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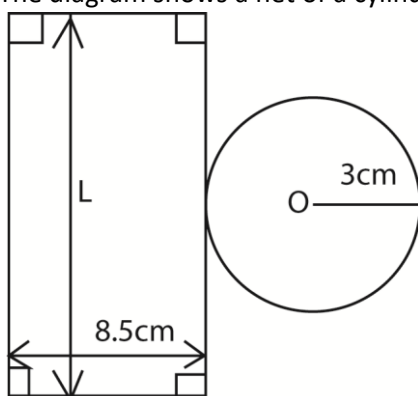


## UCE MATHEMATICS PAPER 2 2014 guide

### SECTION A (40 marks)

Answer all questions in this section

- Express 2.6363 ..... as a fraction in its simplest form. (04marks)
- The function  $g(x) = ax^2 + 3$ . If  $g(2) = 11$ , find the value of  $a$ . (04marks)
- Find the coordinate of the point of intersection of the lines  $y = 2x$  and  $y = 3 - x$ . (04marks)
- Two similar jugs have height of 21cm and 14cm. the smaller jug has a capacity of 1.2litres. Determine the capacity of the larger jug. (04marks)
- Two sets  $M$  and  $N$  are such that  $n(M) = 6$ ,  $n(N) = 11$ ,  $n(M \cap N) = 5$  and  $n(M \cup N)' = 3$ . Find  $nE$  where  $E$  is the universal set.(04marks)
- The scale on a map is 1:2000. A building is represented on the map by an area of  $3\text{cm}^2$ . Find the actual area in  $\text{cm}^2$  occupied by the building. (04marks)
- Find the equation of the line which passes through the point  $(-3, 5)$  and is parallel to the line  $2y + 3x + 7 = 0$  (04marks)
- Abdul's salary is shs. 400,000 per month. He pays an income tax of 30% per month. How much is Abdul's net income per month? (04marks)
- The diagram shows a net of a cylinder. O is the centre of the circle.



Calculate the

- Length marked  $L$ .
  - Area of the curved surface of the cylinder. Use  $(\pi = 3.14)$  (04marks)
- Given that  $Q(4, 1)$  and  $R(1,5)$  are two points in a plane  
 Determine
    - The vector  $RQ$  (02marks)
    - $|RQ|$  (02marks)

## SECTION B (60marks)

Answer any five questions from this section. All questions carry equal marks

11. Fifty six soccer fans supported premier league matches of three teams; Arsenal (A), Chelsea (C) and Liverpool (L). 32 fans watched team A plying 18 watched C playing and 30 watched L playing. 20 fans watched both A and L playing, 12 watched both A and c playing. 8 fans watched both C and L playing. The number of fans that watched all the three teams playing is equal to the number of those that did not watch any of the team playing. Using a Venn diagram;

- (a) Find the number of fans who watched all the three teams playing. (10marks)
- (b) Determine how many fans watched at least two of the teams playing. (02marks)

12. (a) Use logarithm tables to evaluate;  $\frac{\sqrt{33.7} \times 0.429}{76.1}$  (08 marks)

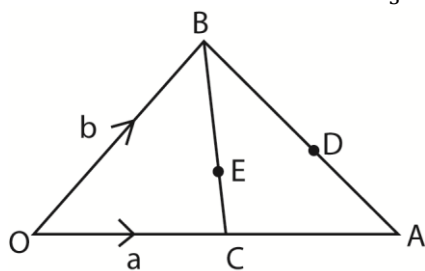
- (b) If  $\log_{10} x = 0.3979$  and  $\log_{10} y = 0.4771$ , find the value of  $\log_{10} x^3 y$ . (04marks)

13. A lorry set off at 7.00am from station A to station B, 360km away. It travelled at a constant speed of  $50\text{kmh}^{-1}$  for 2 hours. The lorry then stopped for 1 hour. It then proceeded at a steady speed for 4hours to station B. A mini-bus left station B at 8.00am for station A and moved non-stop for  $4\frac{1}{2}$  hours.

- (a) Using a scale of 2 cm to represent 40km on the vertical axis and 2cm to represent 1 hour on the horizontal axis, draw on the same axes, the distance time graph for the lorry and mini-bus. (06marks)

- (b) Use your graph to find the;
  - (i) Time when the vehicles met
  - (ii) Distance from A where they met
  - (iii) Average speed for the mini-bus. (06marks)

14. In the figure below.  $OA = a$  and  $OB = b$ ; C and D are the mid-point of AO and AB respectively. E is a point on BC such that  $BE = \frac{2}{3}BC$ .



- (a) Express in terms of a and b the vectors
  - (i) BE
  - (ii) OE
  - (iii) BD (07marks)

- (b) Show that O, E and D lie on straight line (05marks)

15. (a) Given that  $f(x) = x^2 - 4x + 3$  and  $g(x) = \frac{1}{x}$ , find

- (i)  $gf(x)$
- (ii)  $gf(-2)$  (05marks)

- (b) If  $h(x) = 5x + 7$ , find

- (i)  $h^{-1}(x)$
- (ii)  $h^{-1}(8)$

(iii) the value of  $x$  for which  $h^{-1}(x) = 0$

16. (a) Shs 750,000 in a savings and credit organization. The organization gives simple interest of 12% per annum.

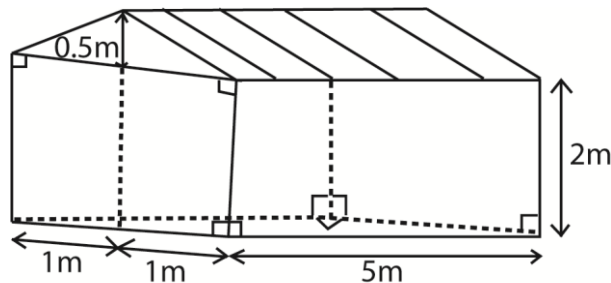
Calculate the

- (i) interest got at the end of two years
- (ii) total amount she had in the organization at the end of two years. (05marks)

(b) Opio bought a radio at shs. 600,000. He wanted to sell it at a profit of 20% but found no buyer. When he reduced the new price by 10% he found a buyer. Determine the;

- (i) price at which he sold the radio
- (ii) percentage profit he made. (07 marks)

17. The figure below shows a store whose dimensions are in metres. The roof is covered with iron sheets.



- (a) What is the volume of the enclosed space? (05 marks)
- (b) Calculate the total surface area of the roof. (05marks)
- (c) The area of each iron sheet which was used is  $0.5m^2$ . How many sheets were used? (02marks)
- (d) The cost of an iron sheet is shs. 18,500. How much money was spent on buying the iron sheets? (02 marks)

## Solutions

### SECTION A (40 marks)

Answer all questions in this section

1. Express 2.6363 ..... as a fraction in its simplest form. (04marks)

Let  $x = 2.6363.....$

$$100x = 263.6363.....$$

$$100x - x = 261$$

$$99x = 261$$

$$x = \frac{261}{99} = \frac{29}{11}$$

2. The function  $g(x) = ax^2 + 3$ . If  $g(2) = 11$ , find the value of  $a$ . (04marks)

$$g(2) = a(2)^2 + 3 = 11$$

$$4a + 3 = 11$$

$$4a = 8$$

$$a = \frac{8}{4} = 2$$

3. Find the coordinate of the point of intersection of the lines  $y = 2x$  and  $y = 3 - x$ . (04marks)

Substituting for  $y = 2x$  into  $y = 3 - x$

$$2x = 3 - x$$

$$3x = 3$$

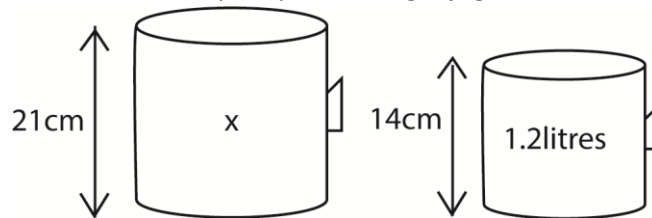
$$x = 1$$

Substituting  $x$  in  $y = 2x$

$$y = 2(1) = 2$$

$$\therefore (x, y) = (1, 2)$$

4. Two similar jugs have height of 21cm and 14cm. the smaller jug has a capacity of 1.2litres. Determine the capacity of the larger jug. (04marks)



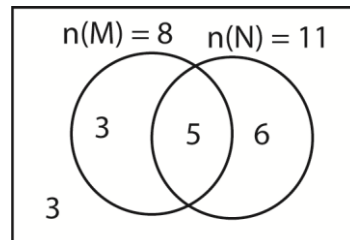
$$L.S.F = \frac{21}{14} = \frac{3}{2}$$

$$V.S.F = \left(\frac{3}{2}\right)^3 = \frac{27}{8}$$

Volume of bigger jug = volume of smaller jug  $\times$  V.S.F

$$= 1.2 \times \frac{27}{8} = 4.05 \text{ litres}$$

5. Two sets  $M$  and  $N$  are such that  $n(M) = 6$ ,  $n(N) = 11$ ,  $n(M \cap N) = 5$  and  $n(M \cup N)' = 3$ . Find  $n(E)$  where  $E$  is the universal set. (04marks)



$$n(E) = 3 + 5 + 6 + 3 = 17$$

6. The scale on a map is 1:2000. A building is represented on the map by an area of  $3\text{cm}^2$ . Find the actual area in  $\text{cm}^2$  occupied by the building. (04marks)

Scale is 1:2000

1cm on the map  $\equiv$  2000cm on the ground

$1\text{cm}^2$  on the map  $\equiv 2000^2\text{cm}^2$  on ground

$3\text{cm}^2$  on map  $\equiv 3 \times 2000^2\text{cm}^2$  on ground

$$\equiv 12,000,000\text{cm}^2 \text{ on the ground}$$

7. Find the equation of the line which passes through the point  $(-3, 5)$  and is parallel to the line

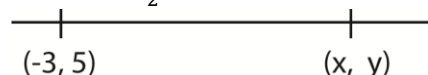
$$2y + 3x + 7 = 0 \text{ (04marks)}$$

$$2y + 3x + 7 = 0$$

$$2y = -3x + 7$$

$$y = -\frac{3}{2}x + \frac{7}{2}$$

$$\text{gradient} = -\frac{3}{2}$$



Parallel lines have equal gradient

$$\frac{y-5}{x-(-3)} = \frac{-3}{2}$$

$$\frac{y-5}{x+3} = \frac{-3}{2}$$

$$2(y-5) = -3(x+3)$$

$$2y - 10 = -3x - 9$$

$$2y + 3x - 1 = 0$$

8. Abdul's salary is shs. 400,000 per month. He pays an income tax of 30% per month. How much is Abdul's net income per month? (04marks)

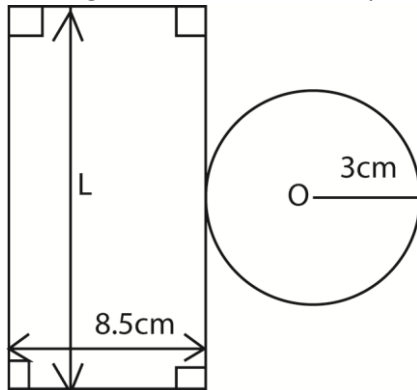
$$\text{Net income} = 400,000 \times \left( \frac{100-30}{100} \right) = 400,000 \times \frac{70}{100} = \text{shs. } 280,000$$

Or

$$\text{Income tax paid} = \frac{30}{100} \times 400,000 = \text{shs. } 120,000$$

$$\text{Net income} = 400,000 - 120,000 = \text{shs. } 280,000$$

9. The diagram shows a net of a cylinder. O is the centre of the circle.



Calculate the

- (c) Length marked L.

$$\begin{aligned} \text{Circumference, } L &= 2\pi r \\ &= 2 \times 3.14 \times 3 \\ &= 18.84\text{cm} \end{aligned}$$

- (d) Area of the curved surface of the cylinder. Use ( $\pi = 3.14$ ) (04marks)

$$\text{Area of curved surface of a cylinder} = 2\pi rh = 18.84 \times 85 = 160.14\text{cm}^2$$

10. Given that Q(4, 1) and R(1,5) are two points in a plane

Determine

- (a) The vector RQ (02marks)

$$\begin{aligned} \text{RQ} &= \text{OQ} - \text{OR} \\ &= \begin{pmatrix} 4 \\ 1 \end{pmatrix} - \begin{pmatrix} 1 \\ 5 \end{pmatrix} = \begin{pmatrix} 3 \\ -4 \end{pmatrix} \end{aligned}$$

- (b)  $|RQ|$  (02marks)

$$|RQ| = \sqrt{3^2 + (-4)^2} = \sqrt{9 + 16} = \sqrt{25} = 5\text{cm}$$

SECTION B (60marks)

Answer any five questions from this section. All questions carry equal marks

11. Fifty six soccer fans supported premier league matches of three teams; Arsenal (A), Chelsea (C) and Liverpool (L). 32 fans watched team A plying 18 watched C playing and 30 watched L

playing. 20 fans watched both A and L playing, 12 watched both A and c playing. 8 fans watched both C and L playing. The number of fans that watched all the three teams playing is equal to the number of those that did not watch any of the team playing. Using a Venn diagram;

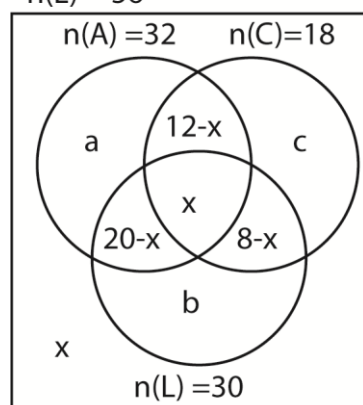
- (a) Find the number of fans who watched all the three teams playing. (10marks)

Summary

$$n(A) = 32, n(C) = 18, n(L) = 30, n(A \cap L) = 20, n(A \cap C) = 12, n(C \cap L) = 8, n(E) = 56$$

$$\text{let } n(A \cap C \cap L) = n(A \cup C \cup L)' = x$$

$$n(E) = 56$$



$$a = 32 - (12 - x + x + 20 - x) = 32 - 32 + x = x$$

$$b = 30 - (20 - x + x + 8 - x) = 30 - 28 + x = 2 + x$$

$$c = 18 - (12 - x + x + 8 - x) = 18 - 20 + x = x - 2$$

$$a + b + c + 12 - x + x + 20 - x + 8 - x + x = 56$$

$$x + 2 + x + x - 2 + 12 - x + x + 20 - x + 8 - x + x = 56$$

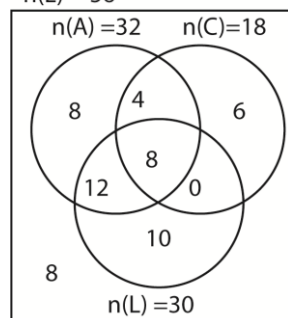
$$2x + 40 = 56$$

$$2x = 16$$

$$x = 8$$

- (b) Determine how many fans watched at least two of the teams playing. (02marks)

$$n(E) = 56$$



$$\text{Number of fans who watched at least two games} = 4 + 12 + 8 + 0 = 24$$

12. (a) Use logarithm tables to evaluate;  $\frac{\sqrt{33.7} \times 0.429}{76.1}$  (08 marks)

$$\frac{\sqrt{33.7} \times 0.429}{76.1} = \frac{(33.7)^{\frac{1}{2}} \times 0.429}{76.1}$$

Number

scientific form

logarithm

$$(33.7)^{\frac{1}{2}}$$

$$(3.37 \times 10^1)^{\frac{1}{2}}$$

$$1.5276 \times \frac{1}{2}$$

$$0.7638$$

$$0.429$$

$$4.29 \times 10^{-1}$$

$$+ \frac{1.6325}{0.3963}$$

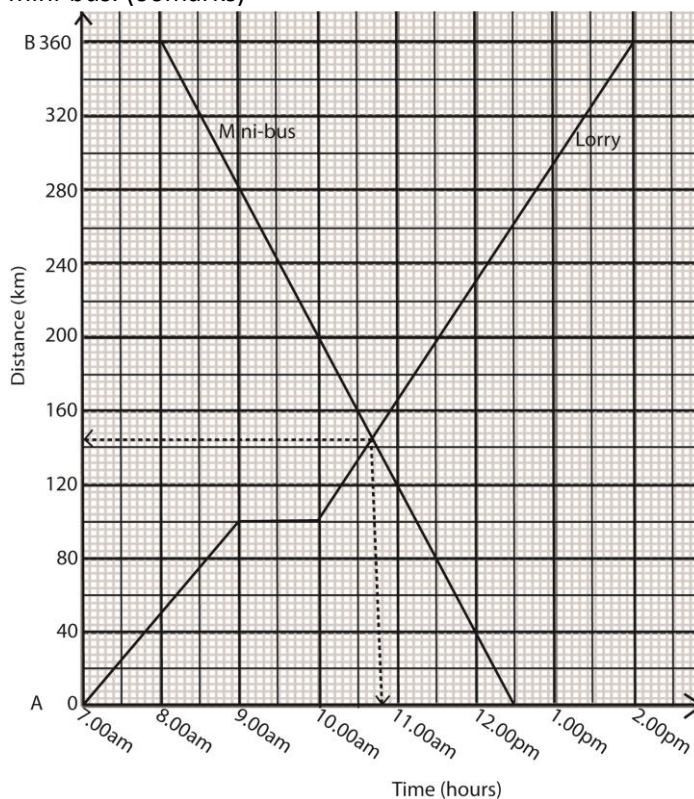
$$\begin{array}{rcl}
 76.1 & 7.61 \times 10^1 & - 1.8814 \\
 & 3.2727 \times 10^{-2} & \underline{2.5149} \\
 & = 0.032727 & 
 \end{array}$$

(b) If  $\log_{10} x = 0.3979$  and  $\log_{10} y = 0.4771$ , find the value of  $\log_{10} x^3 y$ . (04marks)

$$\begin{aligned}
 \log_{10} x^3 y &= 3 \log_{10} x + \log_{10} y \\
 &= 3 \times 0.3979 + 0.4771 \\
 &= 1.6708
 \end{aligned}$$

13. A lorry set off at 7.00am from station A to station B, 360km away. It travelled at a constant speed of  $50\text{kmh}^{-1}$  for 2 hours. The lorry then stopped for 1 hour. It then proceeded at a steady speed for 4 hours to station B. A mini-bus left station B at 8.00am for station A and moved non-stop for  $4\frac{1}{2}$  hours.

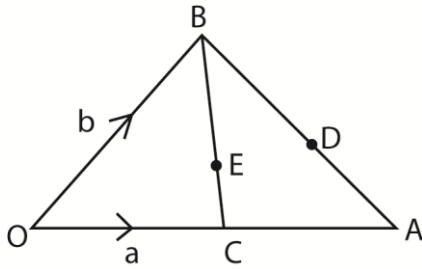
(a) Using a scale of 2 cm to represent 40km on the vertical axis and 2cm to represent 1 hour on the horizontal axis, draw on the same axes, the distance time graph for the lorry and mini-bus. (06marks)



(b) Use your graph to find the;

- Time when the vehicles met  
They met at  $10:30 + 2 \times 6 = 10:30 + 12 = 10:42\text{a.m}$
- Distance from A where they met  
144km
- Average speed for the mini-bus. (06marks)  
Average speed =  $\frac{\text{distance}}{\text{time}} = \frac{360}{4\frac{1}{2}} = \frac{360}{4.5} = 80\text{kmh}^{-1}$

14. In the figure below.  $OA = a$  and  $OB = b$ ; C and D are the mid-point of AO and AB respectively. E is a point on BC such that  $BE = \frac{2}{3} BC$ .



(c) Express in terms of a and b the vectors

$$(i) \quad BE = \frac{2}{3}BC \\ = \frac{2}{3}(BO + OC) = \frac{2}{3}\left(-b + \frac{1}{2}a\right) = \frac{2a-4b}{6}$$

$$(ii) \quad OE = OB + BE \\ = b + \frac{2a-4b}{6} = \frac{6b+2a-4b}{6} \\ = \frac{1}{3}(a+b)$$

$$(iii) \quad BD \text{ (07marks)} \\ BD = \frac{1}{2}BA = \frac{1}{2}(BO + OA) = \frac{1}{2}(-b + a) = \frac{1}{2}(a - b)$$

(d) Show that O, E and D lie on straight line (05marks)

$$OE = \frac{1}{3}(a+b) \\ OD = OB + BD = b + \frac{1}{2}(a - b) = \frac{1}{2}(a + b) \\ \frac{OD}{OE} = \left[\frac{1}{2}(a + b)\right] \div \left[\frac{1}{3}(a + b)\right] = \frac{1}{2} \times \frac{3}{1} = \frac{3}{2} \\ 2OD = 3OE \\ \Rightarrow OE \text{ is parallel to } OD$$

Since O is common to both OE and OD; O, E, and D lie on a straight line

15. (a) Given that  $f(x) = x^2 - 4x + 3$  and  $g(x) = \frac{1}{x}$ ; find

$$(i) \quad gf(x) = \frac{1}{x^2 - 4x + 3}$$

$$(ii) \quad gf(-2) \text{ (05marks)} \\ \frac{1}{(-2)^2 - 4(-2) + 3} = \frac{1}{4 + 8 + 3} = \frac{1}{15}$$

(c) If  $h(x) = 5x + 7$ , find

$$(i) \quad h^{-1}(x) \\ \text{let } y = 5x + 7 \\ 5x = y - 7 \\ x = \frac{y-7}{5} \\ h^{-1}(x) = \frac{x-7}{5}$$

$$(ii) \quad h^{-1}(8) \\ h^{-1}(8) = \frac{8-7}{5} = \frac{1}{5}$$

(iii) the value of x for which  $h^{-1}(x) = 0$

$$\frac{x-7}{5} = 0 \\ x - 7 = 0 \\ x = 7$$



16. (a) Shs 750,000 in a savings and credit organization. The organization gives simple interest of 12% per annum.

Calculate the

- (i) interest got at the end of two years

$$\text{Interest } I = \frac{PRT}{100} = \frac{750,000 \times 12 \times 2}{100} = \text{shs. } 180,000$$

- (ii) total amount she had in the organization at the end of two years. (05marks)

$$A = P + I = 750,000 + 180,000 = \text{shs. } 930,000$$

(b) Opio bought a radio at shs. 600,000. He wanted to sell it at a profit of 20% but found no buyer. When he reduced the new price by 10% he found a buyer. Determine the;

- (i) price at which he sold the radio

$$\text{With a profit of 20\%; new price} = \frac{120}{100} \times 60,000 = \text{shs. } 72,000$$

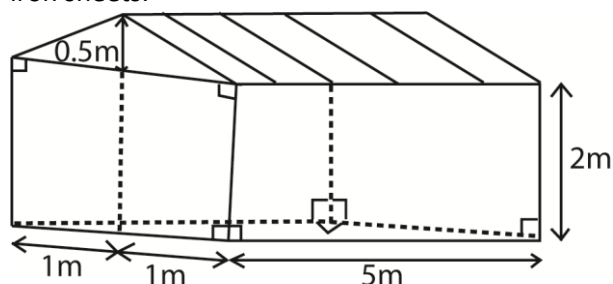
$$\text{With a reduction of 10\%; new price} = \frac{90}{100} \times 72,000 = \text{shs. } 64,800$$

- (ii) Percentage profit he made. (07 marks)

$$\text{Profit made} = \text{shs. } 64,800 - \text{shs. } 60,000 = \text{shs. } 4,800$$

$$\% \text{profit} = \frac{4,800}{60,000} \times 100 = 8\%$$

17. The figure below shows a store whose dimensions are in metres. The roof is covered with iron sheets.

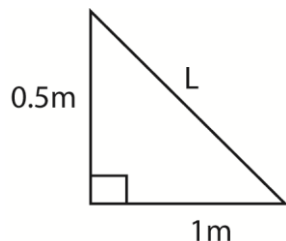


- (a) What is the volume of the enclosed space? (05 marks)

Volume = volume of cuboid + volume of space enclosed by the roof

$$\begin{aligned} &= lwh + \frac{1}{2} \times \text{area of base} \times \text{height} \\ &= 5 \times 2 \times 2 + \frac{1}{2} \times 5 \times 2 \times 0.5 \\ &= 20 + 2.5 = 22.5\text{m}^3 \end{aligned}$$

- (b) Calculate the total surface area of the roof. (05marks)



$$L^2 = (0.5)^2 + 1^2 = 1.25$$

$$L = \sqrt{1.25}\text{m}$$

$$\text{Total surface area of the roof} = 2 \times L \times 5 = 2\sqrt{1.25} \times 5 = 11.18\text{m}^2$$

- (c) The area of each iron sheet which was used is  $0.5\text{m}^2$ . How many sheets were used? (02marks)

$$\text{Number of iron sheets} = \frac{11.18}{0.5} = 20$$

- (d) The cost of an iron sheet is shs. 18,500. How much money was spent on buying the iron sheets? (02 marks)

1 iron sheet costs shs. 18,500

20 iron sheets cost shs.  $20 \times 18,500 = \text{shs. } 270,000$ .

Thank you

Dr. Bbosa Science