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General Mathematics Paper 2, WASSCE (SC), 2023

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Question 1

(a) A car travels a distance of 112 km at an average speed of 70km/h. It then travels further for 60 km at an average speed of 50 km/h. Calculate, for the entire journey, the total time taken.

(b) If $\frac{x}{y} = 2$ and $\frac{y}{z} = 3$, find the value of $\frac{x+y}{y+z}$.

Observation

The Chief Examiner reported that in part (a) of this question a good number of candidates were able to interpret the but could not get the total time because of inadequate understanding of distance, speed and time relation . In part (b), many candidates handled it satisfactorily.

In part (a), they were expected to first find the time spent at the different speeds as $t_1 = \frac{112}{70}$ and $t_2 = \frac{60}{50}$. Then the $Total\ time = \frac{112}{70} + \frac{60}{50} = 2.8\ \text{hours} = 2\ \text{hours}\ 48\ \text{minutes}$.

In part (b), they did as expected by first dividing the numerator and denominator of the expression by to give $\frac{x+y}{y+z} = \frac{\frac{x}{y}+1}{1+\frac{z}{y}}$. Then substitute 2 for $\frac{x}{y}$ and $\frac{1}{3}$ for $\frac{z}{y}$ to give $\frac{2+1}{1+\frac{1}{3}}$. Simplifying gives $\frac{3}{4/3} = \frac{9}{4} = 2\frac{1}{4}$.

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Question 2

In a football match, the tickets for children and adults were sold at D 3.00 and D 5.00 respectively. If 400 people attended the football match and D 1, 700.00 was collected in ticket sales, :

a. How many tickets were sold to adults?

b. Mr. Sonko sold 250 tickets. If 175 of the tickets were for adults, how much sales di he make altogether?

Observation

The Chief Examiner reported that majority of the candidates' attempted this question satisfactorily. But some candidates still omitted the currency unit and also did not state the answer in part (b) of this question in two decimal places.

In part (a), they did as expected by first assigning x as number children and y as number of adults. The total number of people that attended the football match is given as

$x + y = 400$…(1).

The value of tickets sold to children and adult is given as

$3x + 5y = 1700$….(2).

Solving equation (1) and (2)

gives $y = 250$ and $x = 150$.

Therefore, tickets sold to adults = 250 *tickets.*

In part (b), they did as expected by obtaining number of children he sold ticket for as Children = 250 – 175 = 75.

Then Sales = 3 (75) + 5 (175) = 225 + 875 = D 1,100.00.

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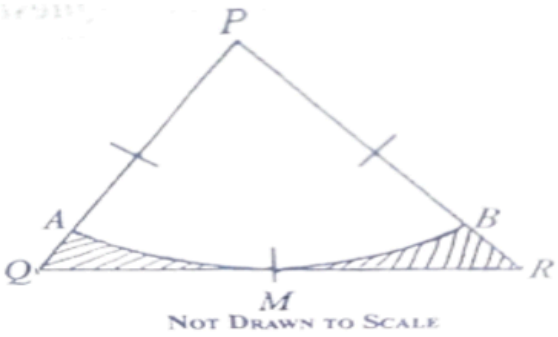
Question 3



In the diagram, PQR is an equilateral triangle of side 18 cm. M is the midpoint of $\overline{QR}$. An arc of a circle with centre P touches $\overline{QR}$ at M and meets $\overline{PQ}$ at A and $\overline{PR}$ at B. Calculate, correct to two decimal places, the area of the shaded region. [Take $\pi = \frac{22}{7}$]

Observation

The Chief Examiner reported that this question was unpopular among candidates. A good percentage of candidates that attempted it could not find out the area of the shaded part because they could not see the figure as a combination of equilateral triangle and a sector.

They were expected to first construct a perpendicular line from P to meet line QR. Observe that ΔPMR is a right-angled triangle. Apply Pythagoras theorem on ΔPMR to give $|\overline{MP}|^2 + 9^2 = 18^2$.

Simplifying gives $|\overline{MP}| = 9\sqrt{3}cm$. Note that Δ PQR is equilateral, means all angles = 60°. Area of sector $PAMB = \frac{60}{360} \times \frac{22}{7} \times (9\sqrt{3})^2$ = 127.2857cm². Area of $\Delta PQR = \frac{1}{2} \times 18 \times 9\sqrt{3}$ = 140.2961.

Therefore, area of shaded region = 140.2961 -127.2857 = 13.0104 = 13.01cm².

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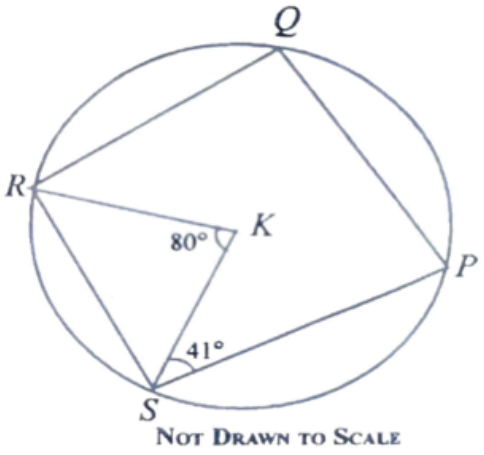
QUESTION 4



In the diagram, P, Q, R and S are points on the circle centre K. $\overline{KR}$ is a bisector of $\angle SRQ$, $\angle SRQ = 41°$ and $\angle SKR = 80°$. Find:

(a) $\angle RQP$;
(b) $\angle SPQ$.

Observation

The Chief Examiner reported that a good percentage of candidates that attempted this question could not interpret the diagram and apply the circle theorem correctly.

In part (a), they were expected to observe that $\angle KRS = \angle KSR$ because they are base angle of isosceles triangle. $2\angle KSR + 80° = 180°$ because they are the angles in a triangle. Simplifying gives $2\angle KSR = 100° \Longrightarrow \angle KSR = 50°$. $\angle RQP + (50 + 41) = 180°$ because they are opposite angles of a cyclic quadrilateral. simplifying gives $\angle RQP = 180° - 91° = 89°$.

In part (b), they were expected to observe that $\angle SRQ = 2\angle KRS = 2 \times 50° = 100°$.

$\angle SRQ + \angle SPQ = 180°$ because they are opposite angles of cyclic quadrilateral. simplifying gives $100° + \angle SPQ = 180° \Longrightarrow \angle SPQ = 180° - 100° = 80°$.

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Question 5

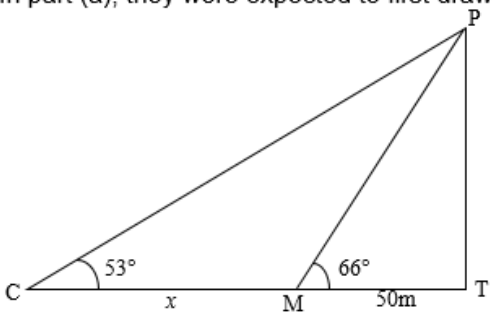
A boy stands at a points M on the same horizontal level as the foot, T, of a vertical building. He observes an object on the top, P of the building at an angle of elevation of 66°. He moves directly backwards to a new point C and observes the same object at an angle of elevation of 53°. If $|\overline{MT}| = 50\ m$,:

(a) Illustrate the information in a diagram;
(b) Calculate, correct to **one** decimal place:
(i) the height of the building;
(ii) $|\overline{MC}|$.

Observation

The Chief Examiner reported that majority of the candidates' who attempted this question could not draw the required diagram properly. Thereby leading to low mark scored by many candidates for this question.

In part (a), they were expected to first draw the diagram as shown:



In part (b) (i), they were expected to apply trigonometric ratio to give $\tan 66 = \frac{|\overline{PT}|}{50}$. Simplifying gives $|\overline{PT}|$

$= 50 \text{ x} \tan 66 = 112.3\text{m}.$

In part (b) (ii), they were expected to apply trigonometric ratio to give $\tan 53 = \frac{112.3}{x+50}$. Cross multiplying gives $1.327\,(x + 50) = 112.3$. Expanding gives $1.327x + 66.35 = 112.3$. Solving gives $x = 34.627$. Therefore, $|\overline{MC}| = 34.6m$.

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Question 6

(a) $M = \{n: 2n - 3 \leq 37\}$, where n is a counting number.

(i) Write down all the elements in M.

(ii) If a number is selected at random from M, what is the probability that it is a:

(α) multiple of 3;

(β) factor of 10.

(b) A shop owner gave an end-of-year bonus to two of his attendents, Kontor and Gapson in the ratio of their ages. Kontor's age is **one and half** times that of Kontor who is 20 years old. If Kontor received Le 200, 000.00, find:

(i) the total amount shared;

(ii) Gapson's share.

Observation

The Chief Examiner reported that majority of the candidates' who attempted this question handled it poorly. In part (a) of this question some candidates failed to get the required probability.

In part (a)(i), they were expected to simplify the inequality $2n - 3 \leq 37$ to give $2n \leq 40$. Solving gives $n \leq 20$. Therefore, the elements of M is given as M = {1, 2, 3, 4, …, 20}.

In part (a) (ii) (α), they were expected to list the multiples of 3 from the elements of M as 3, 6, 9, 12, 15, 18. Observe that the multiples of 3 are 6 in number. Therefore, Probability (multiples of 3) = $\frac{6}{20} = \frac{3}{10}$.

In part (a)(ii)(β), they were expected to list the factors of 10 from the elements of M as 1, 2, 5, 10. Observe that the factors of 10 are 4 in number. Therefore, Probability (factors of 10) = $\frac{4}{20} = \frac{1}{5}$.

In part (b), they were expected to state Kontor : Gapson = 3:2 and assign x as the amount shared. Kontor's share is written as $\frac{3}{5}x = 200{,}000$. Solving gives x = Le 333,333.33. Therefore, the amount shared is Le 333,333.33.

In part (b) (ii), they were expected obtain Gapson share as total share minus Kontor's share gives 333,333.33 – 200,000 = Le 133,333.33.

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Question 7

a. The sum of three numbers is 81. The second number is **twice** the first. Given that th third number is 6 more than the second, find the numbers.

b. Given the points P(3, 5) and Q (on the Cartesian plane such that R (is the midpoin of , find the equation of the line that passes through R and perpendicular to .

Observation

The Chief Examiner reported that performance of candidates in part (a) of this question was encouraging as many candidate could obtain three numbers. While performance in part (b) of this question was unsatisfactory as many candidates had difficulty in getting the equation of the line.

In part (a), they were expected to first x, ($2x$) and ($2x + 6$) as the three numbers. Then sum of the three numbers is given as $x + (2x) + (2x + 6) = 81$. Simplifying gives $5x + 6 = 81$. Solving gives $x = 15$. Therefore, the numbers are 15, 30 and 36.

In part (b), they were expected to first the Midpoint as $\left(\frac{3-5}{2}, \frac{5+7}{2}\right)$. Simplifying gives (-1, 6). Get the Gradient PQ by substituting into the gradient formula to give $\frac{5-7}{3--5} = \frac{-1}{4}$. then Gradient perpendicular to PQ $= \frac{-1}{\frac{-1}{4}} = 4$. Substituting into the equation of a line formula gives $y = 6 + 4(x - (-1))$. Simplifying gives $y = 4x + 10$.

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Question 8

(a) Copy and complete the table of values for $y = 2x^2 - x - 4 \; for \; -3 \leq x \leq 3$.

x	-3	-2	-1	0	1	2	3
y	17			-4			

(b) Using a scale of 2 cm to 1 unit on the *x*-axis and 2 cm to 2 units on the *y*-axis, draw the graph of $y = 2x^2 - x - 4$ for $-3 \leq x \leq 3$

(c) Use the graph to find the:

(i) roots of the equation $2x^2 - x - 4 = 0$;

(ii) values of *x* for which *y* increases as *x* increases,

(iii) minimum point of *y*.

Observation

The Chief Examiner reported that many candidates avoided this question. Most candidates who attempted this question were able to complete the table of values but were unable to draw the graph satisfactorily.

(a) In part (a), they were expected to construct the table of values for $y = 2x^2 - x - 4 \; for \; -3 \leq x \leq 3$ as shown:

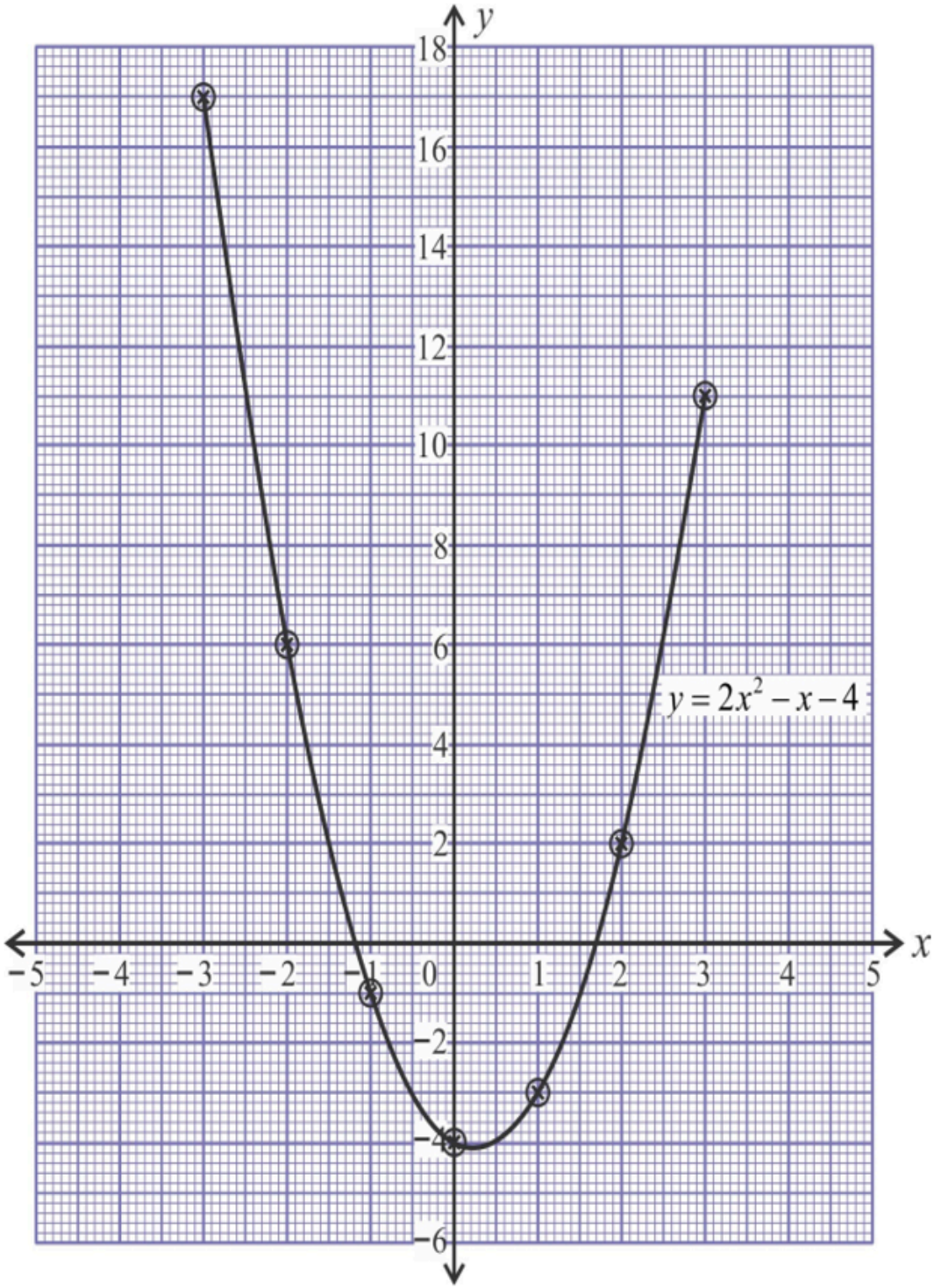
x	-3	-2	-1	0	1	2	3
y	17	(6)	(-1)	-4	(-3)	(2)	(11)

In part (b), they were expected by drawing graph attached:

In part (c) (i), they were expected to read from the graph attached and obtain the roots as $x = -1.3, x = 1.7$.

In part (c) (ii), they were expected to read from the graph attached and obtain values of x for which y increases as x increases as $0.3 < x \leq 3$.

In part (c) (iii), they were expected to read from the graph attached and obtain the minimum point of y as $(0.3 \pm 0.1, -4 \pm 0.2)$.



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Question 9

Height (m)	3	4	5	6	7	8
Number of trees	4	6	4	5	6	2

The table shows the height of teak trees harvested by a farmer.

a. Find the median height.

b. Calculate, correct to one decimal place, the:

1. mean;
2. standard deviation.

Observation

The Chief Examiner reported that many candidates were able to attempt this question satisfactorily.

In part (a), they were expected to first find the total number of trees as 4 + 6 + 4 + 5 + 6 + 2

= 27.

In part (a), they were expected to first find the total number of trees as 4 + 6 + 4 + 5 + 6 + 2 = 27.

Then the Median position = $= \frac{27+1}{2}$ th $= 14^{th}$. Therefore, Median height = 5m

In part (b)(i), they were expected to draw the table as shown:

x	f	fx	fx^2
3	4	12	36
4	6	24	96
5	4	20	100
6	5	30	180
7	6	42	294
8	2	16	128
	$\Sigma f = 27$	$\Sigma fx = 144$	$\Sigma fx^2 = 834$

Then substituting into the mean formula gives Mean = $\frac{144}{27}$ = 5.33 = 5.3(1d.p.)

In part (b) (ii), they were expected to substitute into standard deviation formula to give

Standard deviation = $\sqrt{\frac{834}{27} - \left(\frac{144}{27}\right)^2} = \sqrt{2.297}$ = 1.566 = 1.6 (1d.p.).

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Question 10

In a town Chief X resides 60 m away on a bearing of 057 from the palace P, while Chief Y resides on a bearing of 150 from the same palace P. The residence of X and Y are 180 m apart.

a. Illustrate the information in a diagram.

b. Find, correct to **three** significant figures, the:

i. bearing of X and Y;

ii. distance between P and Y.

Observation

The Chief Examiner reported that the performance of candidates who attempted this question was not encouraging because many were unable to the required bearing diagram.

In part(a), they were expected to draw the diagram as shown:

In part (b) (i), they were expected to apply sine rule to give $\frac{\sin 93^\circ}{180} = \frac{\sin Y}{60}$. Simplifying gives $\sin Y = 0.33287$. Solving gives $Y = \sin^{-1}(0.33287) = 19.44^\circ$. therefore, the bearing of X from Y $= 270^\circ + 60^\circ + 19.44^\circ = 349^\circ$.

In part (b) (ii), they were expected to apply sine rule to give $\frac{\sin(180^\circ - 93^\circ - 19.44^\circ)}{|PY|} = \frac{\sin 93}{180} \Longrightarrow \frac{\sin 67.56^\circ}{|PY|}$ $= \frac{\sin 93}{180}$. Simplifying gives $|\overline{PY}| = \frac{180\ x\ 0.92428}{0.998629} = \frac{166.3703}{0.998629} = 166.598\ m = 167$ m.

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Question 11

a. Two regular polygons P and Q are such that the number of sides of P is twice th number of sides of Q. The difference between the exterior angle of Q and P is 45 Find the number of sides of P.

b. The area of a semi-circle is 32. Find, in terms of , the circumference of the semi-circle

Observation

The Chief Examiner reported that this question was quite popular with the candidates. However, some candidates who attempted part (a) of this question had difficulty with the application of the exterior and interior angle formula for polygon.

In part (a) (i), they were expected to first assign x and $2x$ as the number sides of the polygons. The difference between the exterior angles is given as $\frac{360}{x} - \frac{360}{2x} = 45$. Simplifying gives $2(360) - 360 = 45(2x)$. Expanding gives $720 - 360 = 90x$. Solving gives $x = 4$. Therefore, number of sides of P = 2 × 4 = 8 sides.

In part (b), they were expected to equate the area of a semi circle to what is given to give $\frac{\pi r^2}{2} = 32\pi$. Simplifying gives $r^2 = 64$. Solving gives $r = 8$. Then $d = 16$. Substituting into the length of arc of semi-circle formula gives $\frac{2\pi \times 8}{2} = 8\pi$. Therefore, circumference of semi-circle = $(8\pi + 16)$ cm.

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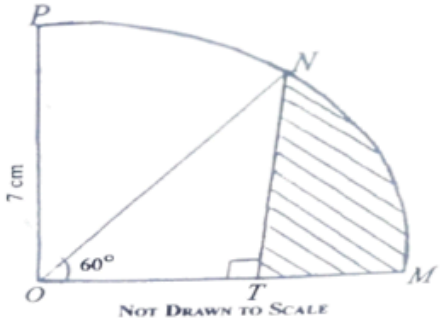
Question 13

(a)



In the diagram, the radius of the sector of circle centre O, is 7 cm and $\angle MON$ is 60°. Find, correct to one decimal place, the area of the shaded portion.

[Take $\pi = \frac{22}{7}$]

(b) The x and y intercepts of a straight line are $-\frac{3}{4}$ and $\frac{2}{7}$ respectively. Find the equation of the line.

Observation

The Chief Examiner reported that few candidates attempted this question did not handled it satisfactorily because of their lack of adequate knowledge of plane geometry and mensuration.

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