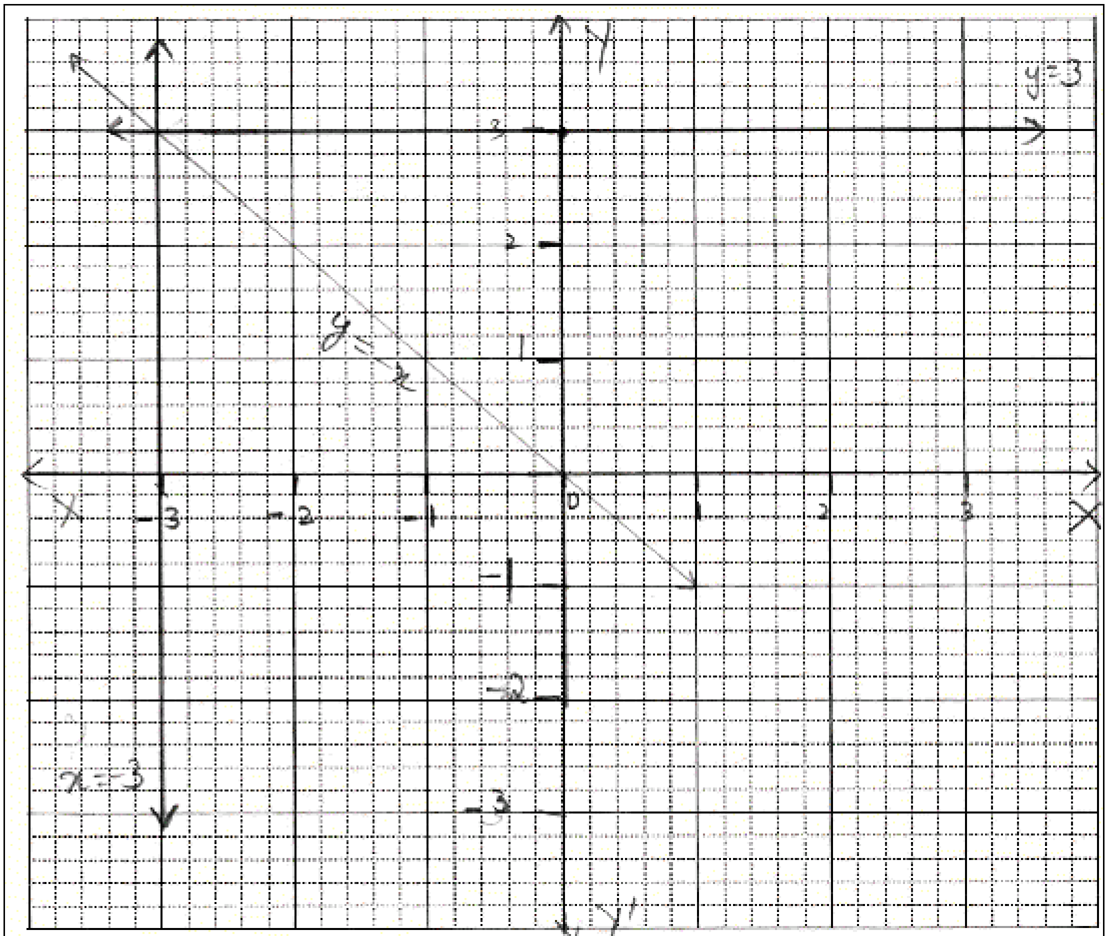
$\boxed{-5=-5}$ verified

Question 4:

Draw lines $y = 3,\ y = -x$ and $x = -3$ on the given paper and find their point of intersection.

Better responses displayed that candidates skillfully drew the given linear equations on the given graph paper by selecting appropriate scales on *x*-axis and *y*-axis to find the point of intersection.

Example:

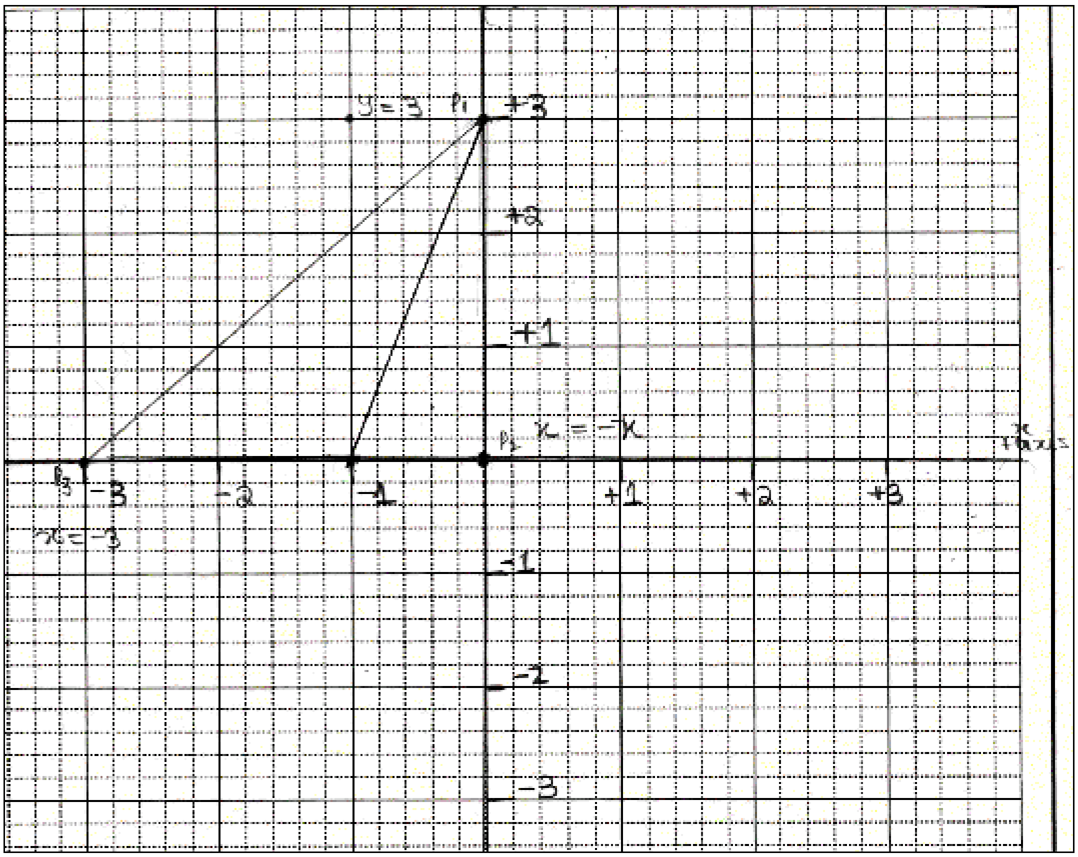


The point of intersection is $(-3, 3)$

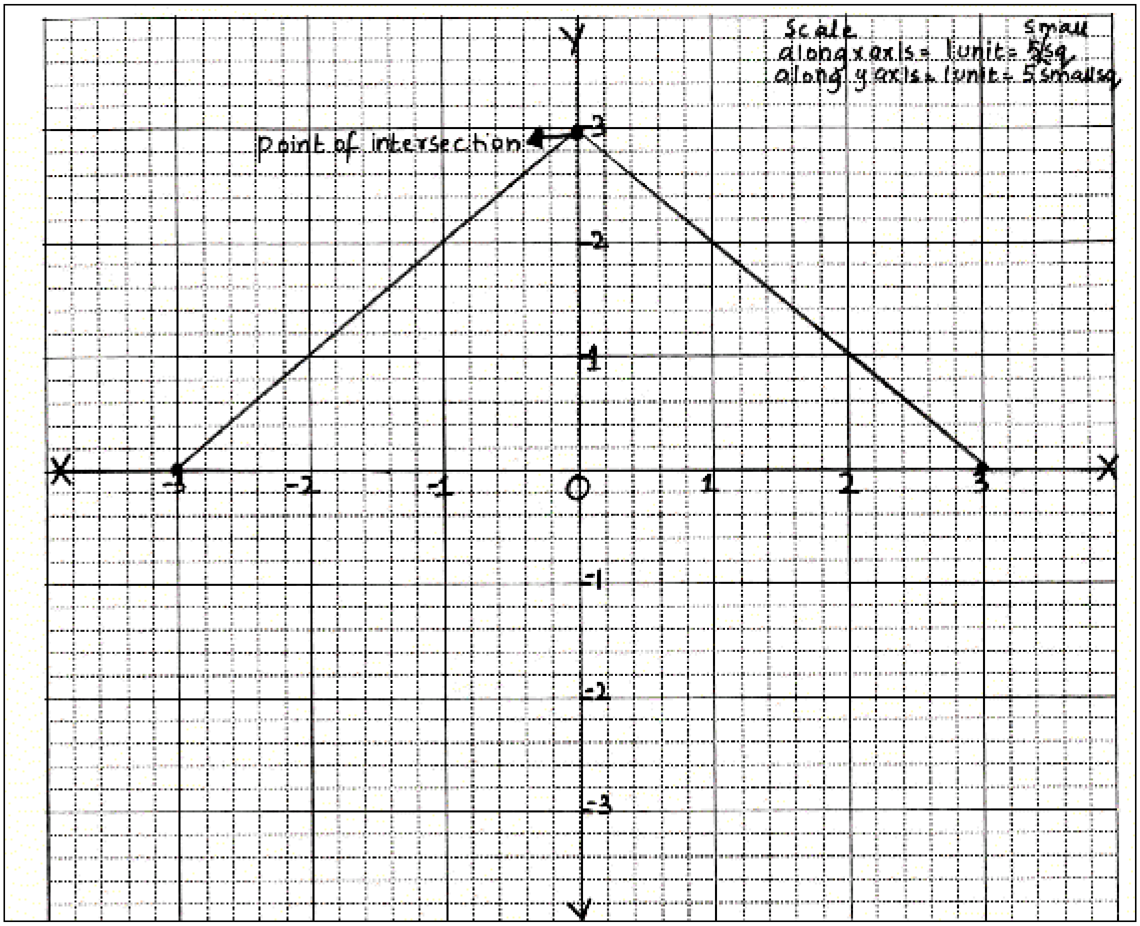
Weaker responses displayed various types of mistakes, some common mistakes have been listed below.

- Candidates failed to perceive $y = 3$ and $x = -3$ as a linear equation rather they just took these lines as points $(0, 3)$ and $(-3, 0)$.
- Candidates failed to take the proper scale on x-axis or y-axis
- Other misconceptions in drawing graph can be seen in the following examples.

Example 1:



Example 2:



Question 5:

Find the value(s) of x in the equation $x^2 - \frac{3}{2}x = 1$ by completing square method.

It was generally not a well-attempted question. Most candidates used quadratic formula and factorisation method, and hence ignored the instruction mentioned in the question to apply completing square method.

Better responses indicated that candidates were well-versed with the use of completing square method. They systematically followed the steps hence successfully found the values of the given equation.

Example 1:

$$x^2 - \frac{3}{2}x = 1$$

Add

(½ of coefficient of x

$\left(\frac{1}{2} \times \frac{3}{2}\right)^2$

$(3/4)^2$

$9/16$

$$x^2 - \frac{3}{2}x + \frac{9}{16} = 1 + \frac{9}{16}$$

$$(x)^2 - 2(x)\left(\frac{3}{4}\right) + \left(\frac{3}{4}\right)^2 = \frac{16+9}{16}$$

$$\left(x - \frac{3}{4}\right)^2 = \frac{25}{16}$$

Taking Square Root On Both Sides

$$\sqrt{(x - 3/4)^2} = \pm\sqrt{25/16}$$

$$x - 3/4 = \pm 5/4$$

either $x - \frac{3}{4} = \frac{5}{4}$ OR $x - \frac{3}{4} = \frac{-5}{4}$

$x = \frac{5}{4} + \frac{3}{4}$ $\quad$ $x = \frac{-5}{4} + \frac{3}{4}$

$x = 8/4$ $\quad$ $x = -2/4$ $\quad$ SS $\{2, -1/2\}$

$x = 2$ $\quad$ $x = -1/2$

Example 2:

$x^2 - \frac{3}{2}x = 1$

Adding $(3/4)^2$ on both sides

$x^2 - 3/2\,x + (3/4)^2 = 1 + (3/4)^2$

$\therefore\ a^2 - 2ab + b^2 = (a+b)^2$

$(x - 3/4)^2 = 1 + 9/16$

$(x - 3/4)^2 = \frac{16+9}{16}$

$(x - 3/4)^2 = \frac{25}{16}$

Taking root on both sides

$(x - 3/4) = \pm 5/4$

$x - 3/4 = 5/4 \quad ; \quad x - 3/4 = -5/4$

$x = 5/4 + 3/4 \quad ; \quad x = -5/4 + 3/4$

$x = 8/4 \quad ; \quad x = -2/4$

$x = 2 \quad ; \quad x = -1/2$

Solution set $= \{2, -1/2\}$

Weaker responses indicated that candidates failed to follow the proper steps needed to solve the question. They made mistakes at various stages. Listed below are some common mistakes.

$$x^2 - \frac{3}{2}x = 1$$
$$x^2 - 3x = 2$$

Few responses indicated that candidates made mistakes in taking square roots, e.g.

$$\sqrt{x^2 - 3x} = \sqrt{2}$$
$$x - 3x = \sqrt{2}$$
$$-2x = \sqrt{2}$$
$$x = -\frac{\sqrt{2}}{2}$$

Few responses indicated that candidates failed to add the correct term to make the given equation a perfect square.

Example 1:

Sol:-

$$x^2 - \frac{3}{2}x = 1$$

$$x^2 - 3x = 2$$

Taking square root on b.s.

$$\sqrt{x^2 - 3x} = \sqrt{2}$$

$$x - 3x = \sqrt{2}$$

$$-2x = \sqrt{2}$$

$$x = \frac{\sqrt{2}}{-2}$$

or

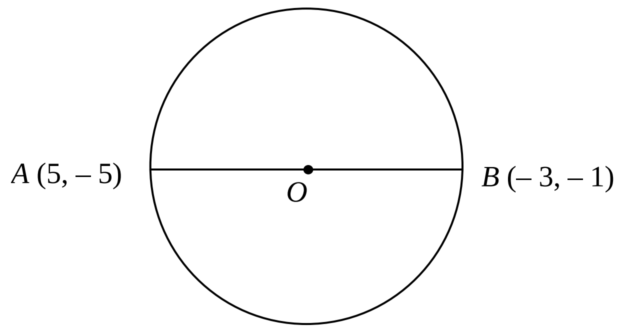
$$x = -\frac{\sqrt{2}}{2}$$ Ans.

Example 2:

$x^2 - \frac{3}{2}x \cancel{+} = 1$	L.T
Finding last term and adding 9 on both sides of the equation.	$\frac{\left(\frac{3}{2}x\right)^2}{4x^2}$
$x^2 - \frac{3}{2}x + 9 = 1 + 9$	$\Rightarrow \frac{\frac{9}{4}x^2}{4x^2}$
$(x)^2 - 2(x)(3) + (3)^2 = 10$	$\Rightarrow \frac{9}{4} \times 4$
$(x+3)^2 = 10$	
$\pm\sqrt{x+3} = \sqrt{10}$	$\Rightarrow 9$
(i) $x+3 = \sqrt{10}$ (ii) $-x-3 = \sqrt{10}$	
$\Rightarrow x = \sqrt{10} - 3$! $\Rightarrow -x = \sqrt{10} + 3$	
eq.(i) accepted. $\Rightarrow x = -\sqrt{10} - 3$	
Solution set : $\{\sqrt{10} - 3, -\sqrt{10} - 3\}$	

Question. 6a:

AB is the diameter of the given circle with centre *O*. Find the length of diameter and radius of the given circle.



NOT TO SCALE

Most of the candidates opted for part a. Generally it was a well-attempted question.

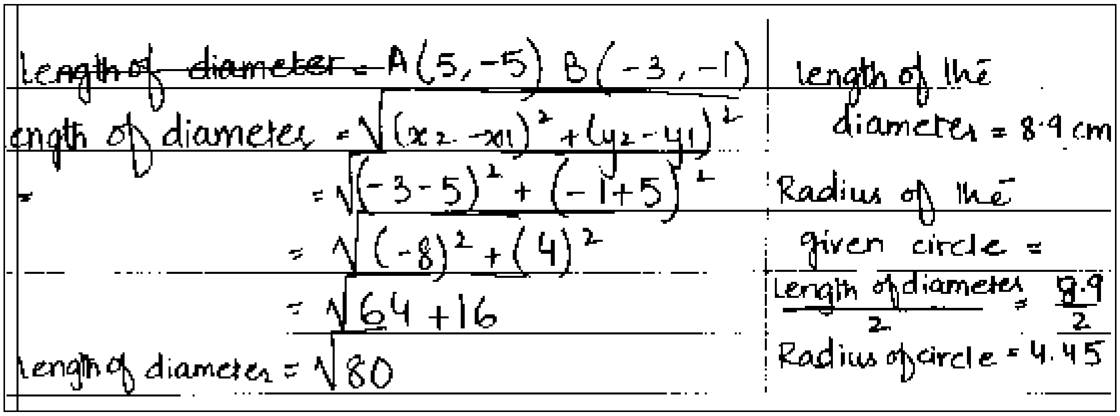
Better responses exhibited that the candidates wrote the correct distance formula, substituted values of the coordinates correctly and were able to find the diameter and radius.

Example 1:

According to distance formula:

$\sqrt{\|x_2-x_1\|^2+\|y_2-y_1\|^2}$	$\sqrt{80}$ = 8.9units
$\sqrt{\|-3-5\|^2+\|-1+5\|^2}$	Hence the diameter of the circle is 8.9 units
$\sqrt{\|-8\|^2+\|4\|^2}$	$r = d/2 \Rightarrow 8.9/2 \Rightarrow 4.45$ units
$\sqrt{64+16}$	Hence the radius of the circle is 4.45 units.
$\sqrt{80}$	

Example 2:



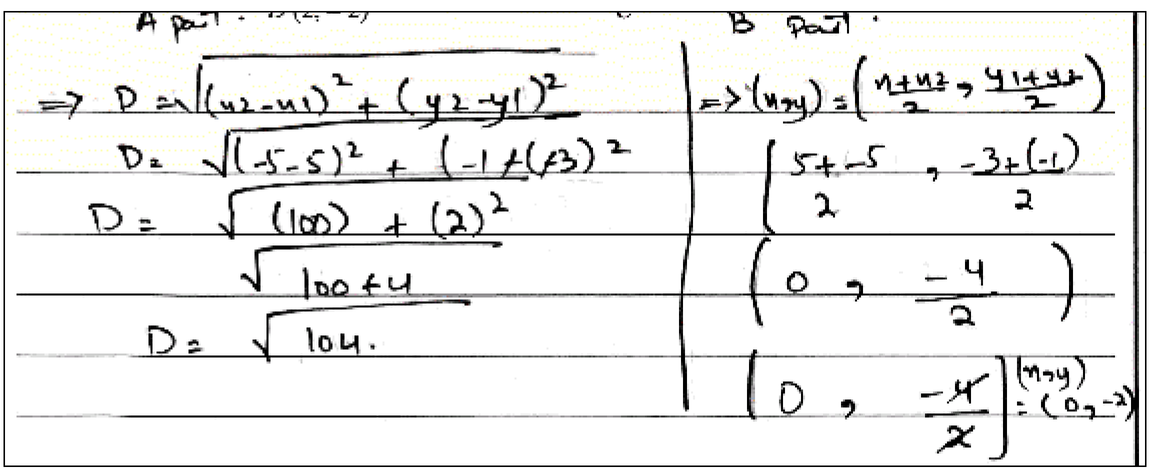
Weaker responses showed that candidates were unable to comprehend the question which resulted in different types of mistakes. Few of those mistakes are as follows:

- Wrote wrong formula:for example, $|AB| = \sqrt{(x_2-x_1)+(y_2-y_1)}$ or $|AB| = \sqrt{(y_2-x_1)^2+(x_2-y_1)^2}$ or $AB = (\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2})$

- Made mistake in substitution of values. For example, $|AB| = \sqrt{(5+5)^2+(-3+1)^2}$

- Made mistakes in simplification after substituting the values in the formula.

Example 1:

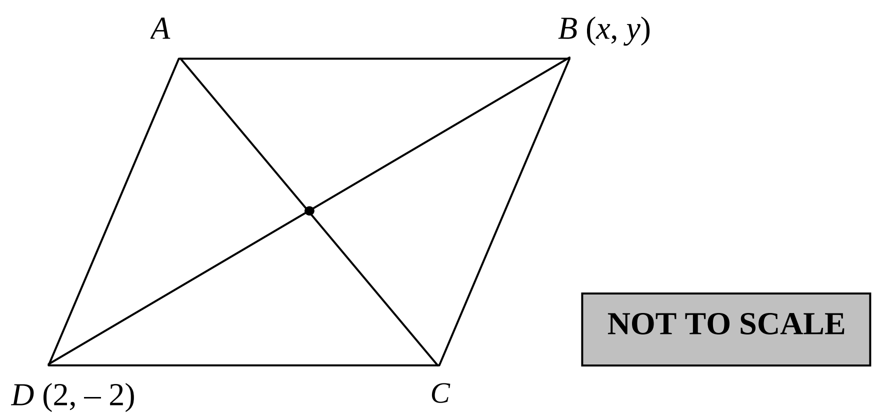


Example 2:

$\lvert d\rvert = (x^2 - x^1)^2 + (y^2 - y^1)^2$	$R = \frac{x + x}{2}$ $R = \frac{y + y}{2}$
$\lvert d\rvert = (-3-5)^2 + (-1-(-5))^2$	
$\lvert d\rvert = (-8)^2 + (4)^2$	$R = \frac{2 + x}{2}$ $R = \frac{-2 + y}{2}$
$\lvert d\rvert$ $-64 + 16$	$2 = 2 + x$ $2 = -2 + y$
$\lvert d\rvert = 48$	$x = 2 - 2$ $y = -2 - 2$
	$x = 0$ $y = -4$

Question. 6b:

AC and *BD* are diagonals of the given parallelogram *ABCD.* The midpoint of the diagonal *AC* is (5, 6) and the coordinates of *D* are (2, – 2). Find the coordinates of *B* (*x, y*) and justify your answer.



This question was based on the application of midpoint formula. Few candidates chose to attempt this question. However, the candidates who attempted this question generally performed well.

Better responses indicated that candidates comprehended the question well and used correct formula and substituted values appropriately to find the coordinates of the point *B* of the other end of the diagonal *BD.*

Example 1:

Q6(b) Using midpoint formula

$(5,6) = \left(\frac{2+x}{2}, \frac{-2+y}{2}\right)$

$\frac{2+x}{2} = 5$, $\frac{-2+y}{2} = 6$

$2+x = 10$, $-2 + y = 12$

$x = 10-2 = 8$, $y = 12+2 = 14$

Coordinates of B are (8,14)

∴ midpoints of the diagonals AC and BD coincide

therefore

midpoint of AC = midpt. of BD

midpoint of BD = (5,6)

Example 2:

$AC(x,y) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

$(5,6) = \left(\frac{2+x_2}{2}, \frac{-2+y_2}{2}\right)$

$5 = \left(\frac{2+x_2}{2}\right)$, $6 = \left(\frac{-2+y_2}{2}\right)$

$10 = 2 + x_2$, $12 = -2 + y_2$

$10 - 2 = x_2$, $12 + 2 = y_2$

$\boxed{8 = x_2}$, $\boxed{14 = y_2}$

$B = (8, 14)$

Midpoint of diagonals AC & DB ~~are~~ is same as diagonals are of same length.

Weaker responses showed that candidates did not read the question carefully, hence, they treated $D(2, -2)$ and (5, 6) as the endpoints of the diagonal and failed to find the coordinates of *B*. In some responses, it was noted that candidates wrote incorrect formula to find the midpoint or applied the distance formula instead of midpoint formula.

Example 1:

The midpoint of AC = midpoint of BD

One of the endpoint of BD = (2, -2) i.e. of D.

Mid point = (5, 6)

$\Rightarrow \frac{x_1 + y_1}{2}, \frac{y_1 + y_2}{2} \Rightarrow \frac{7}{2}, \frac{4}{2}$

$\Rightarrow \frac{2+5}{2}, \frac{-2+6}{2}$ ∴ coordinates of B are $\{\frac{4}{2}, \frac{7}{2}\}$.

Example 2:

Midpoint formula: $= x, y\left(\frac{x_1 + x_2}{2}\right) + \left(\frac{y_1 + y_2}{2}\right)$

$AC = (\overset{x_1}{5}, \overset{y_1}{6})$ $D = (\overset{x_2}{2}, \overset{y_2}{-2})$

$D = (\overset{x_2}{2}, \overset{y_2}{-2})$

$B(x, y)$

$x, y\left(\frac{x_1 + x_2}{2}\right) + \left(\frac{y_1 - y_2}{2}\right)$

$x, y\left(\frac{5 - 2}{2}\right) + \left(\frac{6 - (-2)}{2}\right)$

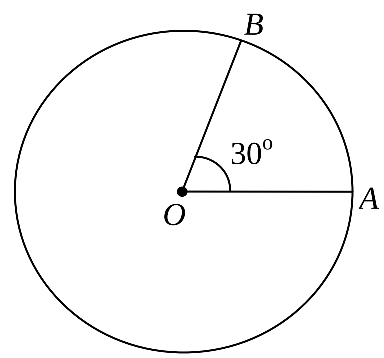
$x, y(2) + (8)$

$(2, 8)$

The coodinates of $B(x, y)$ is $(2, 8)$ answers.

Question 7a:

Consider the given circle with centre *O* and radius 3 cm. Find the length of the arc *AB*.



NOT TO SCALE

This question offered a choice between part a and part b. Candidates mostly opted to attempt part b as it required matching of items in two columns.

The question was based on the application of the formula $l = r\theta$ to find arc length.

Better responses showed that candidates knew the application of the formula and changed the given angle to radian measure before substituting the values in the formula.

Example:

a. Data: (b)

radius = 3cm, θ in radians = $30° \times \frac{\pi}{180°} = \frac{\pi}{6}$ radians

Lenght of arc = ?

Formula: $L = r\theta$

Solution: putting values:-

$L = (3)\left(\frac{\pi}{6}\right)$

$L = \frac{\pi}{2}$

The lenght of arc is 1.57cm.

$\boxed{L = 1.57\text{cm}}$

Weaker responses displayed that candidates wrote wrong formula and made mistakes in conversion of the angle of degree measure to radian measure:

Example 1:

If the radius of the circle is 3 means AO is 3 so BO will be also ~~the~~ 3 if we Add the radius we would get the diameter of the circle diameter or length are both some things

so AO + BO = AB

3 + 3 = AB

6 = AB

The length of the circle ~~as~~ AB is 6cm

Example 2:

$C = 2\pi \times$ ~~[illegible]~~

$r = 3cm$

$L = ?$

Solution:- $C = 2\pi r$

$L = \frac{C}{r}$ $\quad C = \frac{2 \times 22}{7} \times 3$

~~$L = \frac{2 \times 22}{7}$~~ $\quad = 2 \times 3.14 \times 3$

$= 18.8$

$L = \frac{18.8}{3}$

$L = 6.3cm$

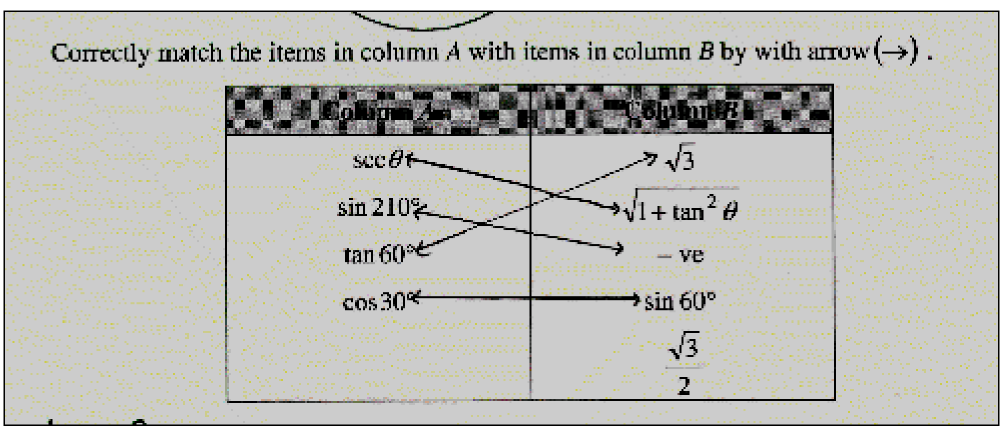
Question 7b:

Correctly match the items in column A with items in column B by with arrow $(\rightarrow)$.

Column A	**Column B**
$\sec\theta$	$\sqrt{3}$
$\sin 210°$	$\sqrt{1+\tan^2\theta}$
$\tan 60°$	$-$ ve
$\cos 30°$	$\sin 60°$
	$\frac{\sqrt{3}}{2}$

Better responses showed that the candidates had good understanding of the trigonometric ratios, identities and sign of trigonometric ratios in different quadrants. Therefore, candidates were able to match the items correctly in the given question.

Example:

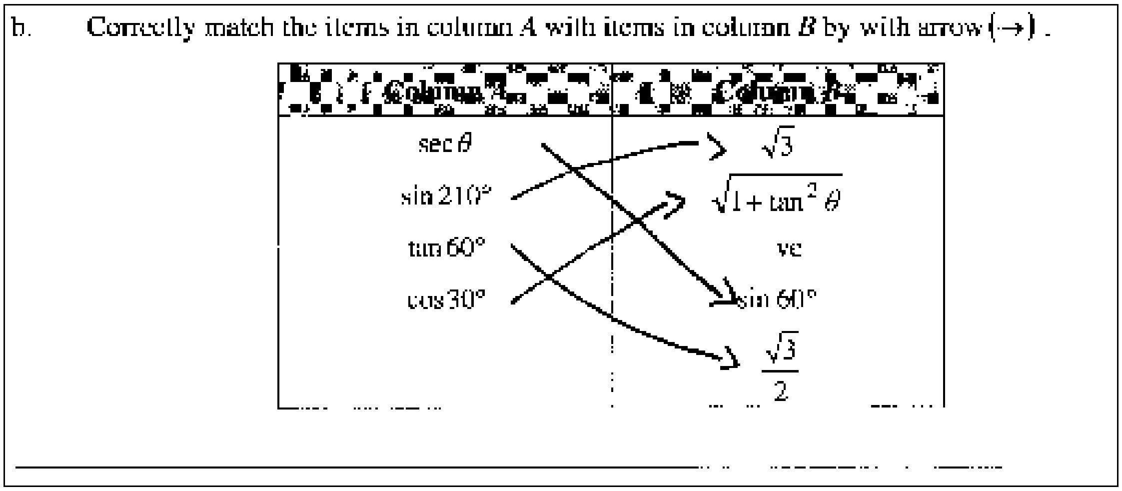


Correctly match the items in column A with items in column B by with arrow $(\rightarrow)$.

Column A	Column B
$\sec\theta$	$\sqrt{3}$
$\sin 210°$	$\sqrt{1+\tan^2\theta}$
$\tan 60°$	$-$ ve
$\cos 30°$	$\sin 60°$
	$\frac{\sqrt{3}}{2}$

Weaker responses displayed lack of understanding of trigonometric concepts asked in the question and consequently failed to match the items correctly.

Example:

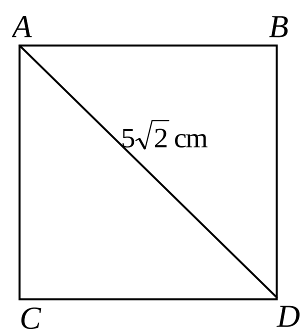


b. Correctly match the items in column A with items in column B by with arrow $(\rightarrow)$.

Column A	Column B
$\sec\theta$	$\sqrt{3}$
$\sin 210°$	$\sqrt{1+\tan^2\theta}$
$\tan 60°$	ve
$\cos 30°$	$\sin 60°$
	$\frac{\sqrt{3}}{2}$

Question. 8a:

The length of diagonal of a square *ABCD* is $5\sqrt{2}$ cm. Find the length of each side of the square and the perimeter of the square.



NOT TO SCALE

The well-attemptedquestion was generally well-attempted. The question offered a choice between **part a** and **part b**. Candidates mostly attempted **part a** of the question which was based on Pythagorean Theorem and its application.

Better responses exhibited that candidates comprehended the question well. They used the fact that all sides of a square are of equal length and using this fact they correctly applied the Pythagorean's theorem to write the equation $a^2 + a^2 = \left(5\sqrt{2}\right)^2$ to get the length of the side and the perimeter of the square *ABCD.* The response presented in Example 1 is different from the other responses and it is encouraging to see how student think differently to solve a problem.

Example 1:

$\cos 45 = \frac{Base}{Hyp}$

$\cos 45 = \frac{Base}{7.071}$

$\frac{1}{\sqrt{2}} \times 7.071 = Base$

$Base = 5$

Each side of square is 5cm

Perimeter $= 4L$

$P = 4 \times 5$

$P = 20cm$

Example 2:

In square ABCD $m\overline{AD}$ = hypotenuse $= 5\sqrt{2}$ cm

and Base = Perpendicular

Suppose Base $= x =$ perp

$(hyp)^2 = (Perp)^2 + (Base)^2$

$25(2) = 2x^2$

$50 = 2x^2$

$\sqrt{x^2} = \sqrt{25}$

$x = 5$

length of each side is 5cm Ans

and perimeter $= 4L$

$4(5)$

20cm = perimeter

length = 5cm

Perimeter = 20 cm

Weaker responses indicated that candidates failed to understand the question which led to wrong application of Pythagorean Theorem. Consequently, such responses failed to find the required length of the square and perimeter of the given square. They made mistakes in calculation and also wrote wrong formula of the perimeter.

Example 1:

$A = l + b + h$

$Hyp^2 = perp^2 + Base^2$

$(5\sqrt{2})^2 = 2a + c$

$(5\sqrt{2})^2 = (2)^2 + c$

$5 \times 2 \quad 4 \quad + (c)^2$

$10 = 4 + c^2$

$10 - 4 = c^2$

$\sqrt{6} = \sqrt{c^2}$

$P = \sqrt{6} + 2 + 5\sqrt{2}$

$P = 2\sqrt{8} + 2 \Rightarrow 2 \times 3 + 2 \Rightarrow 8 + 2 \Rightarrow 10$

$Hyp^2 = perp^2 + Base)^2$

$(5\sqrt{2}) = (Perp^2)(\sqrt{6})^2$

$(5\sqrt{2})^2 = perp^2 + 6$

$10 = perp^2 + 6$

$10 - 6 = perp^2$

$\sqrt{4} = \sqrt{(perp)^2}$

$2 = perp$

$2(10) = 20$ perimeter of square.

Example 2:

$(Hyp)^2 = (base)^2 + ((Perp)^2$

$(5\sqrt{2})^2 = (a)^2 + (a)^2$

$(5\sqrt{2})^2 = 2a^2$

$5(2) = 2a^2$

$10 = 2a^2$

$\frac{10}{2} = a^2$

$a^2 = 5$

$a = 2.23$

$AC = CD = a$

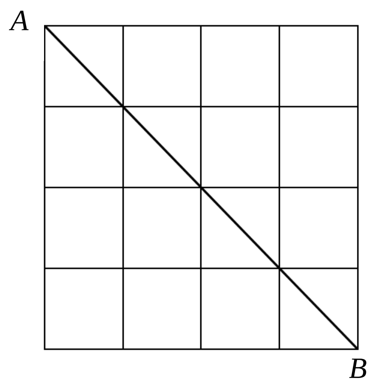
Perp

Perimeter $= 5 \times 5$

$= 4 \cdot 2.23$

Question. 8b:

In the given diagram, there are 16 square tiles, if the area of each square tile is 100 cm^2, then find the length of $\overline{AB}$.



NOT TO SCALE

As compared to part a, this part was attempted by fewer candidates.

Better responses indicated that candidates understood the question well and were able to find the length of each side of the square and applied the Pythagorean's theorem correctly. Hence, they were able to find the length of diagonal *AB.*

In other responses it is noted that candidates applied the Pythagorean theorem on the small square to find the length of the diagonal of the small square then multiplied it with 16 to get the length of *AB.*

Example 1:

$$\text{Area} = \cancel{10}\, l \times l = l^2$$

$$l = \sqrt{A} = 10\text{ cm}$$

$$10 \times 4 = 40\text{ cm}$$

$$(\text{hyp})^2 = (\text{perp})^2 + (\text{base})^2$$

$$(\text{hyp})^2 = (40)^2 + (40)^2$$

$$(\text{hyp})^2 = 1600 + 1600$$

$$(\text{hyp})^2 = 3200$$

$$\text{hyp} = 56.57\text{ cm}$$

Example 2:

Area of 1 square tile $\Rightarrow A = l \times b$ (let suppose length & breadth $= x$)

$$100 = x^2 \Rightarrow \sqrt{100} = \cancel{\sqrt{x^2}}$$

$10 = x \longrightarrow$ length & breadth.

~~As~~ To find the diagonal of each square tile:

By pythagorous theorem

$$(\text{Hyp})^2 = (\text{perp})^2 + (\text{base})^2$$

$$(\text{Hyp})^2 = 100 + 100$$

$$(\text{Hyp})^2 = 200$$

Sq root on b/s

$$\sqrt{\text{Hyp}^2} = \sqrt{200}$$

$$\text{Hyp} = 14.142$$

There are 4 square tiles in $\overline{AB}$

$$\therefore\ 14.142 \times 4$$

$$56.568\text{ cm}$$

length of $\overline{AB} = 56.568\text{cm}$

Weaker responses showed that candidates were unable to comprehend the given question and made different types of mistakes as cited in the following examples:

Example 1:

B

$$\overline{AB} = \frac{16 \times 100}{2}$$

$$\overline{AB} = \frac{1600}{2}$$

$$\overline{AB} = 800\ cm^2$$

The length of $\overline{AB}$ is $800\ cm^2$

Example 2:

B

$$(hyp)^2 = (base)^2 + (perp)^2$$

$$(hyp)^2 = (100)^2 + (100)^2$$

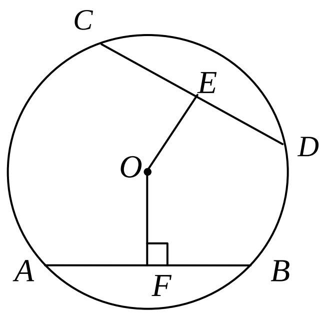
$$hyp = \sqrt{2000}$$

$$hyp = \sqrt{2000}$$

Ans

Question 9:

In the given diagram, if $m\overline{AB} = m\overline{CD} = 10\,\text{cm}$, then answer the following questions.



NOT TO SCALE

i. Find $m\overline{AF}$ and justify your answer.

ii. Is $m\overline{AF} = m\overline{DE}$? Justify your answer.

This question was based on the theorem related to the circle and its properties.

Better responses showed that candidates had command over the theorems and their application. Candidates were able to find the required measurement and were able to justify their answers with proper reason.

Example 1:

Find $m\overline{AF}$ and justify your answer. (2 Marks)

$\overline{AF}$ = 5 cm

Because AB = 10 cm & is equally bisected by a perpendicular bisector.

Is $m\overline{AF} = m\overline{DE}$? Justify your answer. (2 Marks)

Yes, because CD = AB, & they are bisected equally by a perpendicular bisector OE & OF respectively, hence are equal.

Example 2:

i. Find $m\overline{AF}$ and justify your answer. (2 Marks)

~~If AB = CD~~ AB = 10 cm So AF = 5 cm

mAF = 5 cm (because line drawn from the centre bisects a chord perpendicularly and dividing the ~~in~~ the chord into two equal ~~half~~) ~~and~~ halves } = AF = BF)

ii. Is $m\overline{AF} = m\overline{DE}$? Justify your answer. (2 Marks)

Yes m $\overline{AF}$ = m $\overline{DE}$ i.e 5cm = 5cm

because as explained above same is the case for $\overline{CD}$ chord the line from the centre bisects the chord into two equal halves such that CE = ED as length of both chords are equal so AF = DE ie 5 = 5 cm

Weaker responses indicated that the candidates failed to comprehend the properties of circles and, therefore, were unable to find the required measurement or failed to justify their answers.

Example 1:

i. Find $m\overline{AF}$ and justify your answer. (2 Marks)

$m\overline{AF} = 5cm$.

Since of $\overline{OF}$ is drawn perpendicular to $\overline{AB}$ (and it is not the diameter of the circle) it bisects it into two equal lengths

$\overline{AB} = 10 cm$ $\overline{Af} = \overline{AB} = 5cm$.

ii. Is $m\overline{AF} = m\overline{DE}$? Justify your answer. (2 Marks)

~~mAF ≠ mDE ...~~ $m\overline{AF}$ is not equal to $m\overline{DE}$.

~~AB ≠ CD and~~ Since $\overline{OE}$ is not perpendicular to $\overline{CD}$

~~OE is also drawn perpendicular~~ so it does not bisect it into equal lengths.

Example 2:

i. Find $m\overline{AF}$ and justify your answer. (2 Marks)

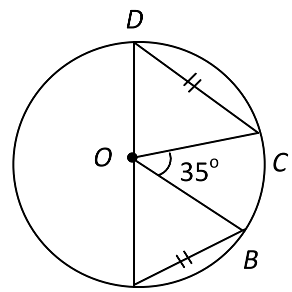
If $m\overline{AB} = m\overline{CD} = 10$ cm so the value of $\overline{AF}$ is of $\overline{AB}$ so the value is 5cm of $\overline{AF}$ because Af is half of the chord of $\overline{AB}$.

ii. Is $m\overline{AF} = m\overline{DE}$? Justify your answer. (2 Marks)

No, because in cirle of chord the opposite side are equal to each other and $m\overline{AF} = m\overline{DE}$ is not opposite side to each other.

Question 10:

Consider the given circle with centre O and find $m\angle AOB$. Justify each step involved in the calculation.



NOT TO SCALE

Better responses displayed that candidates had command over the theorems, applied relevant theorems to find $m\angle AOB$ and justified the steps involved in the process.

Example 1:

If two chords of same circle are equal then they subtend equal angles at the centre $\therefore m\angle COD = m\angle AOB$

Since angle sum on a straight line is 180°

therefore, $m\angle AOB + m\angle COD + 35° = 180°$

$\Rightarrow m\angle AOB + m\angle AOB = 180° - 35°$

$\Rightarrow 2m\angle AOB = 145°$

$\Rightarrow m\angle AOB = \frac{145}{2}$

$\Rightarrow \boxed{m\angle AOB = 72.5°}$ Answer

Example 2:

The length of $m\overline{DC} = m\overline{AB}$ So the $\angle AOB = \angle DOC$

$\angle O + \angle A + \angle B = 180^\circ$

$x + x + 35^\circ = 180^\circ$

$2x = 180 - 35^\circ$

$x = 145/2$

$x = 72.5^\circ$

$\angle AOB = 72.5^\circ$ and $\angle DOC = 72.5^\circ$

Weaker responses indicated that the candidates were unable to comprehend the theorem to be applied in the given question. Hence, they failed to fulfill the requirement of the question and found it difficult to justify their answers.

Example:

$m\angle AOB = 180^\circ \rightarrow$ because it is a right angle triangle

$m\angle A + m\angle O + m\angle B = 180^\circ$

$90^\circ + m\angle O + 45^\circ = 180^\circ$

$135^\circ + m\angle O = 180^\circ$

$m\angle O = 180 - 135$

$\boxed{m\angle O = 45^\circ}$ Ans

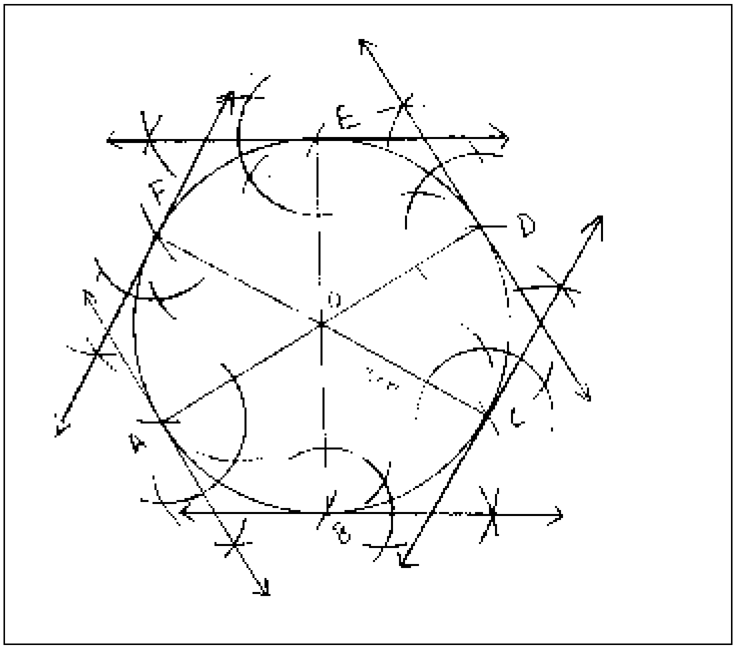
Question 11:

Draw a circle of radius 3 cm in the given space and draw a circumscribed regular hexagon around the given circle.

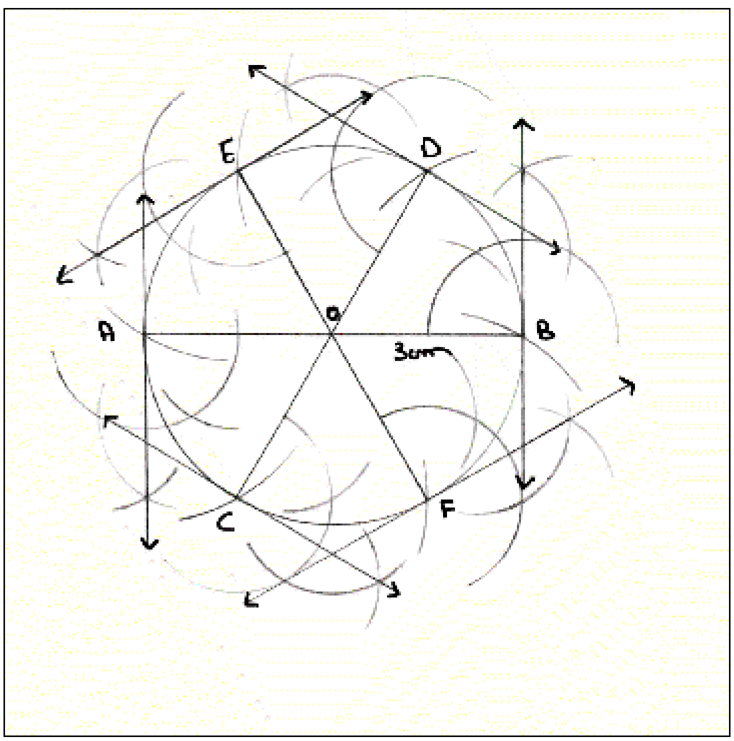
This question was based on the construction of circumscribed regular hexagon around the given circle.

Better responses displayed that candidates had good command over geometrical construction and had clear understanding that the process of drawing required circumscribed regular hexagon around the given circle.

Example 1:

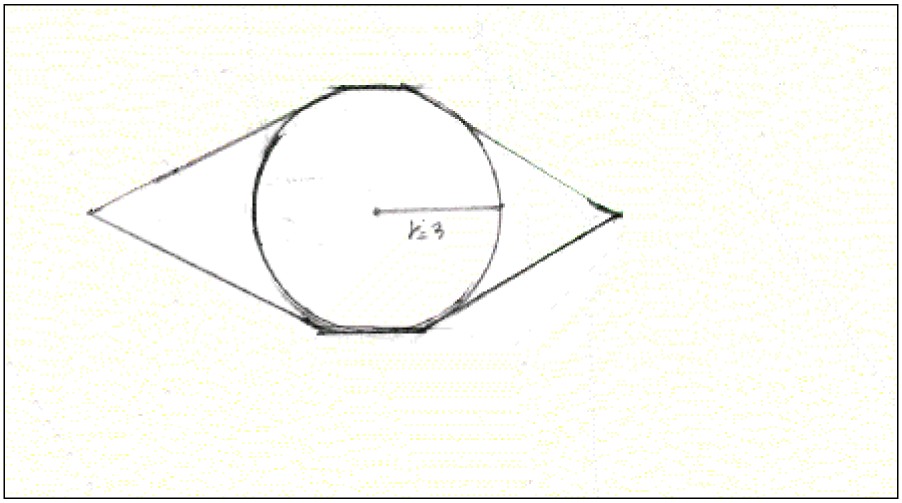


Example 2:



Weaker responses indicated that candidates had lack of understanding and failed to draw the required hexagon. Two examples a recited below:

Example 1:



Example 2: