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Question 1

- a. Given that u_1, u_2, u_3 are consecutive terms of a Geometric Progression (G.P.) with common ratio, r , find the values of u_1 and u_2 .
- b. Two positive numbers are in the ratio 3 : 4. The sum of **thrice** the first number and **twice** the second is 68. Find the **smaller** number.

Observation

The Chief Examiner reported that Candidates' answered this 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 quadratic equation. In part (b), many candidates handled it satisfactorily.

In part(a), they were expected to first find write out r values in ratio form $r = \frac{9}{7-2x}$, $r = \frac{5x+17}{9}$.

Equating together gives $\frac{9}{7-2x} = \frac{5x+17}{9}$. Cross multiplying gives $9 \times 9 = (7 - 2x)(5x + 17)$.

Simplifying gives $10x^2 - x - 38 = 0$. Factorising and solving gives $x = 2, x = -\frac{19}{10}$.

In part (b), they were expected by letting the numbers be x and y . Then form a relation with the first sentence to give $x:y = 3:4$ which implies $\frac{x}{y} = \frac{3}{4}$. Make x the subject to give

$x = \frac{3}{4}y$ (1) . Form a relation with the second sentence to give $3x + 2y = 68$ (2).

Substitute $\frac{3}{4}y$ for x into equation (2) gives $3\left(\frac{3}{4}y\right) + 2y = 68$. Simplifying gives $17y = 272$.

Solving gives $y = 16$. Substituting into equation (1) gives $x = \frac{3}{4} \times 16 = 12$. Therefore, the smaller number is 12.

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Question 2

Given that $y = \left(\frac{pr}{m} - p^2r\right)^{-\frac{2}{3}}$,

(a) make r the subject;

(b) find the value of r when $y = -8$, $m = 1$ and $p = 3$.

Observation

The Chief Examiner reported that majority of the candidates' attempted this question. The ability to make the subject of the relation, substituting and simplifying was generally adhered to by the candidates.

In part(a) they did as expected by taking $-\frac{2}{3}$ root of both sides to give $y^{-\frac{3}{2}} = \frac{pr}{m} - \frac{p^2r}{1}$.

Combining the fractions on the right gives $y^{-\frac{3}{2}} = \frac{pr - p^2rm}{m}$. Cross multiplying gives $my^{-\frac{3}{2}} = pr - p^2rm$. Collecting like terms and making r the subject gives $r = \frac{my^{-\frac{3}{2}}}{p - p^2m}$.

In part(b) they did as expected by substituting values of y , m and p into $\frac{my^{-\frac{3}{2}}}{p - p^2m}$ to give $\frac{1(-8)^{-\frac{3}{2}}}{3 - 3^2(1)}$.

Simplifying gives $r = -\frac{1}{24}$.

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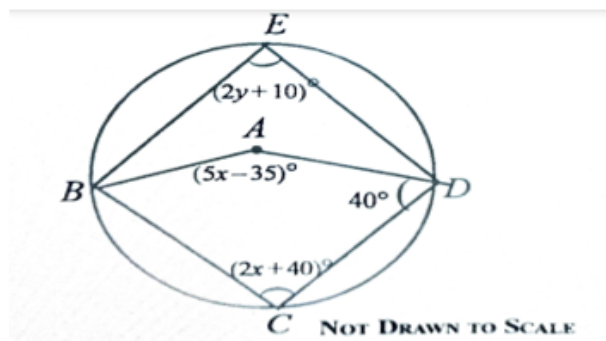
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QUESTION 4



In the diagram, $BCDE$ is a circle with centre A . $\angle BCD = (2x + 40)^\circ$, $\angle BAD = (5x - 35)^\circ$, $\angle BED = (2y + 10)^\circ$ and $\angle ADC = 40^\circ$. Find:

- (a) the values of x and y .
- (b) $\angle ABC$.

Observation

The Chief Examiner reported that a good percentage of candidates that attempted this question creditably well.

In part (a), they were expected to observe that $2x + 40 + 2y + 10 = 180^\circ$ by opposite angles of a cyclic quadrilateral theorem. Simplifying gives $x + y = 65^\circ$ (1).

Observe that $5x - 35 = 2(2y + 10)$ applying angle at centre is twice angle at circumference theorem. Simplifying gives $5x - 4y = 55^\circ$ (2). Solving equation (1) and (2) gives $x = 35^\circ, y = 30^\circ$.

In part (b), they were expected to observe that $\angle ABC + \angle BAC + \angle ADC + \angle BC = 360^\circ$ in quadrilateral $ABCD$. Substituting gives $\angle ABC + [2 \times 35^\circ + 40^\circ] + [5(35) - 35]^\circ + 40^\circ = 360^\circ$. Simplifying gives $\angle ABC + 290^\circ = 360^\circ$. Solving gives $\angle ABC = 70^\circ$.

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Question 5

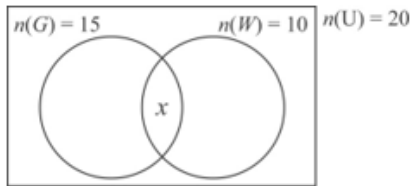
- (a) Given that $m = \tan 30^\circ$ and $n = \tan 45^\circ$, simplify, without using calculator, $\frac{m-n}{mn}$, leaving the answer in the form $p + \sqrt{q}$.
- (b) There are 20 women in a bus. 15 of them wear glasses and 10 wear wrist watches. If a woman is chosen at random from the bus, find the probability that she wears **both** glasses and wrist watch.

Observation

The Chief Examiner reported that majority of the candidates' who attempted part (a) the question were able to get the value of . However, few found it difficult to rationalise and simplify and hence lost most of the marks. While part (b) of the question was satisfactorily attempted by most candidates.

In part(a), they were expected find and substitute the trigonometric ratios in surd form into the given expression to give $\frac{\frac{\sqrt{8}}{8} - 1}{\left(\frac{\sqrt{8}}{8}\right)(1)}$. Simplifying gives $\frac{\sqrt{8}-3}{\sqrt{8}}$. Rationalizing and simplifying gives $1 - \sqrt{3}$.

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



From the diagram, we observe that $20 = 15 + 10 - x$. solving gives $x = 5$.

Therefore, probability($G \cap W$) $\frac{1}{4}$ or 0.25.

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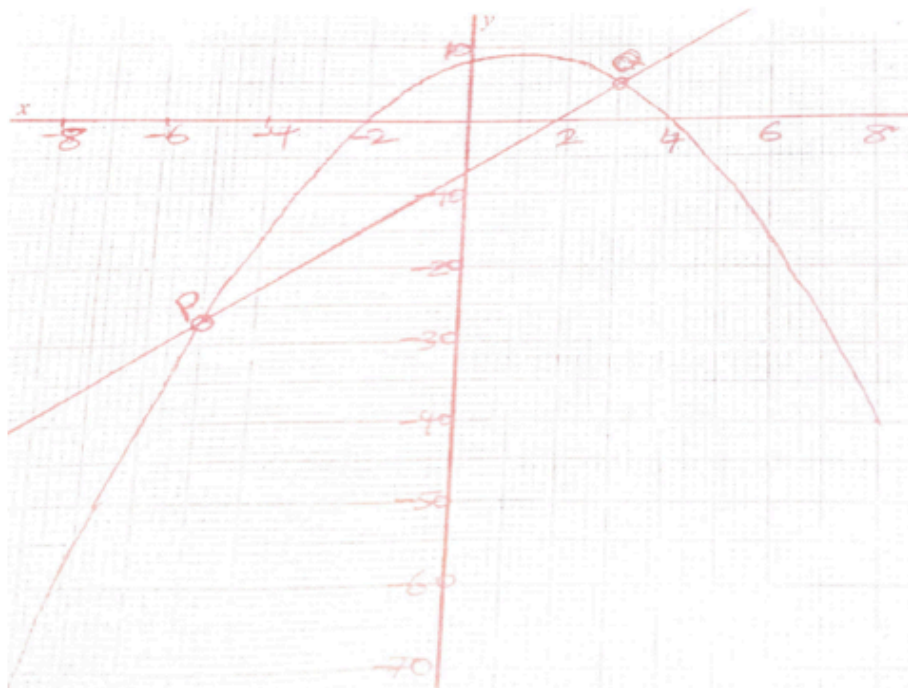
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The graph shows the relation of the form $y = mx^2 + nx + r$, where m, n and r are constants. Using the graph:



- State the scale used on **both** axes;
- find the values of m, n and r .
- find the gradient of the line through **P** and **Q**;
- scale the range of values of x for which $y > 0$.

Observation

handled it poorly. Many candidate could not able the scale of the graph nor able to the values of the constants.

In part (a), they were expected to state the scale as x- axis: 2 cm to 2 units and y-axis 2 cm to 10 units.

In part (b), they were expected bring the linear expressions from the graph as $(x + 2)$, $(x - 4)$.

Expanding and equating to zero gives $x^2 - 2x - 8 = 0$. Since the curve has a maximum point it is written as $y = 8 + 2x - x^2$. Comparing with the general quadratic equation gives

$$m = -1, n = 2, r = 8.$$

In part (c), they were expected to observe from the graph the required coordinates to be

$$P(-5, -27), Q(3, 5). \text{ Substitute into the gradient formula to give } \frac{5 + 27}{3 + 5} = \frac{32}{8} = 4.$$

In part (d), they were expected to state the required range as $\{x: -2 < x < 4\}$.

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Question 7

- (a) A man purchased 180 copies of a book at ₦ 250.00 **each**. He sold y copies at ₦ 300.00 **each** and the rest at a discount of 5 *kobo* in the Naira of the cost price. If he made a profit of ₦ 7,125.00, find the value of y .
- (b) A trader bought x bags of rice at a cost, $c = 24x + 103$ and sold them at a price, $s = 33x - \frac{x^2}{20}$.
- (i) Find the expression for the profit.
 - (ii) If 20 bags of rice were sold, calculate the percentage profit.

Observation

The Chief Examiner reported that performance of candidates in the question was not encouraging. Many candidates failed the unit which made them to lose some mark.

In part (a), they were expected to get the total cost as $180 \times 250 = \text{₦}45,000.00$. The total selling price is given as $300y + (180 - y) \times \frac{95}{100} \times 250 = 62.5y + 42750$. Then substituting into the profit formula gives $7125 = 62.5y + 42750 - 45000$. Simplifying and solving gives $y = 150$ books.

In part (b)(i), they were expected to write out expression for profit as

$$\left(33x - \frac{x^2}{20}\right) - (24x + 103) = 9x - \frac{x^2}{20} - 103.$$

In part (b)(ii), they did as expected by calculating the cost as $24(20) + 103 = 583.00$. the selling price as $33(20) - \frac{(20)^2}{20} = 640.00$. Then the percentage profit as $\frac{640-583}{583} \times \frac{100}{1} = 9.78\%$.

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Question 8

<i>Item</i>	<i>Food and drinks</i>	<i>Fuel</i>	<i>Rent</i>	<i>Building Project</i>	<i>Education</i>	<i>Savings</i>
<i>Percentage(%)</i>	35	7.5	10	15	17.5	

The table shows the monthly expenditure (in percentage) of Mr. Okafor's salary.

- a. Calculate the percentage of Mr. Okafor's salary that was put into savings.
- b. Illustrate the information on a pie chart.
- c. If Mr. Okafor's annual gross salary is \$ 28, 800.00 and he pays tax of 12%, calculate:
 1. his monthly tax;
 2. amount saved **each** month.

Observation

The Chief Examiner reported that part (a) and (c) of this question was well attempted by majority of the candidates'. However, there were a few others who could not simplify correctly. While in part (b), some candidates' were unable to draw the pie chart required correctly.

In part (a), they were expected to add the percentages together and equate to zero to give

$35 + 7.5 + 10 + 15 + 17.5 + x = 100$. simplifying and solving gives .

In part (b), they did as expected to find the angles of the listed items as shown:

$$\text{Food and drink} = \frac{35}{100} \times 360^\circ = 126^\circ$$

$$\text{Fuel} = \frac{7.5}{100} \times 360^\circ = 27^\circ$$

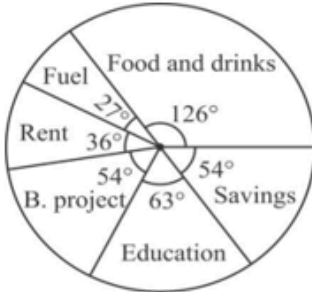
$$\text{Rent} = \frac{10}{100} \times 360^\circ = 36^\circ$$

$$\text{Building project} = \frac{15}{100} \times 360^\circ = 54^\circ$$

$$\text{Education} = \frac{17.5}{100} \times 360^\circ = 63^\circ$$

$$\text{Savings} = \frac{15}{100} \times 360^\circ = 54^\circ$$

Then draw the pie chart as shown:



In part (c)(i), they were expected to first obtain the income tax as $\frac{12}{100} \times 28,800 = \$ 3,456.00$.

Then the monthly income tax as $\frac{3456}{12} = \$288.00$.

In part (c)(ii), they were expected to get the monthly net salary as $\frac{1}{12} (28800 - 3456) =$

$\$2,112.00$. then the amount saved each month as $\frac{15}{100} \times 2112 = \316.80 .

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Question 9

(a) Copy and complete the table of values for $y = \sin x + 7 \cos x$ for $0^\circ \leq x \leq 180^\circ$.

x	0°	20°	40°	60°	80°	100°	120°	140°	160°	180°
y	7.0				4.2		-0.9			

(b) Using a scale 2 cm to 20° on the x – axis and 2 cm to 2 units on the y - axis, draw the graph of $y = \sin x + 7 \cos x$ for $0^\circ \leq x \leq 180^\circ$.

(c) Using the graph, find the:

- (i) value of y when $x = 150^\circ$;
- (ii) range of values of x for which $y > 0$.

Observation

The Chief Examiner reported that many candidates were able to complete the table of values but were unable to draw the correct graph required.

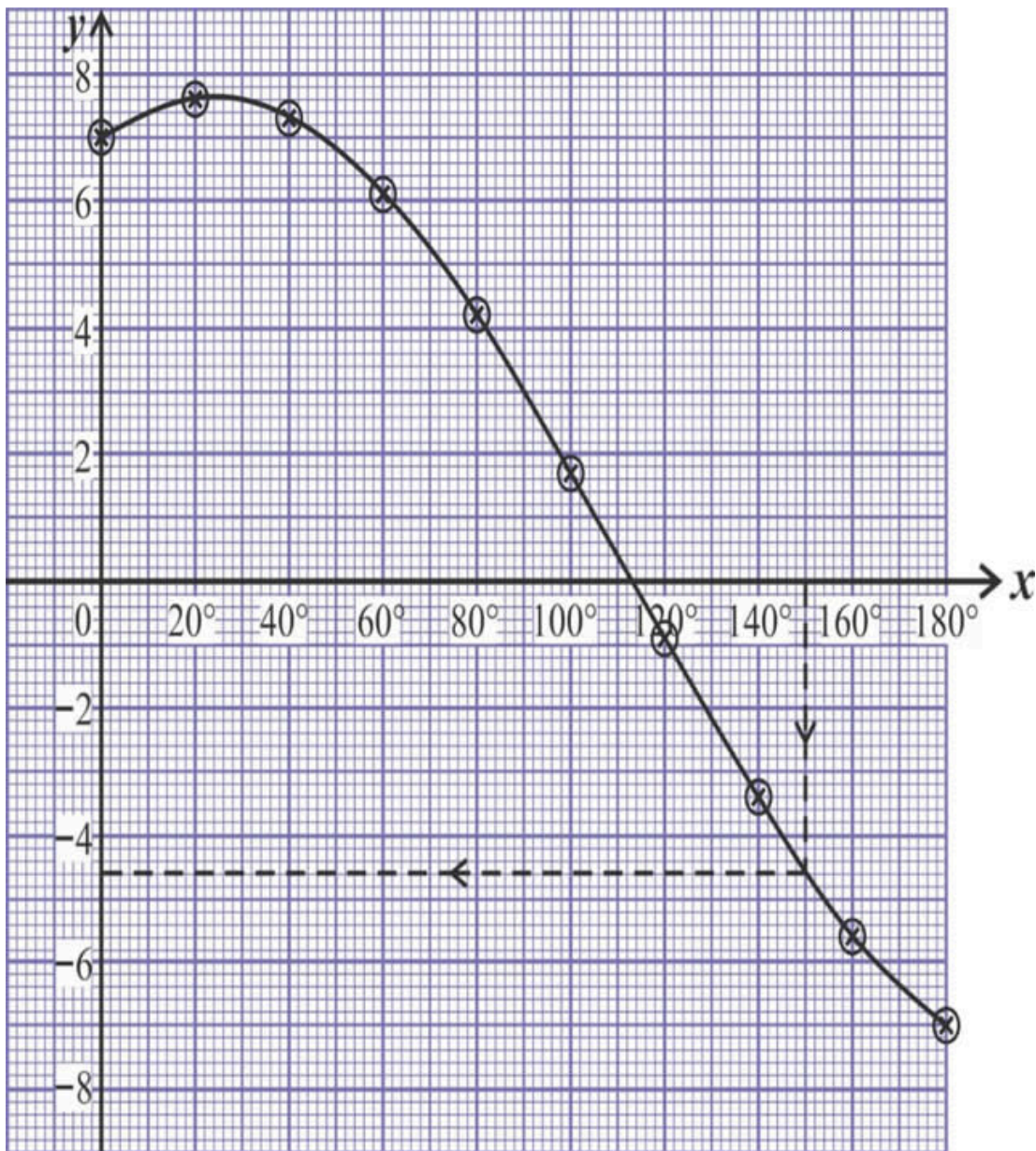
In part (a), they were expected to complete table as shown:

x	0°	20°	40°	60°	80°	100°	120°	140°	160°	180°
y	7.0	7.6	7.3	6.1	4.2	1.7	-0.9	-3.4	-5.6	-7

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

In part (c)(i), they were expected to read and observe from the graph that the value of y when x to be $y = -4.6 \pm 0.2$.

In part (c)(ii), they were expected to read and observe from the graph that the range of values of x for which $y > 0$ to be $\{x: 0 \leq x < 113^\circ \pm 2^\circ\}$.



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Question 10

<i>Age(years)</i>	3	4	5	6	7	8	9	10
<i>Number of Children</i>	2	6	5		6	9	8	5

The table shows the distribution of ages of a number of children in a school. If the mean of the distribution is 7, find the:

- a. A value of ;
- b. standard deviation of their ages.

Observation

The Chief Examiner reported that the performance of candidates who attempted this question was encouraging because many were able to solve it correctly.

In part(a), they were expected to substitute into the mean formula, simplify and solve as shown:

$$7 = \frac{3 \times 2 + 4 \times 6 + 5 \times 5 + 6 \times x + 7 \times 6 + 8 \times 9 + 9 \times 8 + 10 \times 5}{2 + 6 + 5 + x + 6 + 9 + 8 + 5}$$

$$7 = \frac{6 + 24 + 25 + 6x + 42 + 72 + 72 + 50}{41 + x}$$

$$7(41 + x) = 291 + 6x$$

$$287 + 7x = 291 + 6x$$

$$x = 4$$

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

x	f	$x - \bar{x}$	$f(x - \bar{x})^2$
3	2	-4	32
4	6	-3	54
5	5	-2	20
6	4	-1	4
7	6	0	0
8	5	1	9
9	4	2	32
10	6	3	45
	$\Sigma f = 45$		$\Sigma f(x - \bar{x})^2 = 196$

Then substituting into the standard deviation formula and simplifying gives $\sqrt{\frac{196}{45}}$

$$= \sqrt{4.355} = 2.087.$$

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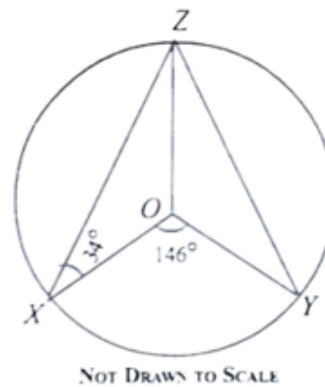
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Question 11

(a) The exterior angles of a polygon are 42° , 38° , 57° , x° , $(x + y)^\circ$, $(2x - 15)^\circ$ and $(3x - y)^\circ$. If x is 7° less than y , find the values of x and y .

(b)



In the diagram, O is the centre of the circle XYZ . $\angle ZXO = 34^\circ$ and $\angle XOY = 146^\circ$. Find $\angle OYZ$.

Observation

The Chief Examiner reported that this question was popular with the candidates. Most candidates who attempted this question performed creditably well in part (a). But the performance in part(b) was poor due to inadequate knowledge of circle geometry. In part (a) (i), they were expected to obtain a relation for the second sentence as . Equate the sum of the exterior angles to 360 as shown:

$42 + 38 + 57 + x + x + y + 2x - 15 + 3x - y = 360^\circ$. Simplifying gives $122 + 7x = 360$.
Solving gives $x = 34^\circ$.

Then substitute 34° for x into $x = y - 7$ gives $34 = y - 7$. Solving gives $y = 41^\circ$. Therefore, $x = 34^\circ$, $y = 41^\circ$.

In part (b), they were expected to apply the that states angle at the circumference is equal half angle at the centre to give $\angle XZY = \frac{1}{2}(146) = 73^\circ$. Applying angles in the same segment theorem observe that $\angle OZX = 34^\circ$. Observe that $\angle XZY = \angle OZX + \angle OZY$. Substituting gives $73^\circ = 34^\circ + \angle OZY$. Then $\angle OZY = 73 - 34 = 39$. Applying angles in the same segment theorem observe that $\angle OZY = \angle OYZ = 39^\circ$.

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Question 12

(a) The probability that an athlete will **not** win any of the **three** races is $\frac{1}{4}$.

If the athlete runs in all the races, what is the probability that the athlete will win:

- (i) **only** the **second** race;
- (ii) **all** the **three** races;
- (iii) **only two** of the races?

(b) A cone with perpendicular height 24 *cm* has a volume of 1200 *cm*³. Find the volume of a cone with the same base radius and height 84 *cm*. [Take $\pi = \frac{22}{7}$]

Observation

The Chief Examiner reported that majority of the candidates' who attempted this question got it right. However, some candidates found part (a) of the question difficult to interpret.

In part(a) (i), they were expected to find the probability of winning any of the three races as $p' = 1 - \frac{1}{4} = \frac{3}{4}$. Deduce that, probability of only the second winning means, first losing, second winning, third losing. Therefore, Probability (only second winning) $= \frac{1}{4} \times \frac{3}{4} \times \frac{1}{4} = \frac{3}{64}$ or 0.04687.

In part (a)(ii), they were expected to deduce that that, probability of all the three winning means, first winning, second winning, third winning. Therefore, Probability (all the three winning) $= \frac{3}{4} \times \frac{3}{4} \times \frac{3}{4} = \frac{27}{64}$ or 0.422.

In part (a) (iii), they were expected to deduce that, probability only two winning has three possibilities namely; first winning, second winning, third losing or first winning, second losing, third winning or first losing, second winning, third winning. Therefore, Probability (only two winning) $= \left(\frac{3}{4} \times \frac{3}{4} \times \frac{1}{4}\right) + \left(\frac{3}{4} \times \frac{1}{4} \times \frac{3}{4}\right) + \left(\frac{1}{4} \times \frac{3}{4} \times \frac{3}{4}\right) = \frac{9}{64} + \frac{9}{64} + \frac{9}{64} = \frac{27}{64}$ or 0.422

In part (b), they were expected to deduce that the first and second sentence means $24:1200 = 84 : V$. Writing in fraction gives $\frac{24}{1200} = \frac{84}{V}$. Solving gives $V = \frac{7}{2} \times 1200 = 4200 \text{ cm}^3$.

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Question 13

- (a) The diameter of a cylinder closed at both ends is 7 cm . If the total surface area is 209 cm^2 , calculate the height. [Take $\pi = \frac{22}{7}$]
- (b) The points X and Y, 19 m apart are on the same side of a tree. The angles of elevation of the top, T, of the tree from X and Y on the horizontal ground with the foot of the tree are 43° and 38° respectively.
- (i) Illustrate the information in a diagram.
 - (ii) Find, correct to **one** decimal place, the height of the tree.

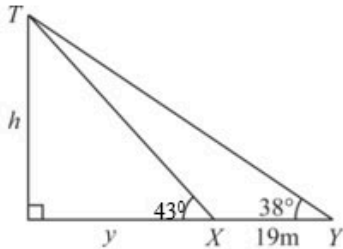
Observation

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

In part (a), they were expected to substitute the given value of parameters into the total surface area of cylinder relation to give $209 = 2 \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2 + 2 \times \frac{22}{7} \times \frac{7}{2} \times h$. Simplifying gives

$$209 = 77 + 22h. \text{ Solving gives } h = 6 \text{ cm.}$$

In part (b)(i), they were expected to a diagram as shown:



In part (b)(ii), they were expected to apply trigonometric ratio to gives $\tan 43^\circ = \frac{h}{y}$ and

$\tan 38^\circ = \frac{h}{y+19}$. Substituting the trigonometric ratio values and cross multiplying the two relations gives $0.9325y = h$ (1) and $0.7813(y+19) = h$ (2). Solving gives

$$y = 98.2 \text{ m and } h = 91.6 \text{ m}$$

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