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(a) Given that $110_x = 40_{five}$, find the value of x.

(b) Simplify $\frac{15}{\sqrt{75}} + \sqrt{108} + \sqrt{432}$, leaving the answer in the form $a\sqrt{b}$, where a and b are positive integers.

The Chief Examiner reported that in part (a),majority of the candidates' were able to convert to base ten as required and solved the quadratic equation formed but a few could not conclude correctly.In part (b), most of the candidates' attempted this question but quite a handful could not rationalize correctly hence loosing few marks. However, in general, performance was better in parts (a) than in (b).

In part (a), they did as expected by converting to base ten and when simplified yielded

$x^2 + x - 20 = 0$ and when solved, they obtained $(x + 5)(x - 4) = 0$ which implies $x = 4$ or $x = -5$.

But x cannot be negative since it is the base, therefore, $x = 4$.

In part (b), they were expected to simplify $\frac{15}{\sqrt{75}} = \frac{3}{\sqrt{3}}$ which will yield $\sqrt{3}$ when rationalized. Similarly,

$\sqrt{108} = 6\sqrt{3}$ and $\sqrt{432} = 12\sqrt{3}$. Thus, substituting and simplifying will yield

$\sqrt{3} + 6\sqrt{3} + 12\sqrt{3} = 19\sqrt{3}$.

Question 2

(a) Find the equation of the line which passes through the points $A(-2, 7)$ and $B(2, -3)$.

(b) Given that $\frac{5b - a}{8b + 3a} = \frac{1}{5}$, find, correct to **two** decimal places, the value of $\frac{a}{b}$.

The Chief Examiner reported that only a few of the Candidates' attempted this question very well. In part (a), they were expected to find the gradient of AB to obtain $(m) = \frac{-3-7}{2+2} = \frac{-5}{2}$.

Then, substituting into $y - y_1 = m(x - x_1)$to arrive at $y + 3 = \frac{-5}{2}(x - 2)$ which can be simplified to $2y + 5x - 4 = 0$, which is the required equation of the line.

In part (b) some of the candidates made equated the numerators and denominators and solved the resulting equations simultaneously. However, they were expected to cross multiply so as to obtain $5(5b - a) = 8b + 3a$ and when simplified to get $17b = 8a$ which can be written as

$\frac{a}{b} = \frac{17}{8} = 2.125$. Therefore, $\frac{a}{b} = 2.13$ correct to **two** decimal places.

Question 3

(a) Ali, Musah and Yusif shared ₦420,000.00 in the ratio 3 : 5 : 8 respectively. Find the sum of Ali and Yusif's shares.

(b) Solve: $2\left(\frac{1}{8}\right)^x = 32^{x-1}$.

The Chief Examiner reported that this question was popular among candidates' but had difficulty in expressing their final answers in two decimal places.

In part (a), they were either expected to first sum the respective ratios to obtain 16 and then proceed to either find the individual's share or sum Ali and Yusif's ratio and find the shares.

Next we find Ali's share = $\frac{3}{16} \times 420,000$ = ₦ 78,750.00 and

Yusif's share = $\frac{8}{16} \times 420,000$ = ₦210,000.00

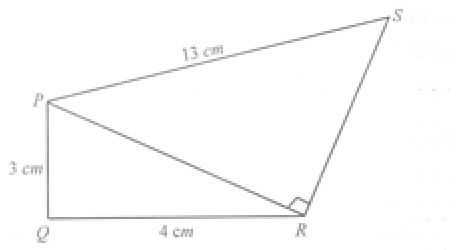
Sum of Ali and Yusif's share = 78,750 + 210,000

= ₦ 288,750.00

In part (b), they were found the base of 8 and 32 as 2 and expressed $2\left(\frac{1}{8}\right)^x = 32^{x-1}$ as

$2^{1-3x} = 2^{5x-5}$. Next, they equated the exponents and solved the resulting equation to obtain $x = \frac{3}{4}$.

Question 4



In the diagram PQRS is a quadrilateral, $\angle PQR = \angle PRS = 90^\circ$, $|PQ| = 3\ cm$, $|QR| = 4\ cm$ and $|PS| = 13\ cm$. Find the area of the quadrilateral.

The Chief Examiner reported that this question was popular among the candidates as majority of them correctly applied the Pythagoras theorem and they went further to find the areas of triangles PQR and PRS and summed to get the area of quadrilateral PQRS.

From ΔPQR, $|PR|^2 = |PQ|^2 + |QR|^2 = 3^2 + 4^2 = 25$ so that $|PR| = \sqrt{25} = 5cm$.

Similarly, from ΔPRS, $|RS| = \sqrt{13^2 - 5^2} = \sqrt{144} = 12\ cm$.

Area of $\Delta PQR = \frac{1}{2} \times 4 \times 3 = 6\ cm^2$ and Area of $\Delta PRS = \frac{1}{2} \times 5 \times 12 = 30\ cm^2$

Therefore, area of quadrilateral $PQRS$ = Area of ΔPQR + Area of $\Delta PRS = 6 + 30 = 36\ cm^2$.

The main challenge here is that some candidates omitted the units.

Question 5

Three red balls, five green balls and a number of blue balls are put together in a sack. One ball is picked at random from the sack. If the probability of picking a red ball is $\frac{1}{6}$, find:

(a) the number of blue balls in the sack;

(b) the probability of picking a green ball.

The Chief Examiner reported that most of the candidates' could not interpret the requirement of this question, thereby, losing some marks.

In part (a), if we let number of blue balls = x so that total number of balls = $8 + x$. Then, the probability of picking a red ball is $\frac{1}{6} = \frac{3}{8+x}$ and they were expected to cross multiply and solve the resulting equation to obtain $x = 10$. Thus, number of blue balls = 10 so that total number of balls = 10 + 8 = 18.

In part (b), the probability of picking a green is P (Green ball) = $\frac{5}{18}$.

Question 6

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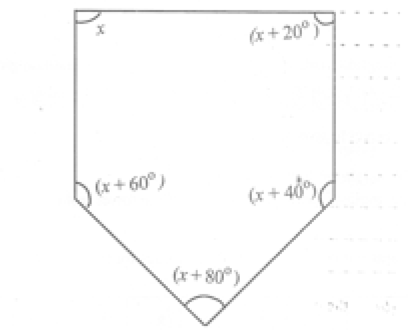
(a) The force of attraction, F, between two bodies varies directly as the product of their masses, m_1 and m_2, and inversely as the square of the distance, d, between them. Given that $F = 20\ N$ when $m_1 = 25\ kg$, $m_2 = 10\ kg$ and $d = 5\ m$, find:
  (i) an expression for F in terms of m_1, m_2 and d;
  (ii) the distance, d, when $F = 30\ N$, $m_1 = 7.5\ kg$ and $m_2 = 4\ kg$.

(b)



NOT DRAWN TO SCALE

Find the value of x in the diagram.

The Chief Examiner reported that majority of the candidates who attempted this question performed very well.

In part (a) (i), they stated joint variation as F $\alpha \frac{m_1m_2}{d^2}$ which can be written as F = $\frac{km_1m_2}{d^2}$ where k is the constant of proportionality. Theysubstituting to get 20 = $\frac{k \times 25 \times 10}{5^2}$simplifiedand found the value of k to be $k = 2$. Hence, F = $\frac{2m_1m_2}{d^2}$.

In part (a) (ii), they substituted to get 30 = $\frac{2 \times 7.5 \times 4}{d^2}$ so that $d^2 = \frac{60}{30} = 2$. Then, $d = \sqrt{2} = 1.414\ m$.

In part (b), they found the sum of interior angles of a polygon to be 540° so that
$(x + 60°) + (x + 40°) + (x + 20°) + x + (x + 80°) = 540°$ and solved for x to obtain $x = 68°$.

Question 7

Question 8

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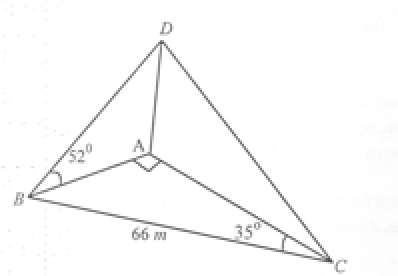
(a) Solve the inequality $\frac{1}{3}x - \frac{1}{4}(x+2) \geq 3x - 1\frac{1}{3}$.
(b)



In the diagram, AB is a right – angled triangle on a horizontal ground. |AD| is a vertical tower. $\angle BAC = 90^\circ$, $\angle ACB = 35^\circ$, $\angle ABD = 52^\circ$ and |BC| = 66 m. Find, correct to **two** decimal places, the:

(i) height of the tower;
(ii) angle of elevation of the top of the tower from C.

The Chief Examiner reported that most of the Candidates' did not attempt this question and those that did only did well in part (a) than in (b).

In part (a), they did as expected by clearing fractions to get $4x - 3(x+2) \geq 36x - 16$ and simplified to arrive at $-35x \geq -10$ and when solved, they had $x \leq \frac{2}{7}$.

In part (b) (i), from ΔABC, sin 35° = $\frac{|AB|}{66}$ so that |AB| = 37.86 m.

Similarly, from ΔABD, tan 52° = $\frac{|AD|}{37.86}$, then |AD| = 48.46 m.

Therefore, the height of the tower = 48.46 m, correct to **two** decimal places.

In part (b)(ii), from ΔACD, let $\angle ACD = \theta$, Cos 35° = $\frac{|AC|}{66}$ so that |AC| = 54.06 m.

Also, tan θ = $\frac{48.46}{54.06}$ and solving for θ, θ = $\tan^{-1}$ (0.8962) = = 41.87°.

Therefore, the angle of elevation of top of tower from C = 41.87°

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Question 9

(a) Copy and complete the table of values for $y = 2\cos x + 3\sin x$ for $0^\circ \leq x \leq 360^\circ$.

x	0°	60°	120°	180°	240°	300°	360°
y	2.0				−3.6		

(b) Using a scale of 2 cm to 60° on the x – axis and 2 cm to 1 unit on the y – axis, draw the graph of
$y = 2\cos x + 3\sin x$ for $0^\circ \leq x \leq 360^\circ$.

(c) Using the graph:
(i) solve $2\cos x + 3\sin x = -1$.
(ii) find, correct to one decimal place, the value of y when x = 342°.

The Chief Examiner reported that performance on this question was not quite encouraging so majority of the candidates' could only complete the table without drawing the graph and answering the question that followed

In part (a), they completed the table as expected

x	0°	60°	120°	180°	240°	300°	360°
y	2.0	3.6	1.6	−2.0	−3.6	−1.6	2.0

In part (b), using the completed table, they were expected to draw the graph of y as shown

Question 10

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A woman bought 130 *kg* of tomatoes for ₦52,000.00. She sold half of the tomatoes at a profit of 30%. The rest of the tomatoes began to go bad, she then reduced the selling price per *kg* by 12%. Calculate:

(a) the new selling price per *kg*;
(b) the percentage profit on the entire sales if she threw away 5 *kg* of bad tomatoes.

The Chief Examiner reported that this question was not well attempted by most candidates'. The challenge of calculating cost price or selling price when percentage profit is given posed a lot of problem.

In part (a), given that cost price of 130*kg* tomatoes = ₦52,000, then cost price per kg is $\frac{52{,}000}{130}$ = ₦ 400.00.Also, half were sold at profit of 30%, this implies that selling price of per *kg* is$\frac{130}{100}$ × ₦ 400 = ₦ 520.00. Then, selling price was reduced by 12% so that the new selling price per *kg* = $\frac{88}{100}$ × 520 = ₦ 457.60.

In part (b), the selling price of first 65 *kg* = 65 × ₦ 520 = ₦ 33,800.00

Next, 60 *kg* left since 5 *kg* were thrown away. Thus, selling price of 60*kg* = 60 × 457.60 = ₦ 27,456.00. Therefore, total selling price of 125*kg* = 33,800 + 27,456 = ₦61,256.00.

Profit on whole sales = 61,256 – 52,000 = ₦ 9,256.00

Percentage profit = $\frac{9{,}256}{52{,}000}$× 100%= 17.8%

Question 11

(a) The third and sixth terms of a Geometric Progression (G.P.) are $\frac{1}{4}$ and $\frac{1}{32}$ respectively. Find the:
  (i) first term and the common ratio;
  (ii) seventh term.

(b) Given that 2 and −3 are the roots of the equation $ax^2 + bx + c = 0$, find the values of *a*, *b* and *c*.

The Chief Examiner reported that this question was highly popular among the Candidates' as performance was quite good.

In part (a) (i), the third term is $ar^2 = \frac{1}{4}$ ------------ (1) while the sixth term is $ar^5 = \frac{1}{32}$ ---------------(2).

Dividing equations (2) by (1) to get $r^3 = \frac{1}{8}$ and taking the cube root of both sides to yield $r = \frac{1}{2}$.

Substituting for *r* in equation (1) and solving for a, *a* = 1.

In part (a) (ii), substituting for the seventh term, $U_7 = ar^6 = 1\left(\frac{1}{2}\right)^6 = \frac{1}{64}$.

In part (b), given that 2 and −3 are the roots of the quadratic equation, then (*x* – 2) (*x* + 3) = 0 and which simplified to $x^2 + x - 6 = 0$. Comparing with $ax^2 + bx + c = 0$, they found that *a* = 1, *b* = 1 and *c* = −6.

Question 12

(a) Given that $\sin y = \frac{8}{17}$, find the value of $\frac{\tan y}{1+2\tan y}$.

(b) An amount of ₦300,000.00 was shared among Otobo, Ada and Adeola. Otobo received ₦60,000.00, Ada received $\frac{5}{12}$ of the remainder, while the rest went to Adeola. In what ratio was the money shared?

The Chief Examiner reported that majority of the candidates' did very well. They solved the problem satisfactorily.

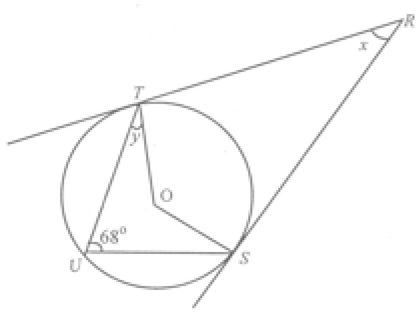
In part (a), they made use of the Pythagoras theorem to find the adjacent side of the right angled triangle to get 15 and thereafter, substituted to get $\frac{\tan y}{1+2\tan y} = \frac{\frac{8}{15}}{1+2\left(\frac{8}{15}\right)}$ and when simplified they got $\frac{\tan y}{1+2\tan y} = \frac{8}{31}$.

In part (b), given that Otobo's share is ₦60,000.00, then the remainder = 300,000 – 60,000 = ₦240,000.00.Ada's share = $\frac{5}{12}$ × 240,000 = ₦100,000.00 and Adeola's share is 240,000 – 100, 000 = ₦140,000.00.

The required ratio is Otobo : Ada : Adeola = 60,000:100,000: 140,000 = 3: 5: 7.

Question 13

(a)



In the diagram, $\overline{RS}$ and $\overline{RT}$ are tangent to the circle with centre O, $\angle TUS = 68^{\circ}$, $\angle SRT = x$ and $\angle UTO = y$. Find the value of x.

(b) Two tanks *A* and *B* are filled to capacity with diesel. Tank *A* holds 600 *litres* of diesel more than tank B. If 100 *litres* of diesel was pumped out of **each** tank, tank *A* would then contain 3 times as much as tank *B*. Find the capacity of *each* tank.

The Chief Examiner reported that majority of the candidates' had difficulties in this question as they seem not avoid attempting it completely. However, they were able to attempt part (b).

In part (a), $\angle SOT = 2\angle SUT = 2 \times 68° = 136^{\circ}$. Observe that $\angle OSR = \angle OTR = 90°$ so that $\angle OSR + x + \angle OTR + \angle SOT = 360^{\circ}$. Next is to substitute and simplified to get $x + 316^{\circ} = 360^{\circ}$ so that $x = 44^{\circ}$.

In part (b), if we let capacity of tank *A* = a and capacity of tank *B* = *b*, then

a = 600 + *b*................. (1)

a – 100 = 3 (*b* – 100)

a = 3*b* – 200.............. (2)

Substituting (2) into (1) yielded 3*b* – 200 = 600 + *b* and solving for *b*, *b* = 400.

Therefore, Capacity of tank *B* = 400 litres

Substituting *b* in (1) yielded *A* = 600 + 400 = 1000

Capacity of *A* = 1000.

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