MATHEMATICS PAPER 1
TERM 2 2019
MARKING SCHEME

1. Evaluate: (3 mks)

$$\left(\frac{\left(1\frac{3}{7}-\frac{5}{8}\right)x\frac{2}{3}}{\frac{3}{4}+1\frac{5}{7}\div\frac{4}{7}of\,2\frac{1}{3}}\right)^{-2}$$

$$\left(\frac{\frac{3}{4}+\frac{12}{7}\div\frac{4}{7}\times\frac{7}{3}}{\left(\frac{10}{7}-\frac{5}{8}\right)\times\frac{2}{3}}\right)^{2}\checkmark \quad 2.$$

$$\left(\frac{\frac{3}{4}+\frac{12}{7}\times\frac{7}{4}\times\frac{7}{3}}{\left(\frac{80-35}{56}\right)\times\frac{2}{3}}\right)^{2}$$

$$\left(\frac{\frac{3}{4}+7}{\frac{45}{56}\times\frac{2}{3}}\right)^{2}\checkmark=\left(\frac{31}{4}\times\frac{28}{15}\right)^{2}=\left(\frac{217}{15}\right)^{2}$$

$$\frac{47089}{225}=209\frac{64}{225}\checkmark$$

2. Mr. Kamau son and daughter needed clothes. The son clothes were costing Ksh 324 while the daughter clothes were costing Ksh 220. Mr Kamau wanted to give them equal amounts of money. Calculate the least amount of money he would spend on the two and how many clothes each will buy. (3 mks)

2	324	220
2	162	110
3	81	55
3	27	55
3	9	55
3	3	55
5	1	11
11	1	1

$2^2\times3^4\times5\times11\checkmark$

$\frac{17820}{324}$

$=55$ clothes $\checkmark$

$\frac{17820}{220}$

$=81$ clothes $\checkmark$

3. Use reciprocal tables to find the value of $(0.325)^{-1}$ hence evaluate $\frac{\left(\sqrt[3]{0.000125}\right)}{0.325}$, give your answer to 4 s.f. (3 mks)

$\checkmark$

$\frac{1}{3.25\times10^{-1}}=0.3077\times10^{1}$

$=3.077\times\sqrt[3]{125\times10^{-6}}$

$3.077\times5\times10^{-3}.\checkmark$

$\frac{15.385}{1000}=0.015385\checkmark$

4. A type of paper is 40cm long, 32 cm wide and 0.8 mm thick. The paper costs sh 10 per m^2. Find the total cost of a pile of such paper of height 4.8m. **(4 mks)**

No of papers in the pile $= \frac{4{\cdot}8}{0.8\times10^{-3}} = \frac{4.8\times1000}{0.8}$ ✓

$= 6000$

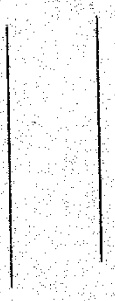
Area of one paper $= (0.4\times0.32)m^2$

Total area $= 0.4\times0.32\times6000$ ✓

$= 768$

Total Cost $= 768\times10$ ✓ $=$ Sh 7680 ✓

5. A square based brass plate is 2mm high and has a mass of 1.05kg. The density of the brass is 8.4 g/cm^3. Calculate the length of the plate in centimeter. (3 mks)



Volume of brass $= \frac{1.05}{8.4\times1000} = 1.25\times10^{-4}\ m^3$ ✓

$= 125\ cm^3$ ✓

$x\times x\times\frac{2}{10} = 125$ ✓

$x^2 = 625$

$x = 25$ cm ✓

6. Solve for x in the equation: (3 mks)

$$\frac{x-3}{4} - \frac{x+3}{6} = \frac{x}{3}$$

Lcm $= 12$.

$3(x-3) - 2(x+3) = 4x$ ✓

$3x - 9 - 2x - 6 = 4x$.

$x - 15 = 4x$ ✓

$-3x = 15$

$x = -5$. ✓

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7. A salesman earns 3% commission for selling a chair and 4% commission for selling a table. A chair fetches K£ 75. One time, he sold ten more chairs than tables and earned seven thousand, two hundred Kenya shillings as commission. Find the number of tables and chairs sold. (4 mks)

Let the No of Chairs and tables Sold be c and t respectively

Commission earned.

$\frac{3}{100}(600c) + \frac{4}{100}(1500t) = 7200$ ✓

$3c + 10t = 1200$ ✓

$c - t = 10$

$3c - 3t = 30$

$13t = 1170$

$t = 90$ ✓

$c = 10 + t$

$c = 10 + 90$

$= 100$ ✓

8. Using the three quadratic identities only factorise and simplify: (3 mks)

$$\frac{(x-y)^2 - (x+y)^2}{(x^2+y^2)^2 - (x^2-y^2)^2}$$

$$\frac{x^2 - 2xy + y^2 - (x^2 + 2xy + y^2)}{x^4 + 2x^2y^2 + y^4 - (x^4 - 2x^2y^2 + y^4)}$$ ✓

$$\frac{x^2 - 2xy + y^2 - x^2 - 2xy - y^2}{x^4 + 2x^2y^2 + y^4 - x^4 + 2x^2y^2 - y^4}$$ ✓

$$\frac{-4xy}{4x^2y^2}$$ ✓

$$= \frac{-1}{xy}$$ ✓

9. Two numbers are in the ratio 3 : 5. When 4 is added to each the ratio becomes 2 : 3. What are the numbers? (3 mks)

Soln.

$\frac{x}{y} = \frac{3}{5} \Rightarrow 5x = 3y \Rightarrow x = \frac{3}{5}y$.

$\frac{x+4}{y+4} = \frac{2}{3}$

$3(x+4) = 2(y+4)$

$3x + 12 = 2y + 8$

$2y - 3x = 4$ ✓

but $x = \frac{3}{5} \times 20$

$x = 12$ ✓

$2y - 3\left(\frac{3}{5}y\right) = 4$

$2y - \frac{9}{5}y = 4$

$\frac{10y - 9y}{5} = 4$

$y = 20$ ✓

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10. Given that $\text{Sin}(x + 4^0) = \text{Cos}(3x)^0$. Find $\tan(x + 40^0)$ to 4 s.f. (3 mks)

$x + 40 + 3x = 90$

$4x = 50$

$x = 12.5$ ✓

$\tan(x + 40) = \tan 52.5$ ✓

$= 1.303225373$

$= 1.303$ (4 s.f.) ✓

11. In a regular polygon, the exterior angle is $^1/_3$ of its supplement. Find the number of sides of this polygon. (3 mks)

Interior + exterior = 180.

$x + \frac{1}{3}x = 180$

$\frac{4}{3}x = 180$

$x = \frac{45}{180} \times \frac{3}{4}$

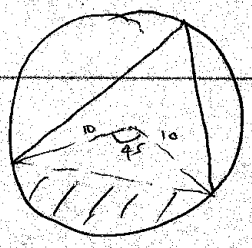
$= 135$

Exterior = 45 ✓

No of sides $= \frac{360}{45}$ ✓

$= 8$ ✓

12. Find the area of a segment of a circle whose arc subtends an angle of $22\frac{1}{2}^0$ on the circumference of a circle, radius 10cm. (3 mks)



$\frac{45}{360} \times \pi r^2 - \frac{1}{2} \times 10 \times 10 \sin 45.$

$= \frac{45}{360} \times \frac{22}{7} \times 100 - 50 \sin 45$ ✓

$= 39.26990817 - 35.35533906$ ✓

$= 3.914569111$ ✓

13. An airplane leaves point A (60^0S, 10^0W) and travels due East for a distance of 960 nautical miles to point B. determine the position of B and the time difference between points A and B. (3 mks)

Distance along a latitude $= \theta \times 60 \cos x$

$960 = \theta \times 60 \cos 60°$

$\theta = \frac{960}{60 \cos 60°}$ ✓

$= 32$.

longitude of B $= 32 - 10$

$= 22°$

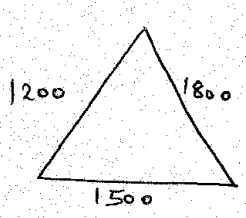
Position of B $(60°S, 22°E)$ ✓

Time diff.

$= 32 \times 4 = 128$ min

$= 2$hrs. 8min ✓

14. Mr. Onyango's piece of land is in a form of triangle whose dimensions are 1200M, 1800M and 1500M respectively. Find the area of this land in ha. (Give your answer to the nearest whole number). (3 mks)



$S = \frac{1200 + 1800 + 1500}{2}$

$= 2250$ ✓

$A = \sqrt{2250(2250-1200)(2250-1800)(2250-1500)}$

$= \sqrt{7.9734 \times 10^{11}}$

$= 892941.0675 \text{ m}^2$ ✓

$= \frac{892941.0675}{10000}$

$= 89.29410675$

$\simeq 89$ hac ✓

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15. Two men each working for 8 hours a day can cultivate an acre of land in 4 days. How long would 6 men, each working 4 hours a day take to cultivate 4 acres? (3 mks)

Men	hrs	Acres	Days
2	8	1	4
6	4	4	?

$\frac{2}{6_3} \times \frac{8}{4} \times \frac{4}{1} \times 4 = \frac{32}{3} = 10\frac{2}{3}$ days. ✓

16. Find the equation of a straight line which is perpendicular to the line $8x + 2y - 3 = 0$ given that they intersect at $y = 0$ leaving your answer in a double intercept form. (3 mks)

$2y = -8x + 3$.

$y = -4x + \frac{3}{2}$

$M_2 = \frac{1}{4}$ ✓

When $y = 0$

$8x = 3$

$x = \frac{3}{8}$

$\frac{y - 0}{x - \frac{3}{8}} = \frac{1}{4}$

$y = \frac{1}{4}\left(x - \frac{3}{8}\right)$

$y = \frac{1}{4}x - \frac{3}{32}$ ✓

$\frac{1}{4}x - y = \frac{3}{32}$

$\frac{8}{3}x - \frac{32}{3}y = 1$ 7

$\frac{x}{\frac{3}{8}} + \frac{y}{-\frac{3}{32}} = 1$ ✓

SECTION B

17. (a) Use the mid-ordinate rule to estimate the area bounded by the curve $y = x + 3x^{-1}$, the x-axis, lines $x = 1$ and $x = 6$. (4 mks)

x	1.5	2.5	3.5	4.5	5.5
y	3.5	3.7	4.36	5.167	6.045

$A = 1(3.5 + 3.7 + 4.36 + 5.167 + 6.045)$

$= 1(22.772)$

$= 22.772 \text{ units}^2$

(b) Find the exact area of the region in (a) above. (3 mks)

$\int_1^6 (x + 3x^{-1})\,dx.$

$= \left[\frac{x^2}{2}\right]_1^6 = \frac{6^2}{2} - \frac{1^2}{2} = 17.5 \text{ units}^2$

(c) Calculate the percentage error in area when mid-ordinate rule is used. (3 mks)

$\%\ \text{error} = \frac{|17.5 - 22.772|}{17.5} \times 100$

$= 30.1257\%$

18. A car whose initial value is Ksh 600,000 depreciates at a rate of 12% p.a. Determine:

(a) Its value after 5 years. (4 mks)

$A = P\left(1 - \frac{r}{100}\right)^n$ ✓

$= 600000\left(1 - \frac{12}{100}\right)^5$ ✓

$= 600000\,(0.88)^5$ ✓

$= 600000\,(0.5277$ ✓

$= \text{Ksh } 316620$ ✓

(b) Its value of depreciation after 5 years. (2 mks)

$\text{Ksh}\,(600{,}000 - 316620)$ ✓

$= \text{Ksh } 283380$ ✓

(c) The number of year it will take for the value of the car to be Ksh 300,000 (3 mks)

$300000 = 600000\left(1 - \frac{12}{100}\right)^n$ ✓

$0.5 = 0.88^n$ ✓

$\log 0.5 = n \log 0.88$

$n = \frac{\log 0.5}{\log 0.88}$ ✓

$= 5.422$ years.

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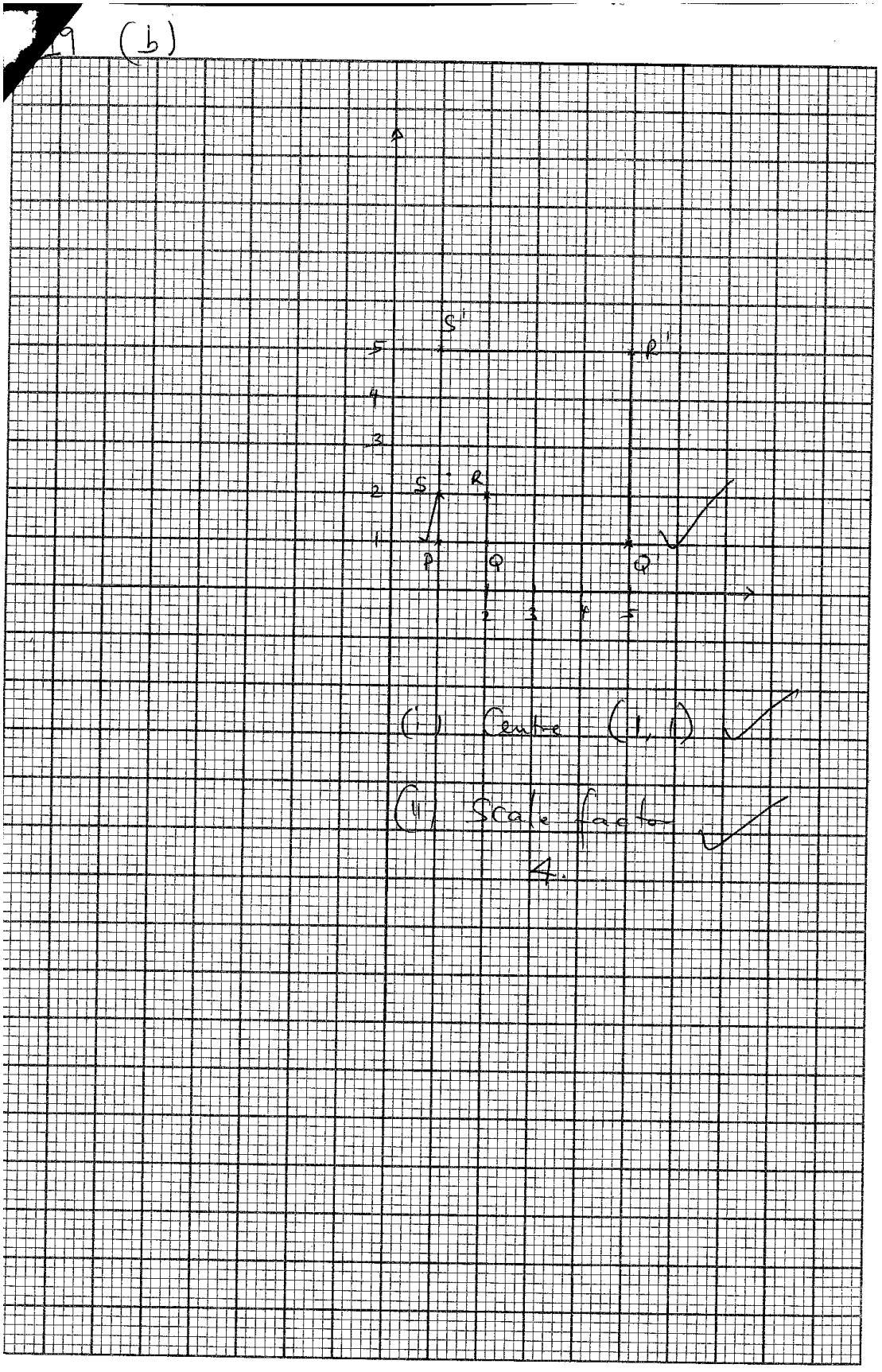
29 (b)



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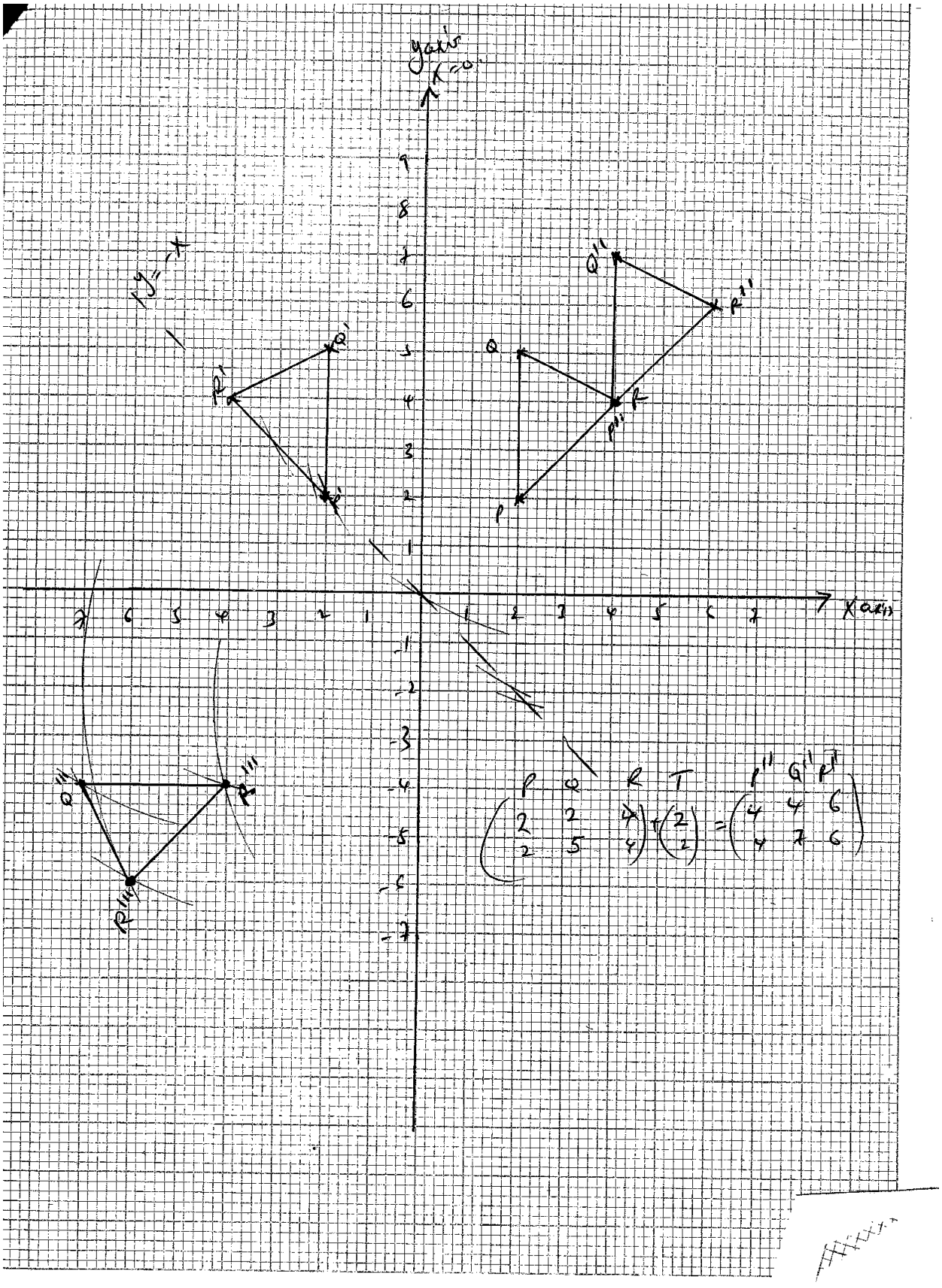


21. Three warships P, Q and R are at sea such that ship Q is 400 km on a bearing of N30^0 E from ship P. ship R is 750 km from ship Q and on a bearing of S60^{0}E from ship Q. an enemy warship is sighted 1000 km due south of ship Q.

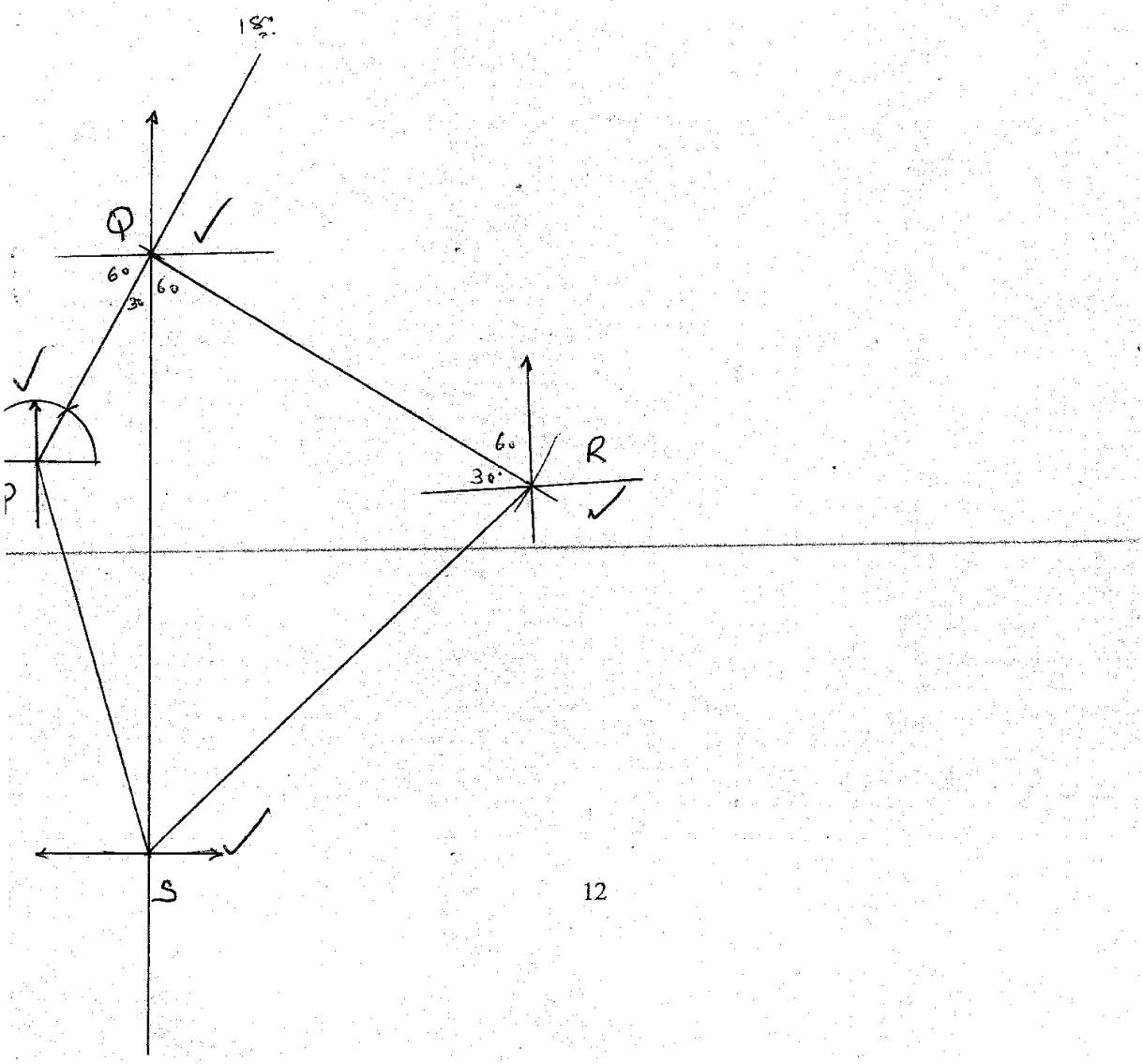
(a) Use scale drawing to locate the position of ships P, Q, R and S. (4 mks)

(b) Find the compass bearing of: (2 mks)
(i) Ship P from ship S N 15° W ✓
(ii) Ship S from ship R S 50° W ✓

(c) Use scale drawing to determine: (2 mks)
(i) The distance of S from P 6.8cm x 100 = 680Km ± 10Km. ✓
(ii) The distance of R from S 8.8 cm x 100 880 Km ± 10Km ✓

(d) Find the bearing of: (2 mks)
(i) Q from R 300° or N 60° W ✓
(ii) P from Q 210 or S 30° W. ✓

1cm rep 100 km



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22. The table below shows the amount in shillings of pocket money given to students in a particular school.

x	210	224.5	234.5	244.5	254.5	264.5	274.5	284.5	294.5
Pocket money (Kshs)	201 – 219	220 – 229	230 – 239	240 – 249	250 – 259	260 – 269	270 – 279	280 – 289	290 – 299
	19	10	10	10	10	10	10	10	10
No. of students	5	13	23	32	26	20	15	12	4
fx	1050	2918.5	5393.5	7824	6617	5290	4117.5	3414	1178

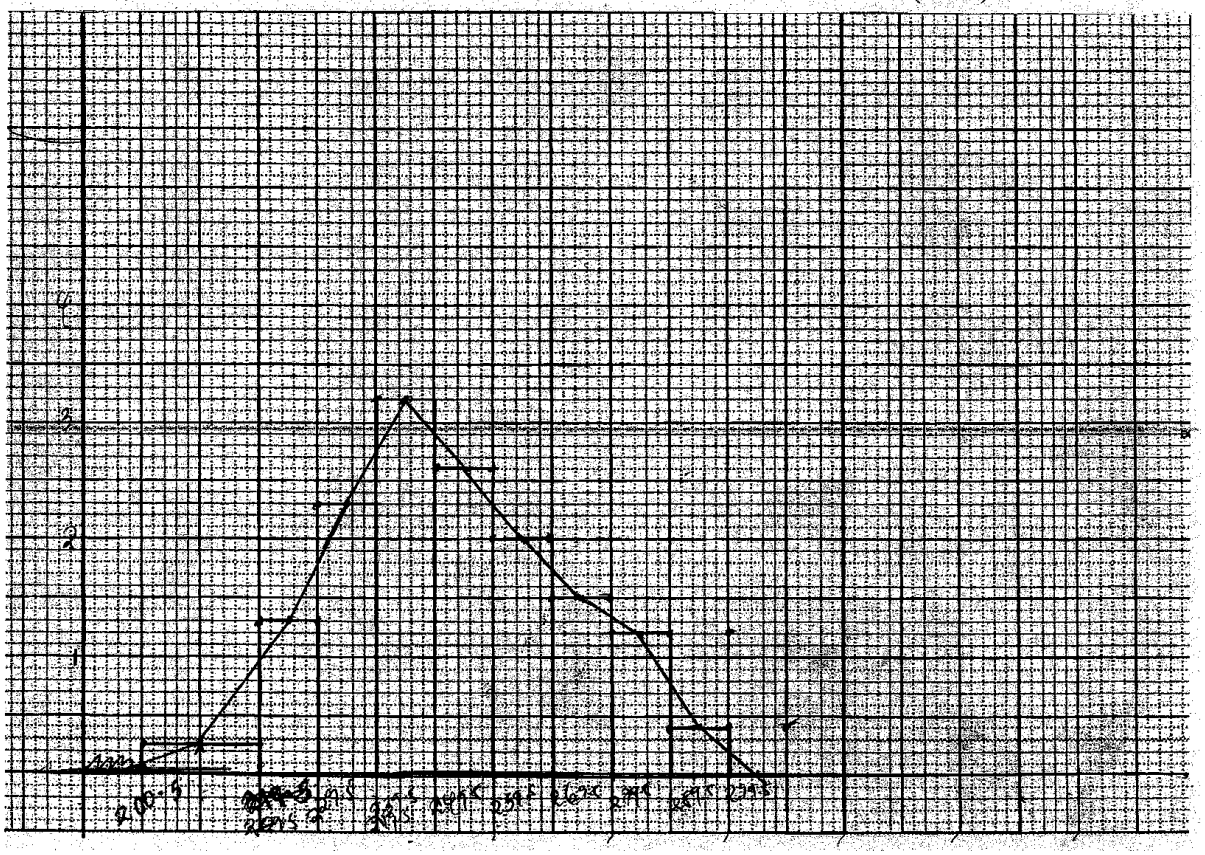
$\sum fx = 37802.5$

(a) State the modal class. (1 mk)

(b) Calculate the mean amount of pocket money given to these students to the nearest shilling. (4 mks)

$$\frac{\sum fx}{\sum f} = \frac{37802.5}{150} = 252.02 \approx 252$$

(c) Use the same axes to draw a histogram and a frequency polygon on the grid provided. (5 mks)



23. Given that points X (0,-2), Y (4, 2) and Z (x,6);

(a) Write down the column vector $\overrightarrow{XY}$. (1 mk)

$\overrightarrow{XY} = Y - X \quad \begin{pmatrix}4\\2\end{pmatrix} - \begin{pmatrix}0\\-2\end{pmatrix} = \begin{pmatrix}4\\4\end{pmatrix}$ ✓

(b) (i) Find $|\overrightarrow{XY}|$ leaving your answer in index form. (3 mks)

$|\overrightarrow{XY}| = \sqrt{4^2+4^2}$ ✓

$\sqrt{32}$ ✓

$= 5.656854249$ ✓

(ii) Given that $|\overrightarrow{XZ}| = 11.3170$, find the coordinates of Z. (3 mks)

$\overrightarrow{XZ} = Z - X$

$\begin{pmatrix}x\\6\end{pmatrix} - \begin{pmatrix}0\\-2\end{pmatrix} = \begin{pmatrix}x\\8\end{pmatrix}$ ✓

$\sqrt{x^2+64} = 11.3170$ ✓

$x^2 + 64 = (11.3170)^2$

$x^2 = 128.074489 - 64$

$x^2 = 64.074489$

$x = 8.0046$

$Z(8,6)$ ✓

(c) Find the mid-point of the line YZ. (3 mks)

$Y(4,2) \quad Z(8,6)$

Midpoint $= \left(\frac{4+8}{2}, \frac{2+6}{2}\right)$ ✓

Midpoint $= (6,4)$ ✓

24. A bus and a matatu left Voi from Mombasa, 240 km away at 8.00 am. They travelled at 90 km/h and 120 km/h respectively. After 20 minutes the matatu had a puncture which took 30 minutes to mend. It then continued with the journey.
(a) How far from Voi did the catch up with the bus. (6 mks)

Bus travelled a distance of $\frac{20}{60} \times 90 = 30$ km

After 30min

$\frac{30}{60} \times 90 = 45$ km

Total distance by bus

$30 + 45 = 75$ km.

Matatu $= 120 \times \frac{20}{60} = 40$ km

Distance between the two

$75 - 40 = 35$ km

Relative speed $= 120 - 90$

$= 30$ km/h

Time to catch up $\Rightarrow \frac{35}{30} = \frac{7}{6}$

Distance from Voi $\Rightarrow$

$40 + (\frac{7}{6} \times 120) = 180$ km

(b) At what time did the matatu catch up with the bus? (2 mks)

$20 + 30 + 1$hr 10min $= 2$ hrs.

$8.00 + 2$hrs $=$ 10.00 A.M.

(c) At what time did the bud reach Mombasa? (2 mks)

Time taken by bus $= \frac{240}{90} = 2$hr: 40min

Arrival time $= 8.00 + 2$h40min

$=$ 10.40 A.M