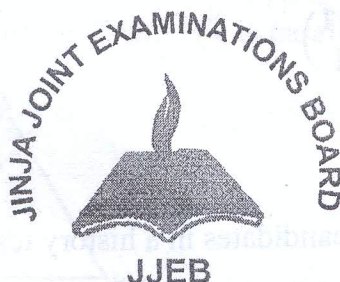


456/1
MATHEMATICS
Paper 1
JULY, 2014
2½ hours



JINJA JOINT EXAMINATIONS BOARD

Uganda Certificate of Education

MOCK EXAMINATIONS – JULY, 2014

MATHEMATICS

Paper 1

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

Answer **ALL** questions in Section A and **not more than FIVE** from section B.

Any additional question(s) answered will not be marked.

All necessary calculations must be shown and should be done on the same page as the rest of the answer.

Mathematical tables and graph papers are provided.

Silent, non-programmable scientific calculators may be used.

SECTION A (40 MARKS)

Answer all questions in this section.

1. Factorize completely $a^3b - ab^3$ and use it to find the value of $3^3(2) - 3(2^3)$ (4 marks)
2. Find the solution set for the quadratic inequality $x^2 - 6x - 16 < 0$ (4 marks)
3. Given that $A = \begin{pmatrix} -1 & -1 \\ 1 & 1 \end{pmatrix}$
 - (i) Find A^2 (4 marks)
 - (ii) Name matrix A^2
4. The average mark of 20 candidates in a history test was 63. The 5 weakest candidates had an average of 36. Find the average mark of the other 15 candidates. (4 marks)
5. Solve for n in the equation (4 marks)

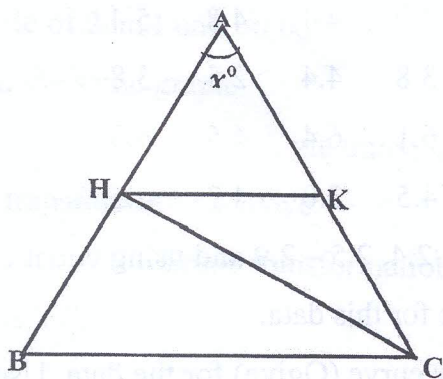
$$(4)^{2n+1} = 8^6$$
6. A forest ranger sighted fire from the top of a tower 80m high. If the angle of depression of the fire was 17.5° how far was the ranger from the foot of the tower? Give your answer to 3 significant figures. (4 marks)
7. Given that $a * b = \frac{(2a+b)^2}{ba}$ (4 marks)
Evaluate $(3 * 6) * 4$
8. (i) Express 0.000000437 in scientific form (4 marks)
(ii) Find the value of θ when $\log_{10} \sin \theta = \bar{1}.8213$
9. Without using a calculator or mathematical tables, evaluate (4 marks)

$$12(0.5)^{-1} - \{7(3)^{-2}(81)^{3/4}\}$$
10. A two digit number is formed using the numerals 2, 3 and 4 without repeating any numeral. (4 marks)
 - (a) Write down the possibility space
 - (b) Find the probability that the two digit number is divisible by 2.

SECTION B (60 MARKS)

Attempt any five questions only

11. In the diagram ABC is an Isosceles triangle with $AB=AC$. H and K are points on AB and AC respectively such that $BC=HC$ and HK is parallel to BC.



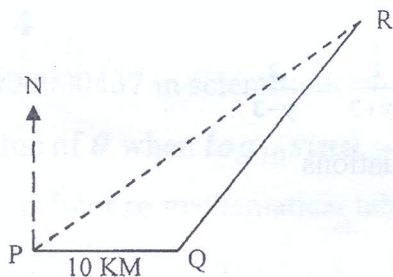
- (a) (i) Given that **angle A** = x° express the angles HBC and CHK in terms of x .
- (ii) What can you say about $\triangle CBH$ and $\triangle ABC$ (6 marks)
- (b) If $AH = HC$ find the value of x . (6 marks)
12. (a) Solve the equation $\frac{3}{y-1} + \frac{1}{2y+3} = \frac{2}{y-3}$ (6 marks)
- (b) Solve the simultaneous equations (6 marks)
- $$x^2 + 3y^2 = 7$$
- $$y - x = 3$$
13. Using a ruler, pencil and pair of compasses only:
- (i) Construct a triangle PQR, where $\overline{QR} = 8.6\text{cm}$ and $\overline{PR} = 6.8\text{cm}$. and angle $PQR = 75^\circ$. Measure $\overline{PQ}$ and angle PRQ .
- (iii) Draw a circle with centre O, inscribing triangle PQR and find the area of the circle. (12 marks)

14. The weights of pupils bags at Happy hours Primary School in kilograms are given below.

3.3	6.0	4.0	2.5	5.4	5.2	4.0	4.3
3.6	5.2	5.5	7.3	4.9	4.4	4.8	5.4
4.5	4.4	2.2	4.9	3.8	4.4	2.5	3.8
3.0	4.8	5.4	3.0	6.1	6.4	4.5	6.0
6.2	3.8	6.5	3.5	4.5	3.0	4.7	4.5

- Starting with a class of 2.0 -2.4, 2.5 – 2.9 and using equal class intervals, form a frequency distribution table for this data.
- Plot a cumulative frequency curve (Ogive) for the data. Use your data to estimate the median weight.
- Calculate the mean weight using an assumed mean of 4.7 (correct your answer to (I.d.p)

15.



In the diagram, which is not drawn accurately, PQR represents the course sailed by a boat after leaving the port P. The point Q is due east of P; the bearing of R from P is 065° , and the bearing of R from Q is 050° .

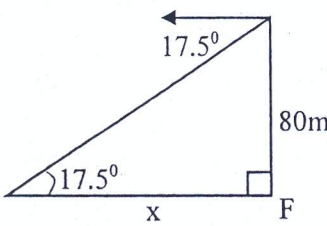
- Find the angles of triangle PQR. (6 marks)
- Given that PQ is 10km, calculate
 - The distance PR
 - The area of triangle PQR. (6 marks)

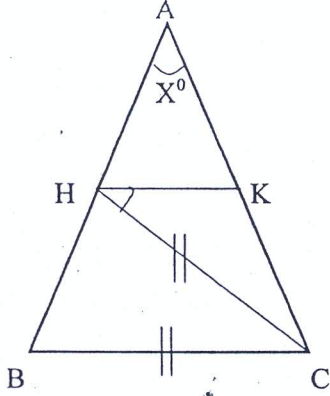
16. A triangle has vertices A (1,1) B(2,4) and C(4,0).
The triangle undergoes a positive quarter turn of 90° about the origin to be mapped onto triangle A' B' C'. The triangle A' B' C' is then reflected in the line $y = -x$ to be mapped onto triangle A'' B'' C''.
- (a) Using a scale of 2cm I unit on both axes, plot the triangles ABC, A'B'C' and A''B''C'' on the same graph. (7 marks)
 - (b) From your graph, describe a single transformation which is equivalent to the two successive transformations above. (2 marks)
 - (c) Find the matrix of the single transformation which maps triangle ABC on to triangle A''B''C''. (3 marks)
17. The head teacher of Bulongo Primary School has shs 12,000,000 for buying Typewriters (x) and solar panels (y). A typewriter costs shs 1,000,000 and a solar panel shs 200,000. She had to buy atleast 6 Typewriters and 20 solar panels.
- (a) Write down three inequalities to represent the given information.
 - (b) Represent the inequalities on a suitable graph, and show the region satisfying the inequalities.
 - (c) Use your graph above to find the number of typewriters and solar panels which should be bought so as to minimize costs and calculate the minimum cost.

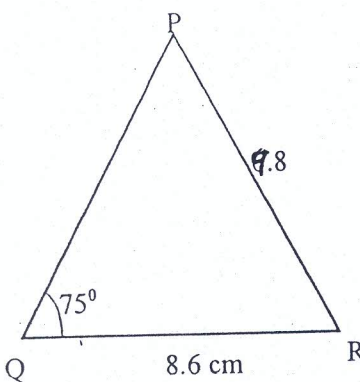
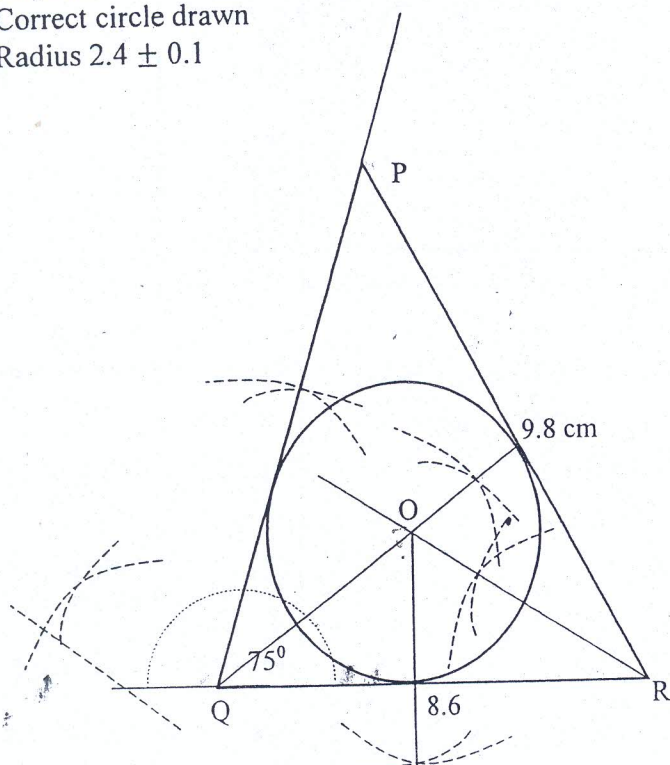
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MARKING GUIDE 456/1 MATHS 2014

Question	Solution	Marks	Comment
1.	$a^3b - ab^3$ $ab(a^2 - b^2)$ $ab(a + b)(a - b)$ $3^3(2) - 3(2^3)$ $= 3 \times 2 (3^2 - 2^2)$ $= 6(3+2)(3-2)$ $= 6 \times 5 \times 1$ $= 30$	M1 M1 M1 A1	 M1 only if $a^3b - ab^3$ is seen factorized. A1 if method above is used.
		04	
2.	$X^2 - 6x - 16 < 0$ $X^2 - 8x + 2x - 16 < 0$ $X(x - 8) + 2(x - 8) < 0$ $(x - 8)(x + 2) < 0$ Either $(x - 8) > 0$ and $(x + 2) < 0$ case I Or $(x - 8) < 0$ and $(x + 2) > 0$ Case II For case II If $x - 8 < 0$ $X < 8$ X can be 7 $X^2 - 6x - 16 = 49 - 42 - 16 = -9$ Since $-9 < 0$ Accept case II and reject case I $X - 8 < 0, x < 8$ $X + 2 > 0, x > -2$ or $-2 < x$ $-2 < x < 8$	M1 M1 B1 A1	 For factorizing For stating to cases above.
		04	
3.	(i) $A^2 = \begin{pmatrix} -1 & -1 \\ 1 & 1 \end{pmatrix} \begin{pmatrix} -1 & -1 \\ 1 & 1 \end{pmatrix}$ $= \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ (ii) Matrix A is a zero matrix	M1 A1 B2	For multiplying two matrices.
		04	
4.	Total marks scored by 20 candidates $20 \times 63 = 1260$ Total marks scored by 5 weakest candidates is $5 \times 36 = 180$ Marks scored by other 15 candidates is $1260 - 180$ $= 1080$ Average mark is $\frac{1080}{15}$ $= 72$	M1 A1 M1 A1	
		04	
5.	$4^{2n+1} = 8^6$ $(2^2)^{2n+1} = (2^3)^6$ $2^{4n+2} = 2^{18}$ $4n + 2 = 18$	M1 M1	Expanding 4 as 2^2 & 8 as 2^3

	$4n = 16$ $n = 4$	M1 A1	
		04	
6.	 Let x be the required distance $\frac{80}{x} = \tan 17.5^\circ$ $x = \frac{80}{\tan 17.5^\circ} = \frac{80}{0.3153}$ $x \approx 253.73$	B1 M1 M1 A1	For diagram Accept 253.7
		04	
7.	$3 * 6 = \frac{(2 \times 3 + 6)^2}{6 \times 3}$ $= \frac{12^2}{18}$ $= \frac{12 \times 12}{18}$ $= 8$ $(3 * 6) * 4 = 8 * 4$ $= \frac{(2 \times 8 + 4)^2}{4 \times 8}$ $= \frac{(16 + 4)^2}{32}$ $= 12.5$	M1 A1 M1 A1	 M1 for his 8
		04	
8.	(i) $.000000437 = 4.37 \times 10^{-7}$ (ii) Antilog of 1.8213 $= 6.627 \times 10^{-1}$ $\sin \theta = 0.6627$ $\theta = \sin^{-1} 0.6627$ $\theta = 41.5^\circ$	B1 M1 A1 A1	
		04	
9.	$12(0.5)^{-1} - \{7(3)^{-2}(81)^{3/4}\}$ $= 12(\frac{1}{2})^{-1} - \{\frac{7}{3^2}(81)^{3/4}\}$ $= 12 \times 2 - [\frac{7 \times 3^3}{3^2}]$ $= 24 - [7 \times 3]$ $= 24 - 21$ $= 3$	M1 M1 M1 A1	For $0.5 = \frac{1}{2}$ Simplification
		04	
10. (a)	$\{23, 24, 32, 34, 42, 43\}$	B2	

(b)	Numbers divisible by 2 are {24,32,34,42} Probability is $\frac{4}{6}$ or $\frac{2}{3}$	M1 A1	0.6667 scores A0.
		04	
11. (a)	 (i) $\angle HBC = \frac{1}{2}(180^\circ - x^\circ)$ $= 90 - \frac{x^\circ}{2}$ $\angle CHK = \angle BCH$ $\angle CHK + 2\angle HBC = 180^\circ$ $\angle CHK = 180^\circ - (180^\circ - x^\circ)$ $= x^\circ$ (ii) Triangle CBH is similar to $\triangle ABC$	M1 A1 B1 M1 A1 B1	$(90 - \frac{x^\circ}{2})$ on sight scores M1A1
(b)	If AH = HC $\angle HCA = x^\circ$ Also $\angle BCH = x^\circ$ $\angle ABC = \angle ACB = 2x^\circ$ $X + 2x + 2x = 180^\circ$ $5x = 180^\circ$ $X = 36^\circ$	B1 B1 B1 M1 M1 A1	
		12	
12. (a)	$\frac{3}{y-1} + \frac{1}{2y+3} = \frac{2}{y-3}$ $3(2y+3)(y-3) + (y-1)(y-3) = 2(2y+3)(y-1)$ $3(2y^2 - 3y - 9) + (y^2 - 4y + 3) = 2(2y^2 + y - 3)$ $6y^2 - 9y - 27 + y^2 - 4y + 3 = 4y^2 + 2y - 6$ $7y^2 - 13y - 24 = 4y^2 + 2y - 6$ $3y^2 - 15y - 18 = 0$ Or $y^2 - 5y - 6 = 0$ $(y-6)(y+1) \neq 0$ $y-6=0$ or $y+1=0$ $y=6$ or $y=-1$	M1 M1 M1 M1 A1A1	LCM = $(y-1)(y-3)$ $2(y+3)$ Correct use of L.C.M Opening brackets correctly. Forming a quadratic equation. Factorizing A1 for $y=6$ A1 for $y=-1$

No.	Solution	Marks	Comment
13.2	<u>Sketch</u>  QR 8.6 ± 0.2 $\angle PQR$ $75^\circ \pm 1$ PR 9.8 ± 0.2 $\angle PRQ$ 47° PQ $= 7.6 \text{ cm} \pm 0.2$ Bisecting any two angles Centre O labelled clearly perpendicular from O to any side of triangle Correct circle drawn Radius 2.4 ± 0.1 	B1 M1 M1 M1 A1 A1 M1 M1 M1 M1 A1 A1	8.4 – 8.8 $74^\circ - 76^\circ$ 9.6 – 10.0 7.4 – 7.8 For each angle For each angle (2.3 – 2.5)

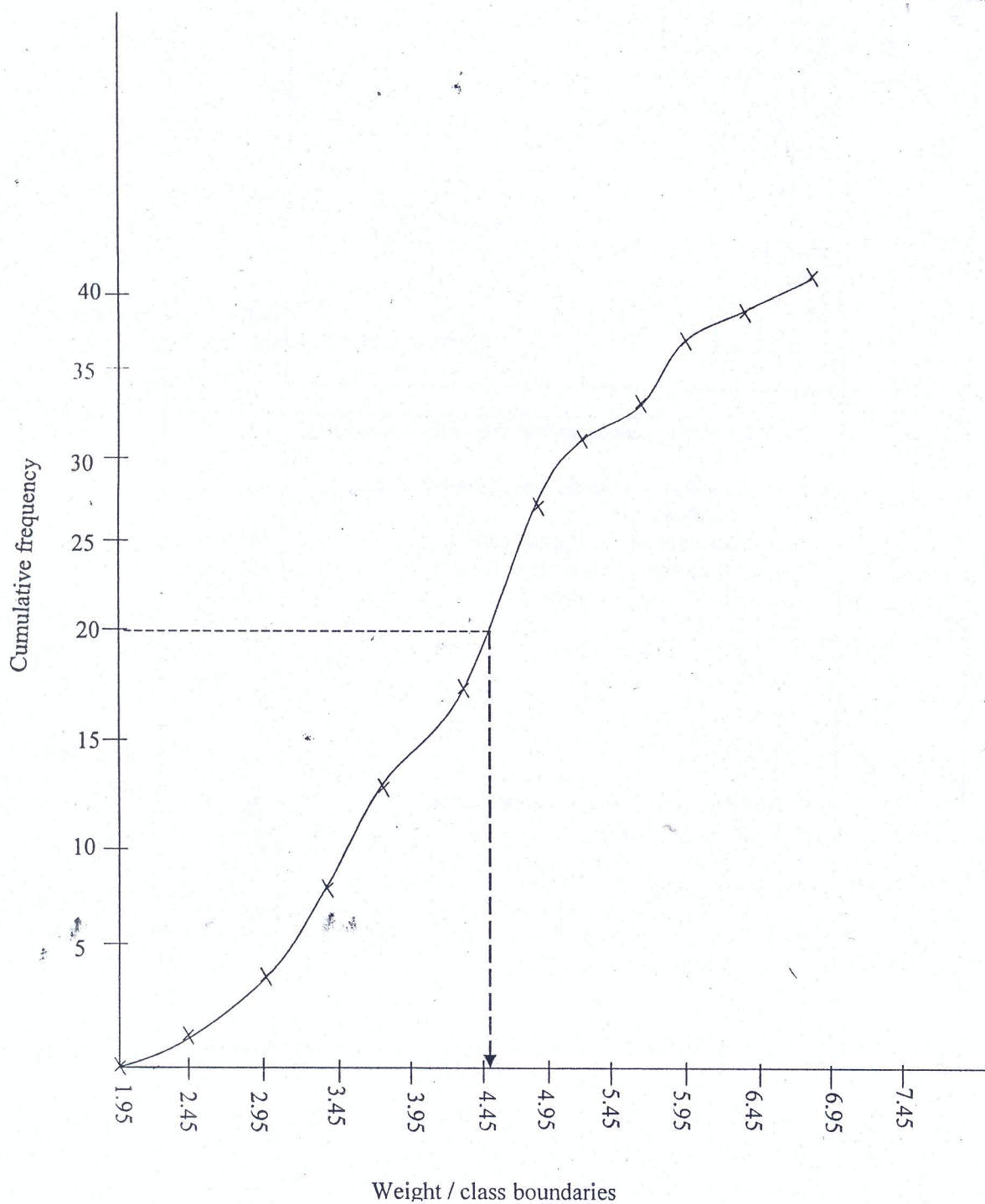
14.6

Weight	Tally	Freq	Class mark x	d	fd	cf
2.0-2.4	I	1	2.2	-2.5	-2.5	1
2.5-2.9	II	2	2.7	-2.0	-4.0	3
3.0-3.4	IIII	4	3.2	-1.5	-6.0	7
3.5-3.9	IIII	5	3.7	-1.0	-5.0	12
4.0-4.4	IIII I	6	4.2	-0.5	-3.0	18
4.5-4.9	IIII III	9	4.7	0	0	27
5.0-5.4	IIII	5	5.2	0.5	2.5	32
5.5-5.9	I	1	5.7	1.0	1.0	33
6.0-6.4	IIII	5	6.2	1.5	7.5	38
6.5-6.9	I	1	6.7	2.0	2.0	39
7.0-7.4	I	1	7.2	2.5	2.5	40
		$\Sigma f = 40$			$\Sigma fd = 8.5$	

B1

B1
M1

14.6



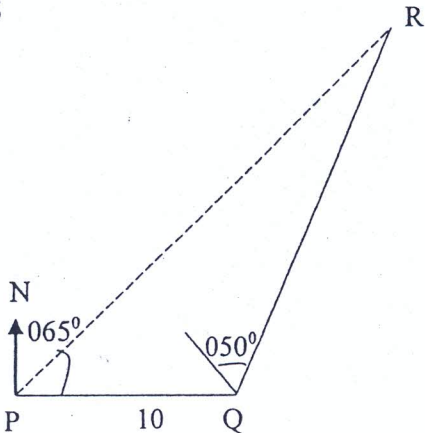
Median weight is 4.55 kg

14iii

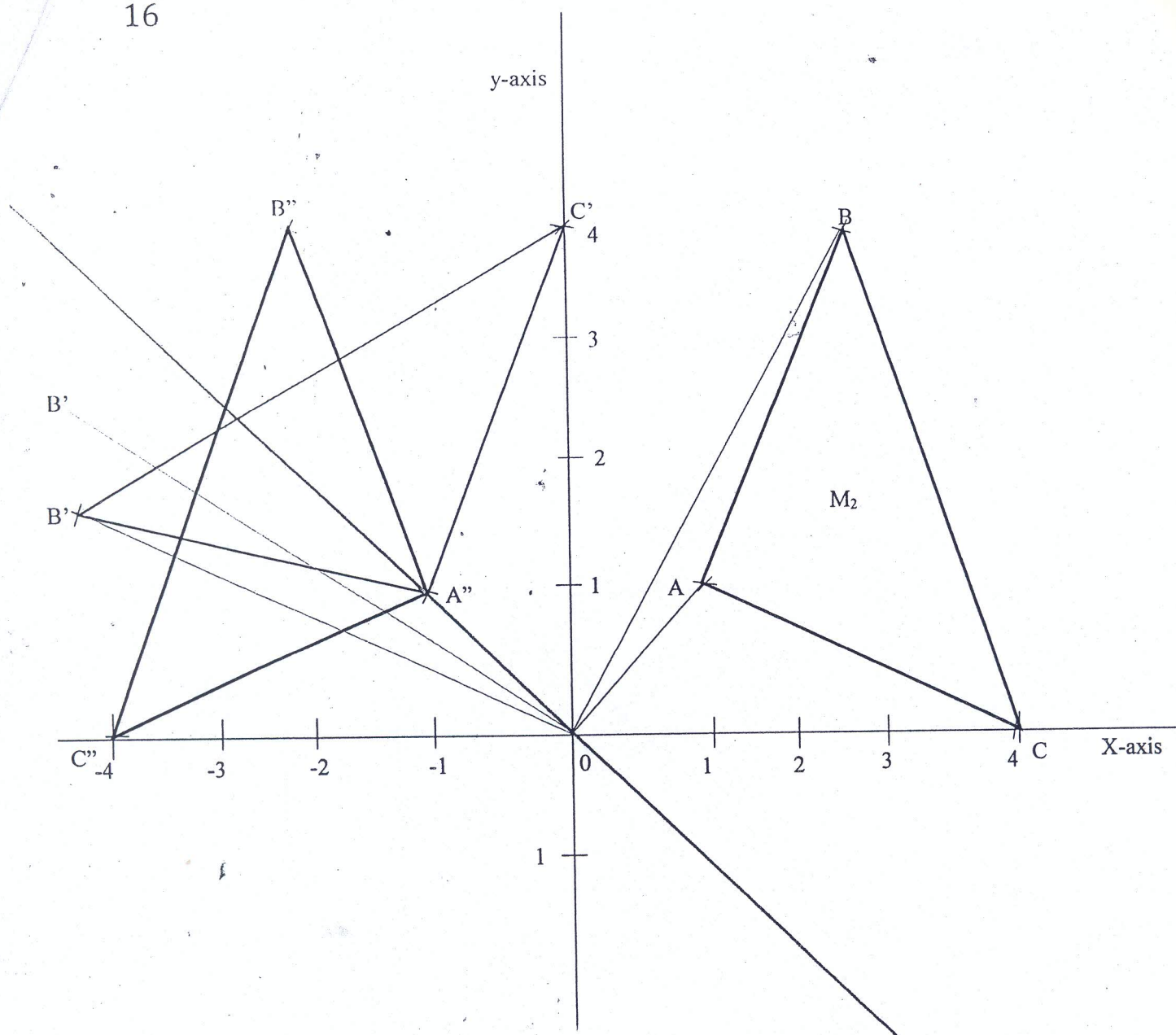
(iii) Mean = $4.7 + \frac{8.5}{40}$
 = 4.9125

M1
A1

Accept (4.9)

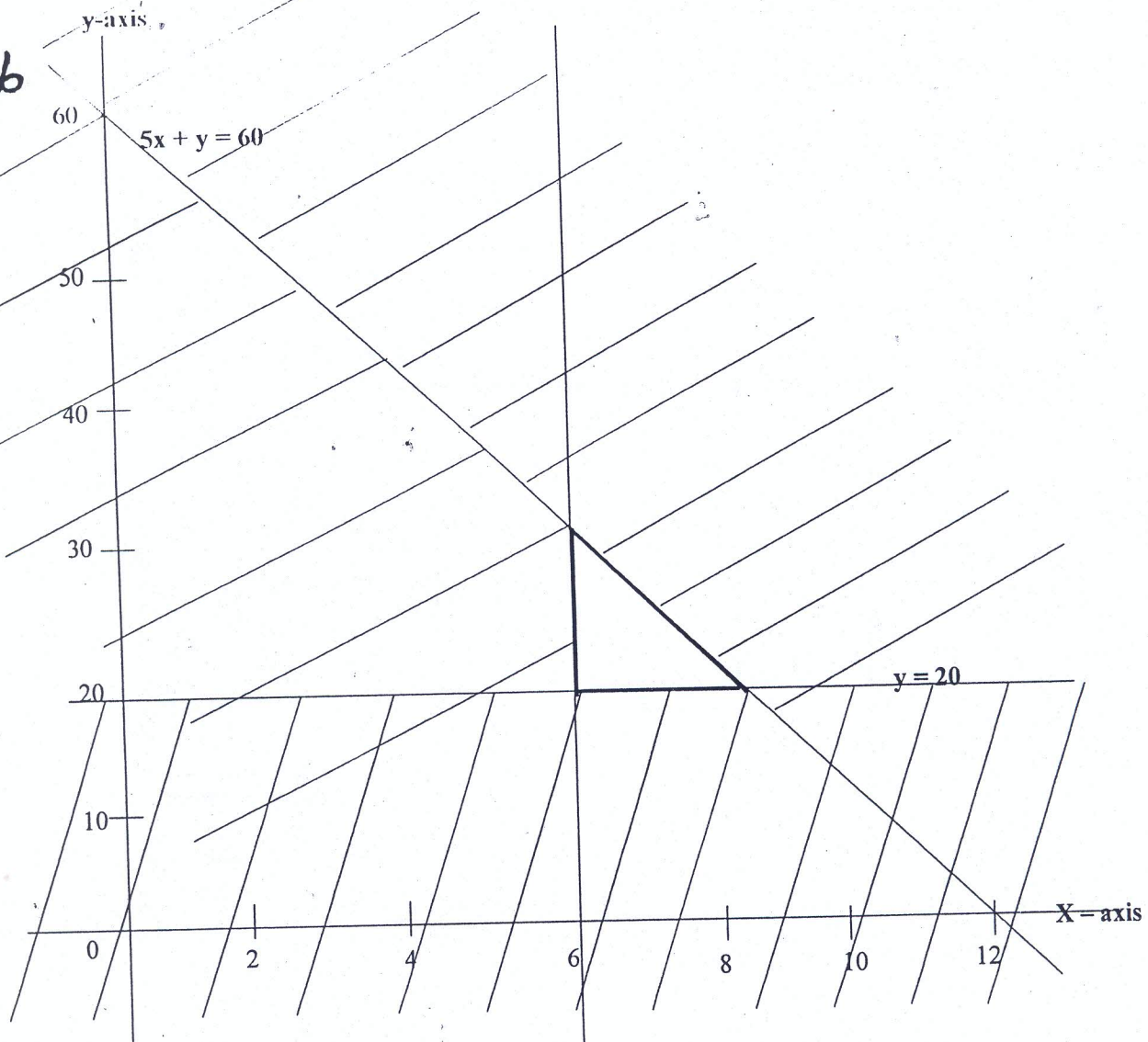
15.	(a) ;  $\angle RPQ = 90^\circ - 65^\circ$ $\angle P = 25^\circ$ $\angle PQR = 90^\circ + 50^\circ$ $\angle Q = 140^\circ$ $\angle R = 180^\circ - (140^\circ + 25^\circ)$ $= 15^\circ$ (b) (i) $\frac{PR}{\sin 140^\circ} = \frac{10}{\sin 15^\circ}$	M1 A1 M1 A1 M1 A1 M1M1	
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16



17a	$x \geq 6$ ----- (ii) $y \geq 20$ ----- (iii) (b) See graph attached Drawing line $y = 20$ and shading Drawing line $5x + y = 60$ and shading Drawing line $x = 6$ and shading Correct region unshaded (c) Number of type writers are 6 and solar panels are 20 Total cost is $6 \times 1,000,000 + 20 \times 200,000$ $= \text{shs. } 10,000,000$	M1 M1 M1 M1 M1 A1 B1 B1 M1 A1	
		12	

17 b



- END -