SECTION I (50 MARKS)

Answer all the questions in this section

1. Use mathematical tables to evaluate: $\frac{2}{(3.432)^2} + \frac{4}{\sqrt{0.0684}}$ (3mks)

$\frac{2}{1.8525} + \frac{4}{0.26153}$

$2(0.5396) + 4(0.3826) \times 10$

$1.0792 + 15.304$

$= 16.3836$

m_1 — for finding the square root.

m_1 → finding reciprocal

A_1 → for the ans.

2. A wholesaler sold a cell phone to a retailer making a profit of 20%. The retailer later sold the cell phone for Ksh.3120 making a profit of 30% calculate the amount of money the wholesaler had paid for the cell phone. (3 mks)

$130\% = 3120$

$100\% = \frac{100 \times 3120}{130}$ ✓ m_1

$= Sh.\ 2400$

$120\% = 2400$

$100\% = \frac{100 \times 2400}{120}$ ✓ m_1

$= Sh.\ 2000$ ✓ A_1

3. A piece of plot measuring 27m by 16m is to be divided into smaller rectangular units leaving no remainder. Calculate the highest number of smaller units whose dimensions are each graeter than 1m that can be obtained from the plot. (3mks)

$27 = 3 \times 3 \times 3$

$16 = 2 \times 2 \times 2 \times 2$] m_1

Area $= (27 \times 16)$

$n = \frac{432}{3 \times 2}$ ✓ m_1

$= 72$ units ✓ A_1

4. A Kenyan bank buys and sells foreign currencies as shown below.

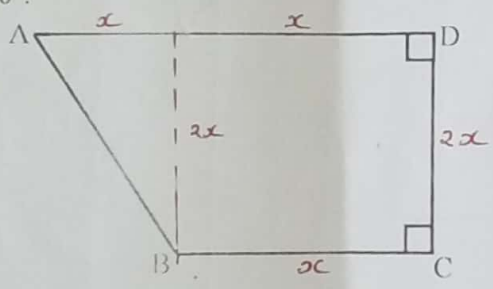
	Buying	Selling
1US Dollar	76.38	75.19
1UK pound	132.92	132.95

A tourist arrived in Kenya from Britain with 126,000 UK sterling pounds. He converted the pounds into Kenyan shillings. While in Kenya he spent $\frac{4}{5}$ of the money. He changed the balance to US dollars. Calculate to the nearest Dollar, the amount he received. (3 mks)

126 000 × 132.92
= Sh. 16, 747, 920.
4/5 × 16,747,920 ✓ M1
= Sh. 13, 398, 336.

Balance
(16 747 920 − 13 398 336)
= Sh. 3,349 584 ✓ M1
75.19
= 44 548.2644 US dollars
= 44 548 US dollars ✓ A1

5. The figure below shows quadrilateral ABCD in which AB = 6cm. BC = $\frac{1}{2}$CD, CD = DA and angle ADC = angle BCD = 90^0.



Calculate the area of the quadrilateral ABCD. (4 Mks)

$x^2 + 4x^2 = 36$ ✓ M1
$\frac{5x^2}{5} = \frac{36}{5}$
$x^2 = 7.2$
$x = 2.683281573$ ✓ A1

$A = \frac{1}{2} \times 8.049844719 \times 5.366563146$ ✓M1
$= 21.6\ cm^2$ ✓A1

6. The exterior angle of a regular polygon is $(\chi - 50)°$ and the interior angle is $(2\chi + 20)°$. Find the number of sides of the polygon. (3 mks)

$(x - 50) + 2x + 20 = 180$ ✓M1
$x - 50 + 2x + 20 = 180$
$3x - 30 = 180$
$3x = 180 + 30$
$\frac{3x}{3} = \frac{210}{3}$
$x = 70°$

exterior
$(70 - 50) = 20°$
$n = \frac{360}{20}$ M1
$n = 18$ sides. A1

7. simplify: $\frac{12x^2+ax-6a^2}{9x^2-4a^2}$ (3 mks)

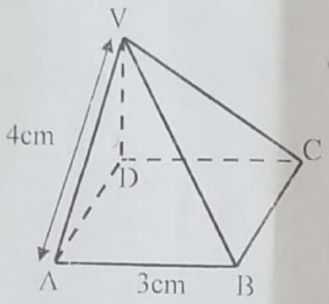
$$\frac{12x^2+9xa-8xa-6a^2}{(3x^2-2a)(3x+2a)}$$

$$\frac{3x(4x+3a)-2a(4x+3a)}{(3x-2a)(3x+2a)}$$ ✓M

$$\frac{(3x-2a)(4x+3a)}{(3x-2a)(3x+2a)}$$ ✓M1

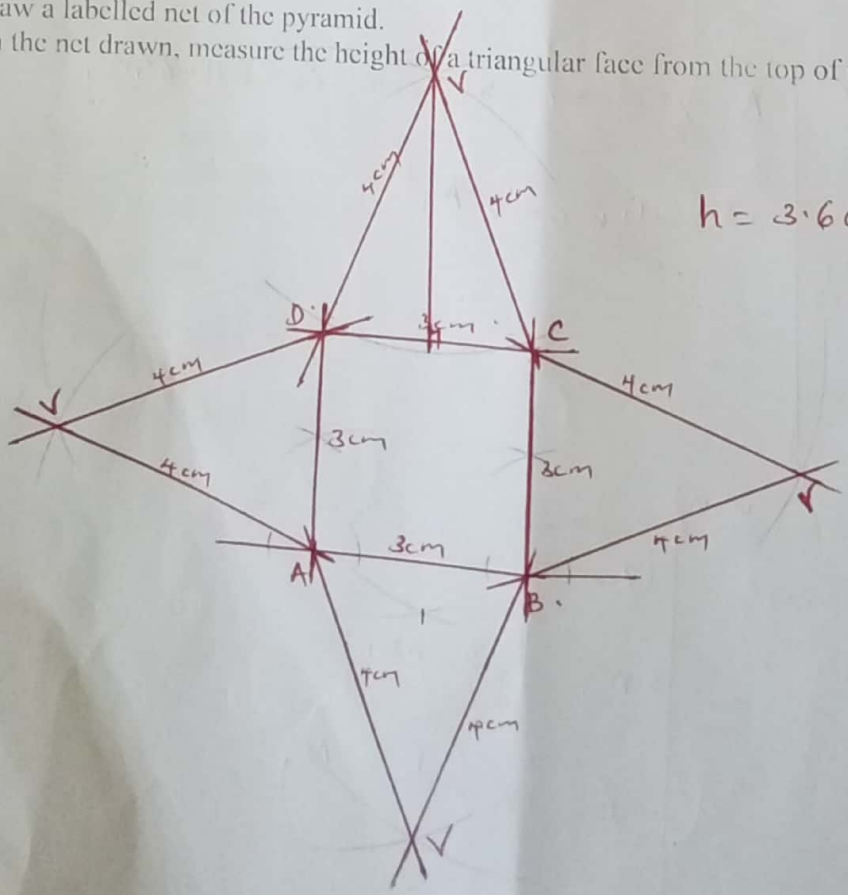
$$= \frac{4x+3a}{3x+2a}$$ ✓A1

8. The diagram below represents a right pyramid on a square base of side 3cm. The slant edge of the pyramid is 4cm.



(a) Draw a labelled net of the pyramid. (2 Mks)

(b) On the net drawn, measure the height of a triangular face from the top of the pyramid. (1 Mk)



h = 3·6 cm. ✓B1

B1 } for correct net
B1 } and correct labelling

9. The mass of two similar solids are 324g and 768g. Find

(a) height of the smaller solid if the height of the bigger solid is 20cm. (2 mks)

V.S.f = 768/324 = 64/27

L.S.f = $\sqrt[3]{64/27}$ = 4/3 = 20/h M1

h = 20×3/4 = 15cm A1

(b) the surface area of the smaller solid if the surface area of the bigger solid is 40cm². (2 mks)

A.S.f = $(4/3)^2$ = 16/9

16/9 = 40/A M1

A = 40×9/16 = 23.0625 cm^2 A1

10. State all the integral values which satisfy the inequality $\frac{3a+2}{4} < \frac{2a+3}{5} < \frac{4a+15}{6}$ (3mks)

3a+2/4 < 2a+3/5

15a+10 < 8a+12

7a/7 < 2/7

a < 2/7 B1

2a+3/5 < 4a+15/6

12a+18 < 20a+75

−8a/8 < 57/8

−a < 7.125

a > −7.125 B1

−7.125 < a < 0.2857 ✓B1

(−7, −6, −5, −4, −3, −2, −1, 0)

11. The length of a rectangle is (3x + 1) cm, its width is 3 cm shorter than its length. Given that the area of the rectangle is 28cm², find its length, (3 marks)

(3x+1)(3x−2) = 28 --- M1

$9x^2 - 6x + 3x - 2 = 28$

$9x^2 - 3x - 30 = 0$

$3x^2 - x - 10 = 0$

$3x^2 - 6x + 5x - 10 = 0$

3x(x−2) + 5(x−2) = 0

(3x+5)(x−2) = 0 ✓M1

3x + 5 = 0 or x = 2

3x/3 = −5/3

x = −5/3

so a = 2

Length = (3x+1) cm

= (3(2)+1) cm

= 6+1

= 7cm ✓A1

12 The curved surface area of a cylindrical container is 1980cm². If the radius of the container is 21cm, calculate to one decimal place the capacity of the contai(Take $\pi = \frac{22}{7}$). (4 mks)

$2\pi rh = 1980$

$2 \times \frac{22}{7} \times 21 \times h = 1980$ m1

$h = \frac{1980}{132} = 15cm.$

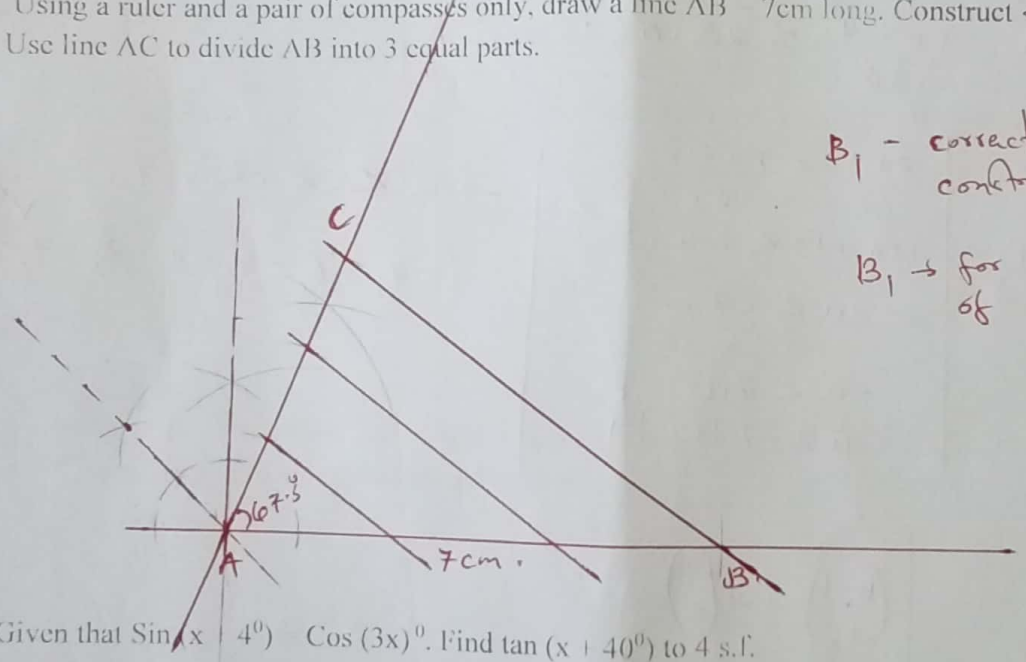
$V = \pi r^2 h = \frac{22}{7} \times 21^2 \times 15$ m1

$= \frac{20790}{1000}$ ✓ m1

$= 20.81.$

$= 20.8$ ✓ A1

13. Using a ruler and a pair of compasses only, draw a line AB 7cm long. Construct $< BAC = 67.5^0$. Use line AC to divide AB into 3 equal parts. (2 mks)



B1 - correct line AB and construction of 67.5°.

B1 → for correct division of line AB.

14. Given that $\sin(x + 4^0) = \cos(3x)^0$. Find $\tan(x + 40^0)$ to 4 s.f. (3 mks)

$(x+4) + 3x = 90.$ ✓ m1

$4x + 4 = 90.$

$\frac{4x}{4} = \frac{86}{4}$

$x = 21.5^\circ$

$\tan(x + 40^\circ) = \tan(21.5 + 40)$ ✓ m1

$\tan 61.5^\circ = 1.841770826$

$= 1.842$ ✓ A1

15. Given that $\log_{10}7 = 0.8451$ and $\log_{10}6 = 0.7782$, find $\log_{10}25.2$ (3 mks)

$\log_{10} 25.2 = \log_{10}\left(\frac{6\times6\times7}{10}\right)$ M1

$= 2(0.7782) + (0.8451) - 1$ ✓M1

$= 2.4015 - 1$

$= 1.4015$.

$= 2.5121 \times 10^{1}$

$= 25.21$ ✓A1

16. The position vector **OA** $= -3a\,i + b\,j$, **OB** $= 6a\,i + 4b\,j$ and **OC** $= 15a\,i + 7b\,j$, where a and b are scalars. Find in column form:

(i) **AB** (1 mk)

$\begin{pmatrix}6a\\4b\end{pmatrix} - \begin{pmatrix}-3a\\b\end{pmatrix} = \begin{pmatrix}9a\\3b\end{pmatrix}$ ✓B1

(ii) **AC** (1 mk)

$\begin{pmatrix}15a\\7b\end{pmatrix} - \begin{pmatrix}-3a\\b\end{pmatrix} = \begin{pmatrix}18a\\6b\end{pmatrix}$ ✓B1

Hence show that A,B and C are collinear. (1 mk)

$\underset{\sim}{AC} = k\,\underset{\sim}{AB}$.

$\begin{pmatrix}18a\\6b\end{pmatrix} = k\begin{pmatrix}9a\\3b\end{pmatrix}$

$k = \frac{18a}{9a}$

$k = 2$.

$\underset{\sim}{AC} = 2\,\underset{\sim}{AB}$. ✓B1

A - common point.

Hence collinear.

SECTION II (50 MARKS)

Answer any five questions in this section

17. A straight line passes through the points (8, -2) and (4, -4)

(a) Write its equation in the form ax + by + c = 0 where a, b and c are integers. (3 Mks)

$m = \frac{-4+2}{8-4} = \frac{-2}{4}$ ✓m

$= -\frac{1}{2}$.

$\frac{y+2}{x-8} = -\frac{1}{2}$ ✓m_1

$2y + 4 = -x + 8$.

$2y + x - 4 = 0$.

$\therefore x + 2y - 4 = 0$ ✓B$_1$

(b) If the line in (a) above cuts the x-axis at point p, determine the coordinates of P. (2 Mks)

$P(x, 0)$.

$x + 3y - 4 = 0$ ✓m_1

$x - 4 = 0$

$x = 4$.

$P(4, 0)$ ✓ B$_1$

(c) Another line which is perpendicular to the line in (a) above passes through point P and cuts the y-axis at the point Q. Determine the coordinates of point Q. (3 Mks)

$g = 2$ $(4, 0)$

$\frac{y-0}{x-4} = 2$ ✓m_1

$y = 2x - 8$ ✓B$_1$

$Q(0, y)$.

when $x = 0$.

$y = -8$.

$Q(0, -8)$ ✓ B$_1$

(d) Find the length of QP (2 Mks)

$QP = \begin{pmatrix} 4 \\ 0 \end{pmatrix} - \begin{pmatrix} 0 \\ -8 \end{pmatrix} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$ ✓m$_1$

$|QP| = \sqrt{4^2 + 8^2}$

$= 16 + 64$

$= \sqrt{80}$

$= 8.94427191$ ✓A$_1$

$=$

18. A group of people planned to contribute equally towards buying land at a price of Shs 180,000. However 3 members of the group withdrew from the project. As a result, each of the remaining members were to contribute KShs. 3000 more.

(a) Find the original number of members in the group. (6 Mks)

Original

$\frac{180,000}{n}$ ✓ m1

New:

$\frac{180,000}{n-3}$ ✓ m1

$\frac{180000}{n-3} - \frac{180,000}{n} = 3000$ ✓ m1

$\frac{180,000n - 180000n + 540000}{n(n-3)} = 3000$

$540000 = 3000n^2 - 9000n$.

$n^2 - 3n - 180 = 0$. ✓ m1

$n^2 - 15n + 12n - 180 = 0$.

$n(n-15) + 12(n-15) = 0$.

$(n+12)(n-15) = 0$. ✓ m1

$n = -12$ and 15.

$n = 15$ ✓ A1

(b) How much would each person have contributed if the 3 people had not withdrawn. (2 Mks)

$\frac{180,000}{15} = Sh.\ 12,000$. m1 A1

(c) Calculate the percentage increase in the contribution per person caused by the withdrawal. (2 Mks)

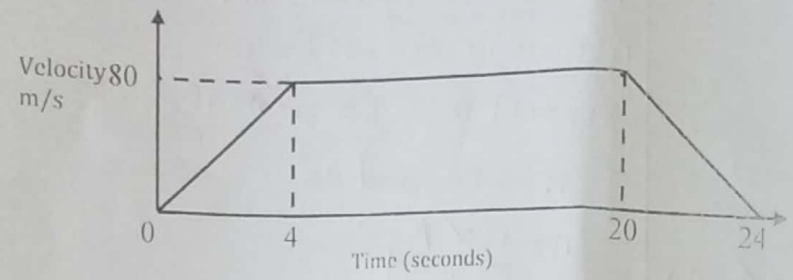
$\frac{15,000 - 12000}{12,000} \times 100\%$

$\frac{3000}{12000} \times 100^{25}$

$\frac{1}{4} \times 25$

$= 25\%$.

19. a) The figure below is a velocity time graph for a car.



(i) Find the total distance travelled by the car. (2 Mks)

$A = \frac{1}{2} \times 40^{20} \times 80$ ✓M1

$= 1600\text{m}$ ✓A1

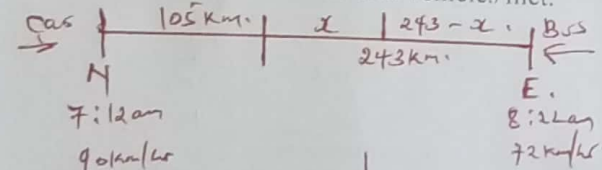
(ii) Calculate the deceleration of the car. (2 Mks)

$a = \frac{0-80}{4}$ M1

$= \frac{-80^{20}}{4_1} = -20\text{m/s}^2$ A1

(b) A car left Nairobi towards Eldoret at 7.12 a.m. at an average speed of 90km/h. At 8.22 a.m, a bus left Eldoret for Nairobi at an average speed of 72km/hr. The distance between the two towns is 348km. Calculate:

(i) the time when the two vehicles met. (4 Mks)



Car

$D = 90 \times \frac{7}{6}$ ✓M1

$= 105\text{km}.$

$t = D/S.$

$= \frac{x}{90} = \frac{243-x}{72}$ ✓M1

$\frac{162x}{162} = \frac{21870}{162}$

$x = 135.$

$t = \frac{135}{90}$

$= 1.5\text{hrs}.$

The time they met $= 7:12 + 2\text{hrs } 40\text{min}.$ ✓M1

$= 9:52\text{ am}.$ ✓A1

(ii) the distance from Nairobi to the meeting place. (2 Mks)

$= (105 + 135)$ ✓M1

$= 240\text{km}.$ ✓A1

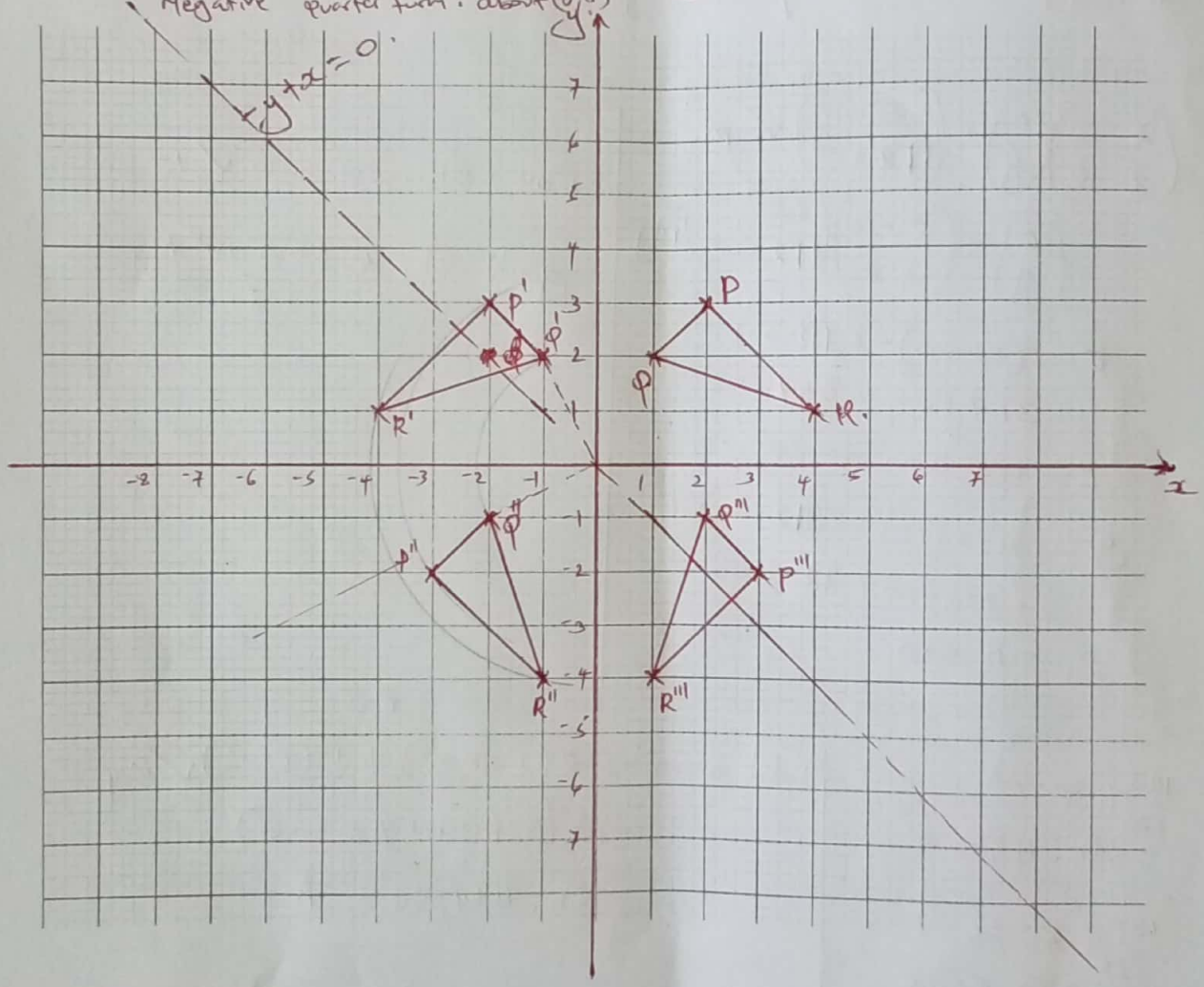
20. Triangle PQR has vertices at P (2,3), Q(1,2) and R(4,1), while triangle $P^IQ^IR^I$ has vertices P^I(-2,3),Q^I(-1,2), R^I(-4,1)

(a) (i) Draw triangle PQR and $P^IQ^IR^I$ on the grid provided. (2 Mks)

(ii) Describe fully a single transformation which maps triangle PQR onto triangle $P^IQ^IR^I$.
- Reflection in the line $x = 0$. / y-axis (2 Mk)

(b) (i) On the same grid, draw triangle $P^{II}Q^{II}R^{II}$ the image of PQR under a reflection on the line y + x = 0 (2 Mks)

(ii) Describe fully a single transformation which maps triangle $P^{II}Q^{II}R^{II}$ onto triangle $P^IQ^IR^I$.
Rotation -90° about the origin. or 270° turn / Negative quarter turn. about (0,0) (2 Mk)



(c) (2mks).

21. A trader bought 8 cows and 12 goats for a total of Ksh.294,000. If he had bought 1 more cow and 3 more goats he would have spend Ksh.337,500.

(a) Form two equations to represent the above information. (2 mks)

$8a + 12g = 294,000$ ✓ M1 $\quad 2a + 3g = 73500$ ✓ A1

$9a + 15g = 337500$ ✓ M1 $\quad 3c + 5g = 112500$ ✓ A1

(b) Use matrix method to determine the cost of a cow and that of a goat. (4 mks)

$\begin{pmatrix} 2 & 3 \\ 3 & 5 \end{pmatrix}\begin{pmatrix} c \\ g \end{pmatrix} = \begin{pmatrix} 73500 \\ 112500 \end{pmatrix}$ ✓ M1

$\begin{pmatrix} c \\ g \end{pmatrix} = \begin{pmatrix} 5 & -3 \\ -3 & 2 \end{pmatrix}\begin{pmatrix} 73,500 \\ 112,500 \end{pmatrix}$ ✓ M1

$c = 5(73,500) - 3(112,500)$

$= 367500 - 337500.$

$c = 30,000.$

$g = -3(73,500) + 2(112,500)$

$= -220,500 + 225,000$

$= 4,500,$

Cow = Sh. 30,000 ✓ A1

goat = Sh. 4,500 ✓ A1

(c) The trader sold the animals he had bought making a profit of 40% per cow and 45% per goat.

(i) Calculate the total amount of money he received. (2 mks)

$\frac{140}{100} \times 30000$

$= Sh. 42,000$

$\frac{145}{100} \times 45000$

$= Sh. 6525$

Total amount $= 8(42000) + 12(6525)$ ✓ M1

$= Sh(336000 + 78,300)$

$= Sh. 414,300$ A1

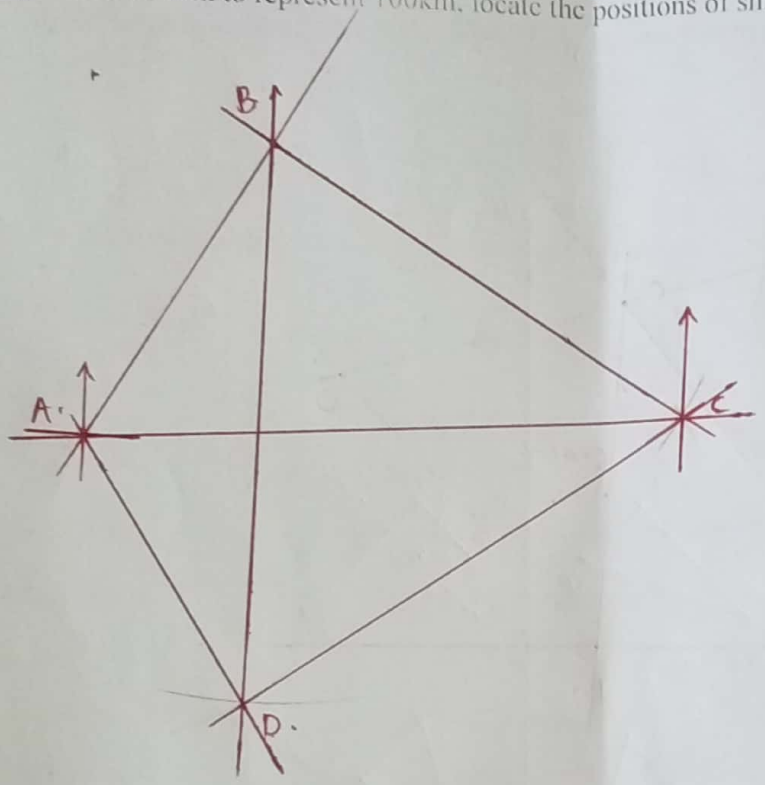
(ii) Determine his profit in Kenya shillings. (2 mks)

$Profit = Sh. (414,300 - 294,000)$

$= Sh. 120,300$

22. Three warships A, B and C are at the sea such that ship B is 500km on a bearing N30E from ship A. Ship C is 700km from ship B on a bearing of 120°. An enemy ship D is sighted 800km due south of ship B.

a) Taking a scale of 1cm to represent 100km, locate the positions of ships A, B, C and D. (4 mks)



b) Find the bearing of:

i) Ship A from D

$327^\circ \pm 1^\circ$ (1 mk)

ii) Ship D from C

$234^\circ \pm 1^\circ$ (1 mk)

c) Use scale drawing to determine the distance between

i) D and A

$4.4\text{cm} \pm 0.1\text{cm} = 440\text{km}$ (1 mk)

ii) C and D.

$7.6 \pm 0.1\text{cm} = 760\text{km}$ (1 mk)

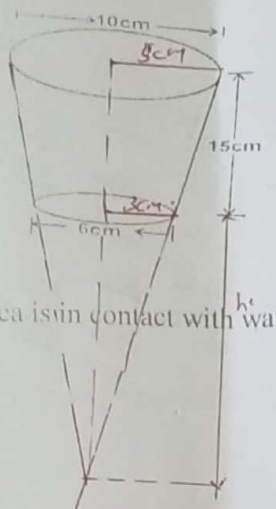
d) Measure angle DAC and angle BCD

$\angle DAC = 61^\circ \pm 1^\circ$ (2 mks)

$\angle BCD = 66^\circ \pm 1^\circ$

CamScanner

23. The figure below shows a tumbler with diameters 6cm and 10cm and height 15cm.



(a) If it is filled with water, what area is in contact with water? (7 Mks)

$\frac{h+15}{5} = \frac{h}{3}$ ✓M1

$3h + 45 = 5h$

$45 = 2h$

$h = 22.5$

$A = \pi RL - \pi rl$

$L^2 = 37.5^2 + 5^2$

$= 1406.25 + 25$ ✓A

$L = 37.832$

$l^2 = 22.5^2 + 3^2$

$= 506.25 + 9$

$l = 22.699$ ✓A1

$A = \pi RL - \pi rl$

$= \pi(5 \times 37.832 - 3 \times 22.699)$ ✓M1

$= \pi(189.16 - 68.097)$

$= \pi(121.063)$

$= 380.331\ cm^2$

Area of the lower circle.

$= \frac{22}{7} \times 9$ ✓M1

$= 28.274$

Total Area ✓

$= (380.331 + 28.274)$ M1

$= 408.61\ cm^2$ ✓A1

(b) Find the volume of the tumbler. (3 Mks)

$V = \frac{1}{3}\pi R^2 H - \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi(5^2 \times 37.5 - 3^2 \times 22.5)$ ✓M1

$= \frac{1}{3}\pi(937.5 - 202.5)$

$= \frac{1}{3}\pi(735)$ ✓M1

$= 769.69\ cm^3$ ✓A1

24. The following are masses of 25 people taken in a clinic.

20	35	29	45	60
66	56	29	48	37
59	64	24	28	32
25	45	48	52	55
54	55	36	39	26

(a) Using a class width of 8 and starting with the lowest mass of the people. Make a frequency distribution table for the data. (3 Mks)

class	f	x	fx
20 – 27	2	23.5	47
28 – 35	7	31.5	220.5
36 – 43	3	39.5	118.5
44 – 51	4	47.5	190
52 – 59	6	55.5	333
60 – 67	3	63.5	190.5
68 – 75	$\Sigma f = 25$		$\Sigma fx = 1099.5$

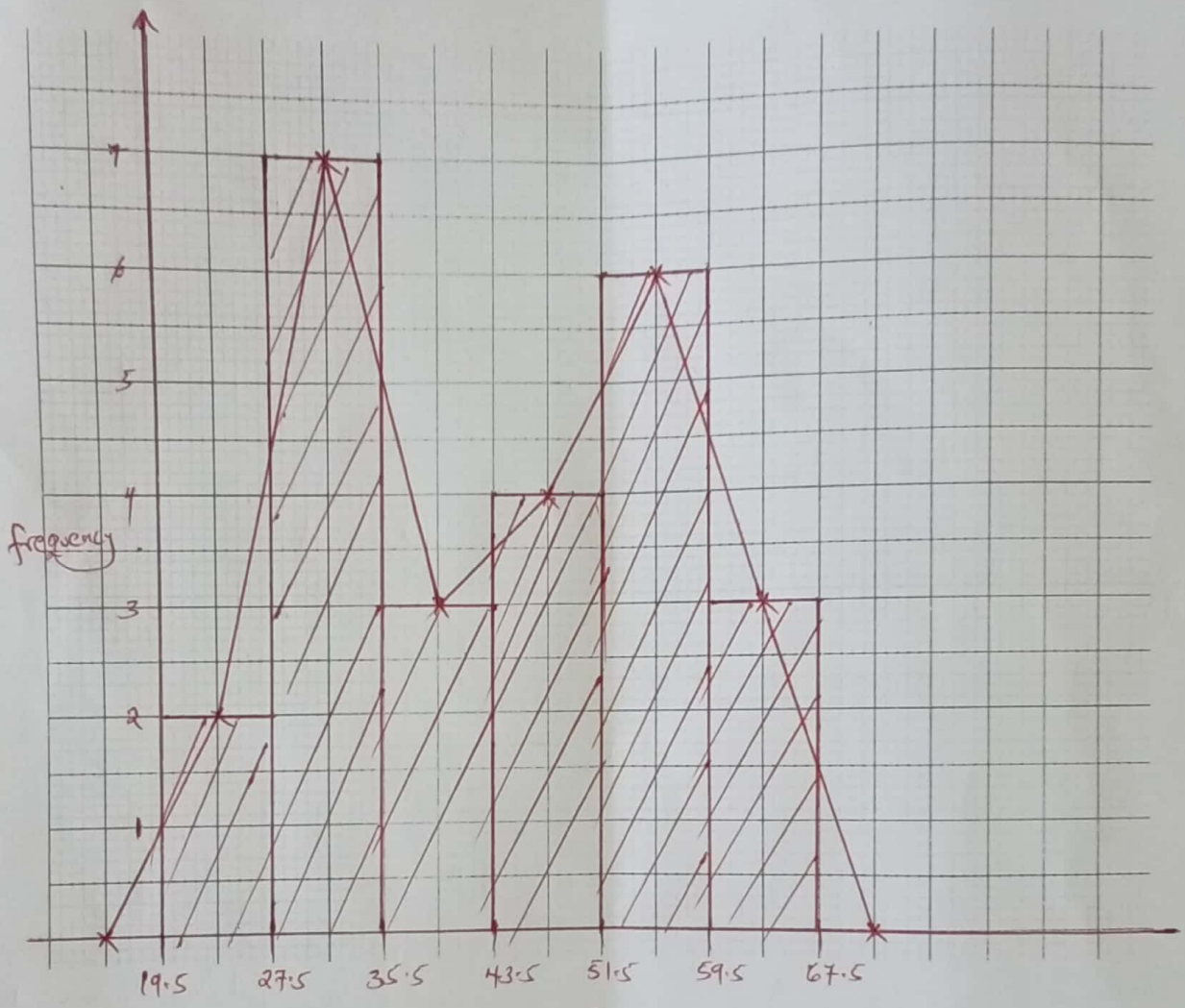
(b) Calculate the ~~median~~ mean mass of the people. (2 Mks)

$$\bar{x} = \frac{\Sigma fx}{\Sigma f}$$

$$= \frac{1099.5}{25}$$

$$= 43.98$$

(c) On the grid provided, draw a histogram and a frequency polygon to represent the information. (5 Mks)



B_1 → for correct scale and variable x and y.

B_2 → for all correct bars.

B_2 → for correct frequency polygon.