NAME.........MARKING SCHEME............... INDEX NO...........................

CANDIDATE'S SIGNATURE...................

DATE:......................

GATUNDU SOUTH FORM FOUR 2013 EVALUATION EXAM

121/1
MATHEMATICS
PAPER I
JULY/AUGUST 2013
TIME: 2 ½ HOURS

INSTRUCTIONS TO CANDIDATES

a) Write your name and index number in the space provided above.
b) This paper consists of two sessions: Section I and section II.
c) Answer **all** the questions in the section I and **only five** questions from section II.
d) All answer and working **must** be done on the question paper in the space provided below each questions.
e) Marks may be given for correct working even if the answer is wrong.
f) Non-programmable silent electronic calculators and KNEC Maths tables may be used.

SECTION I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

SECTION II

17	18	19	20	21	22	23	24

Grand Total	

1

BODMAS

1. Evaluate

(3 marks)

$$\frac{\frac{1}{4}\text{ of }2 + 3\frac{3}{4} \div \frac{3}{8} - 4\frac{1}{2} \times 3\frac{1}{3}}{2\frac{4}{5} \times 1\frac{3}{7} - 4 \div \frac{2}{3} + \frac{3}{5}\text{ of }15}$$

$\frac{1}{2} + \frac{15}{4} \div \frac{3}{8} - \frac{9}{2} \times \frac{10}{3}$

$\frac{1}{2} + \frac{15}{4} \times \frac{8}{3} - \frac{9}{2} \times \frac{10}{3}$

$\frac{1}{2} + 10 - 15 = 10.5 - 15$

$= -4.5$

$\frac{14^2}{5} \times \frac{10^2}{7} - 4 \times \frac{3}{2} + \frac{3}{5} \times 15^3$

$4 - 6 + 9$

$\underline{7}$

$\frac{-4.5}{7}$

-0.6429

2. Convert 0.2̇1̇3̇ to a fraction. (3 marks)

$x = 0.213213\cdots$

$1000x = 213.213\cdots$

$999x = 213$

$x = \frac{213}{999} \frac{71}{333}$

$x = \frac{71}{333}$

3. Solve for y in the equation

(3 marks)

$8^{(2y-1)} \times 32^y = 16^{(y+1)}$

$2^{3(2y-1)} \times 2^{5y} = 2^{4(y+1)}$

$3(2y-1) + 5y = 4(y+1)$

$6y - 3 + 5y = 4y + 4$

$11y - 3 = 4y + 4$

$7y = 7$

$y = \frac{7}{7}$

$y = \underline{1}$

4. Use logathrims to evaluate

(4 marks)

$$\left(\frac{461.7 - 4.53}{121.3 \div 5.6}\right)^{1/3}$$

NO	S.J	log.
457.17	4.572×10^2	2.6601
121.3	1.213×10^2	2.0839
5.6	5.6×10^0	0.7482
		1.3357
		2.6601
		$- 1.3357$
		1.3244

$1.3244 \times \frac{1}{3}$

0.4415

$10^0 \times 2.764$

$= \underline{2.764}$

2

5. Two similar solids gave surface areas 48cm² and 108cm² respectively. Find the volume of the smaller solid if the bigger one has a volume of 162cm². (3 marks)

$A.S.f = 48:108$
$\quad\quad 24:56$
$\quad\quad 4:9$

$L.S.f = 2:3$
$Y.S.f = 8:27$

$\dfrac{8}{27} = \dfrac{x}{162}$

$x = \dfrac{8}{27} \times 162$

$x = \dfrac{2312}{8}$

$x = \dfrac{1296}{27}$

$x = 48 cm^3$

6. A triangular flower garden has an area of 28cm². Two of its edges are 14m and 8m. Find the angle between the two edges. (2 marks)

$28 = \frac{1}{2} \times 14 \times 8 \sin Q$

$28 = 56 \sin Q$

$0.5 = \sin Q$
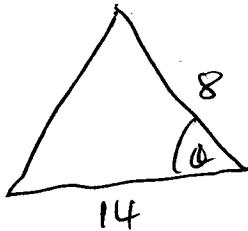
$Q = 30°$

7. O is the centre of the circle and ABCD is a parallelogram. AB=DB and angle AOB = 100°. Find angle ADC. (2 marks)

$\angle ADC = 130°$
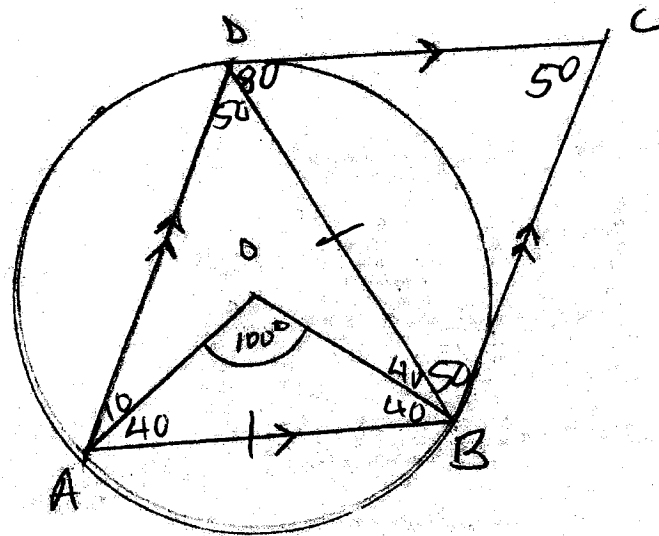
8. A retailer marks a radiogram for sale at ksh3600 so that he can make profit of 20% on the cost price. When he sells it, he allows a discount of 5% of the marked price. Calculate the actual percentage profit. (4 marks)

$$3600 = 120$$
$$30? = 100$$
$$3600 \times \dfrac{100}{120}$$
$$C.P = 3000$$

$$3600 \times \dfrac{95}{100}$$
$$S.P \quad 3420$$
$$P = 3420$$
$$\quad\;\; - 3000$$
$$\quad\quad 420$$

$$\dfrac{420}{3000} \times 100$$
$$14\%$$

9. Find the integral values that satisfy the inequality below. (3 marks)

$$x + 21 \geq 15 - 2x \geq x + 12$$

$$x + 21 \geq 15 - 2x$$
$$3x + 21 \geq 15$$
$$\dfrac{3x}{3} \geq \dfrac{-6}{3}$$
$$x \geq -2$$

$$15 - 2x \geq x + 12$$
$$\dfrac{3}{3} \geq \dfrac{3x}{3}$$

$$1 \geq x$$
$$-2 \leq x \leq 1$$
$$-2, -1, 0, 1$$

10. Two straight lines are perpendicular to each other at point M. One of the lines passes through (2, 6) and the equation of the other line is 2y + 3x – 5 = 0. Calculate the co-ordinates of point M. (4 marks)

$$2y = -3x + 5$$
$$y = -\dfrac{3}{2}x + \dfrac{5}{2}$$
$$G_1 = -\dfrac{3}{2}$$
$$G_2 = \dfrac{2}{3}$$
$$\dfrac{y-6}{x-2} = \dfrac{2}{3}$$

$$y - 6 = \dfrac{2}{3}(x - 2)$$
$$y - 6 = \dfrac{2}{3}x - \dfrac{4}{3}$$
$$y = \dfrac{2}{3}x - \dfrac{4}{3} + \dfrac{6}{1} \dfrac{-4 + 18}{3}$$
$$y = \dfrac{2}{3}x + \dfrac{14}{3}$$
$$\dfrac{2}{3}x + \dfrac{14}{3} = -\dfrac{3}{2}x + \dfrac{5}{2}$$

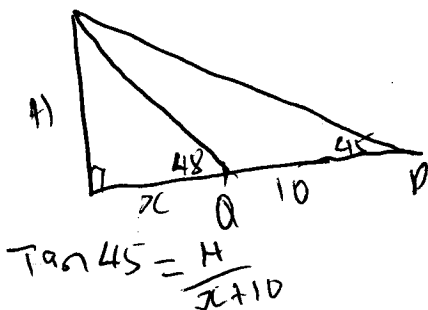$$\dfrac{2}{3} + \dfrac{3}{2} = \dfrac{5}{2} - \dfrac{14}{3}$$
$$\dfrac{4+9}{6} = \dfrac{15-28}{6}$$
$$\dfrac{13}{6}x = -\dfrac{13}{6}$$
$$x = -\dfrac{13}{6} \times \dfrac{6}{13}$$
$$x = -1$$

$$y = \dfrac{3}{2} + \dfrac{5}{2}$$
$$y = \dfrac{8}{2}$$
$$y = 4$$
$$M(-1, 4)$$

11. The angle of elevation of the top of a building from a point P is 45°. From a point Q, which is 10M from P towards the base of the building the angle of elevation is 48°. Calculate the height of the building. (4 marks)

$$Tan 45 = \dfrac{H}{x+10}$$

$$H = (x + 10) Tan 45$$

$$Tan 48 = \dfrac{H}{x}$$
$$H = x Tan 48$$
$$x Tan 48 = (x + 10) Tan 45$$
$$1.1106x = x + 10$$

$$0.1106x = 10$$
$$x = 90.42$$
$$H = 90.42 Tan 48$$
$$H = 100.42M$$

12. A motor cycle and a truck left parkside hotel at the same time. After traveling in the same direction for one and a quarter hours, the motorcycle traveled 25km further than the truck. If the average speed of the motorcycle was 60km/h, find the average speed of the truck. (3 marks)

$1\frac{1}{4} \Rightarrow 1.25\text{hrs}.$

$1.25 \times 60 = 75\text{km}$

$T = 1.25\text{hrs}.$

$D = 50\text{km}.$

$S = \frac{D}{T}$

$\frac{50}{1.25} = 40\text{km/h}.$

13. Ontonglo's team entered a contest, where team of students competes by answering questions that earn either 3 points or 5 points. Ontonglo's team scored 44 points after answering 12 questions correctly. How many 5 points questions did the team earn? (3 marks)

$3x + 5y = 44$

$x + y = 12$

$3x + 5y = 44$

$- 3x + 3y = 36$

$2y = 8$

$y = 4$

$3x + 20 = 44$

$3x = 24$

$x = 8$

$y = 4$

14. The sum of the interior angles of an n sided polygon is $720°$. Find the value of n and hence deduce the name of the polygon. (3 marks)

$(2n - 4)90 = 720$

$(2n - 4) = 8$

$2n = 12$

$n = \frac{12}{2}$

$n = 6$

15. Oruka uses $^1/_3$ of his farm for planting coffee, $^1/_4$ for planting tea and $^2/_5$ of the remainder for mixed farming. He still had 6 hectares of unused land. Find the size of Oruka's land. (4 marks)

$\frac{1}{3} + \frac{1}{4} \quad \frac{4+3}{12} = \frac{7}{12}$

$\frac{5}{12} \times \frac{x}{5} = \frac{1}{6} + \frac{7}{12}$

$\frac{2+7}{12} = \frac{9}{12} \quad \frac{3}{4}$

$\frac{4}{4} - \frac{3}{4} \Rightarrow \frac{1}{4}x = 6$

$x = 24\text{hac}$

5

16. Simplify without using tables (2 marks)

$$\frac{\log 125 - \log 25}{\log 25 + \log 5}$$

$$\frac{3-2}{2+1} = \frac{1}{3}$$

$$\frac{\log 125}{\log 25} \div \log 25 \times \log 5$$

$$\frac{3\log 5 - 2\log 5}{2\log 5 + 1\log 5}$$

SECTION II

17. Sonko traveled to London with ksh 360,000. He exchanged the Kenya shilling for sterling pounds on arrival when the exchange rate was £1 sterling pound = ksh 104.

(a) Determine to the nearest pound how much he received if the bank charged him 2 ½ % commission. (4 marks)

$$1£ = 104k$$
$$x = 360,000$$
$$\frac{360,000}{104}$$
$$£ 3,461.54$$

$$3461.54 \times \frac{97.5}{100}$$
$$£3,375.00$$

(b) In London, he spent £2025 and then traveled to Washington D.C where he exchanged the balance of his money for US dollars. The rate of exchange was £1 sterling pound = 1.6 US dollar. How much did he receive in US dollar assuming no commission was charged? (3 marks)

$$\begin{array}{r}3375 \\ -2025 \\ \hline £1350\end{array}$$

$$1£ = 1.6 us.$$
$$1350 = ?$$
$$1350 \times 1.6 = 2160$$
$$= 2,160 us.$$

(c) He spent ¾ of the money and then traveled back to Nairobi. He exchanged the remaining dollars into Kenya shilling at the rate 1U.S dollar = Ksh 73.25. How much did he receive in Kenya shilling assuming that no commission was charged. (3 marks)
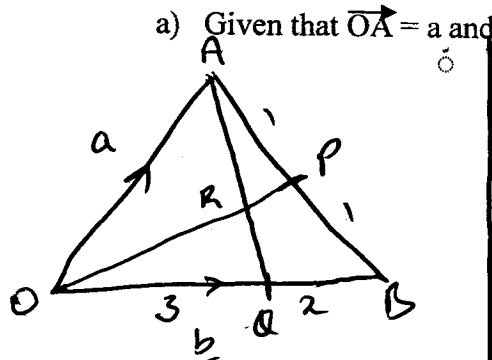
$$\frac{1}{4} \times 2160$$
$$us 540$$

$$1 U.SD = 73.25$$
$$540 u.D = ?$$
$$540 \times 73.25 =$$
$$Ksh. 39,555$$

18. OAB is a triangle where P is the mid-point of line AB, Q is a point on line OB such that OQ:QB = 3:2 and R is a point of intersection of lines AQ and OP.

a) Given that $\overrightarrow{OA}$ = a and $\overrightarrow{OB}$ = b express OP and AQ in terms of a and b. (2 marks)

$$OP = \overrightarrow{OA} + \overrightarrow{AP}$$
$$AB = b - a$$
$$OP = a + \tfrac{1}{2}(b - a)$$
$$OP = a + \tfrac{1}{2}b - \tfrac{1}{2}a$$
$$OP = \tfrac{1}{2}b + \tfrac{1}{2}a$$

$$\overrightarrow{AQ} = \overrightarrow{AO} + \overrightarrow{OQ}$$
$$AQ = -a + \tfrac{3}{5}b$$
$$AQ = \tfrac{3}{5}b - a$$

b) Given that $\overrightarrow{AR} = t\overrightarrow{AQ}$ express the following in terms of a and b.

   (i) $\overrightarrow{AR}$ (1 mark)

$$AR = t\,AQ$$
$$AR = t\left(\tfrac{3}{5}b - a\right)$$
$$AR = \tfrac{3}{5}bt - ta$$

   (ii) $\overrightarrow{OR}$ (1 mark)

$$OR = OA + AR$$
$$OR = a + \tfrac{3}{5}bt - ta$$
$$OR = a(1 - t) + \tfrac{3}{5}bt$$

c) Given that $\overrightarrow{OR} = S\overrightarrow{OP}$ express $\overrightarrow{OR}$ in terms of s, a and b. (1 mark)

$$OR = SoP$$
$$OR = s\left(\tfrac{1}{2}b + \tfrac{1}{2}a\right)$$
$$OR = \tfrac{1}{2}bs + \tfrac{1}{2}as$$

d) Using the expressions for b (ii) above find the values of s and t, hence find the ratio AR:AQ. (5 marks)

$$\tfrac{1}{2}bs + \tfrac{1}{2}as = a(1 - t) + \tfrac{3}{5}bt$$

$$\tfrac{1}{2}s = 1 - t$$
$$\tfrac{1}{2}s = \tfrac{3}{5}t$$

$$s = 2 - 2t$$
$$\tfrac{1}{2}(2 - 2t) = \tfrac{3}{5}t$$
$$1 - t = \tfrac{3}{5}t$$
$$1 = \tfrac{3}{5}t + t$$
$$1 = \tfrac{3t + 5t}{5}$$

$$1 = \tfrac{8}{5}t$$
$$t = \tfrac{5}{8}$$

$$s = 2 - 2\left(\tfrac{5}{8}\right)$$
$$s = 2 - \tfrac{5}{4} \qquad \tfrac{8 - 5}{4}$$
$$s = \tfrac{3}{4}$$
$$t = \tfrac{5}{8}$$

$$AR : AQ$$
$$5 : 3$$

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19. The vertices of a triangles ABC are A(6, 1) B(6, 3) and C(10, 1). The image of this triangle under a certain rotation is A1B1C1 and has vertices A1(2, 5) B1(0,5) C1(2, 9).

   a) On the grid provided plot triangle ABC and $A^1B^1C^1$. (2 marks)
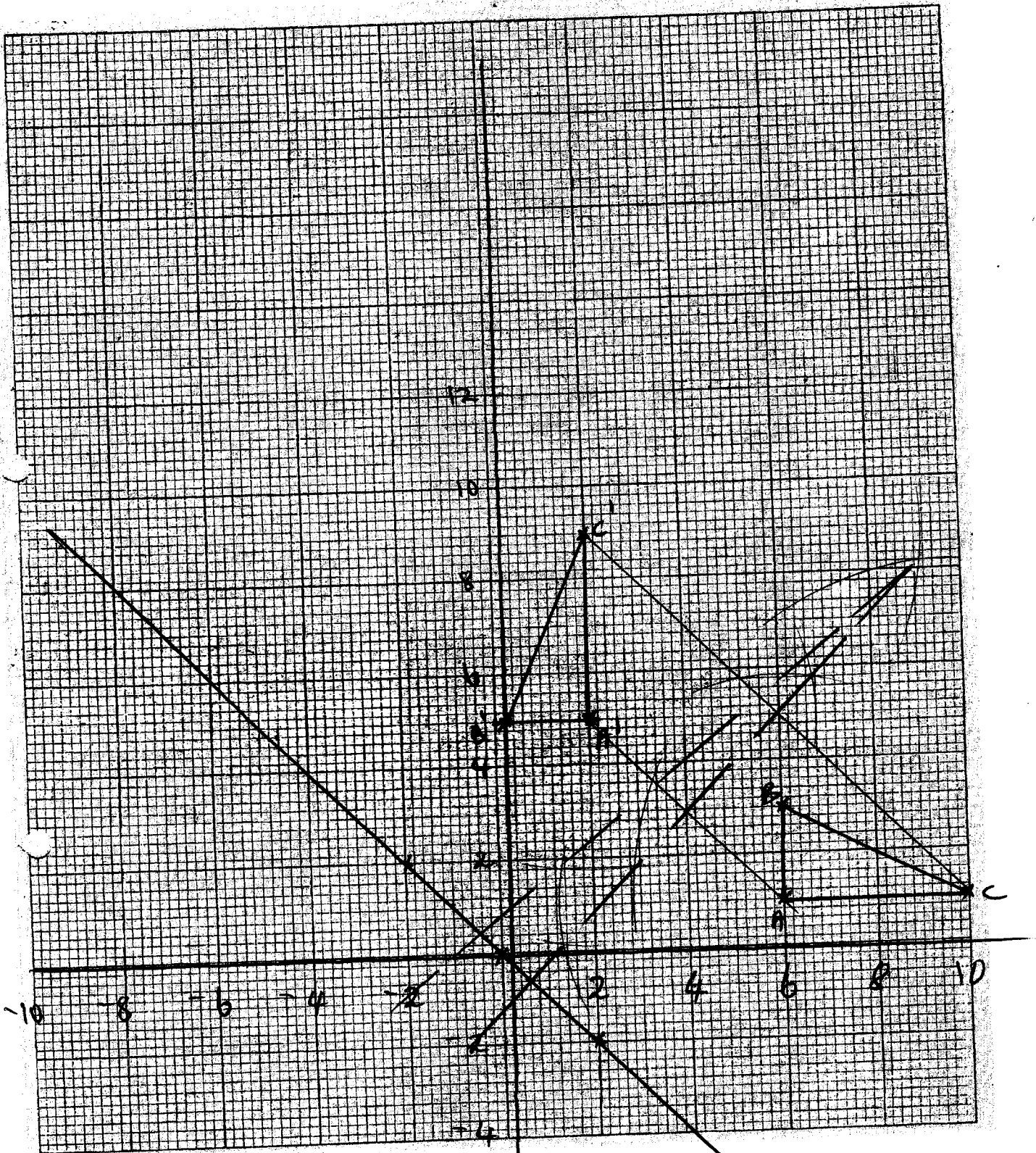
   b) Find (i) the centre of rotation (3 marks)

      (iii)   Angel of rotation. (2 marks)

   c)   Determine the vertices of triangle $A_2B_2C_2$ the image of triangle $A_1B_1C_1$ under reflection in the mirror line y= -x (3 marks)

$$y = -x$$

x	-2	-1	0	1	2
y	2	1	0	-1	-2

20. The diagram below shows a bucket with top diameter 30cm and bottom 20cm. the height of the bucket is 28cm.
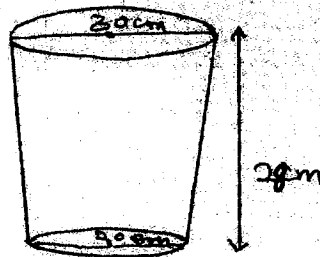

$$\frac{30}{20} = \frac{28+h}{h}$$

$30h = 560 + 20h$

$10h = 560$

$h = 56cm$

$$\frac{1}{3} \times \frac{22}{7} \times 15 \times 15 \times 84$$

$$19,800 cm^3$$

a) Find the capacity of the bucket in litres to one decimal place. (5 marks)

$$\frac{1}{3} \times \frac{22}{7} \times 10 \times 10 \times 56$$

$$\frac{2200 \times 8}{3}$$

$5866.7 cm^3$

$19800 - 5866.7$

$= 13,933.3 cm^3$

$$\frac{13,933.3}{1000}$$

$$= 13.9 L$$

b) Find the area of the metal sheet required to make 100 such buckets, taking 10% extra for overlapping and wastage. (5 marks)

$L = \sqrt{84^2 + 15^2}$

$\sqrt{7056 + 225}$

$85.33 CM$

$L_1 \sqrt{56^2 + 10^2}$

$\sqrt{3136 + 100}$

$L_1 = 56.89 cm$

$\left(\frac{22}{7} \times 85.33 \times 15\right) - \left(\frac{22}{7} \times 56.89 \times 10\right)$

$4022.7 cm^2 - 1788 cm^2$

$2,234 cm^2$

bottom $\frac{22}{7} \times 10 \times 10$

$\frac{2200}{7} = 314.3$

$\begin{array}{r} 2234 \\ + \quad 314.3 \\ \hline 2549 cm^2 \end{array}$

$2549 \times 100 \times \frac{110}{100}$

$280,390 cm^2$

10

21. (a) Using a ruler and a pair of compasses only. Construct a parallelogram PQRS, where PQ = 10cm QR = 7cm and PQR = 120φ. Bisect PQR and SPQ so that the angle bisectors meet at x.
(6 marks)
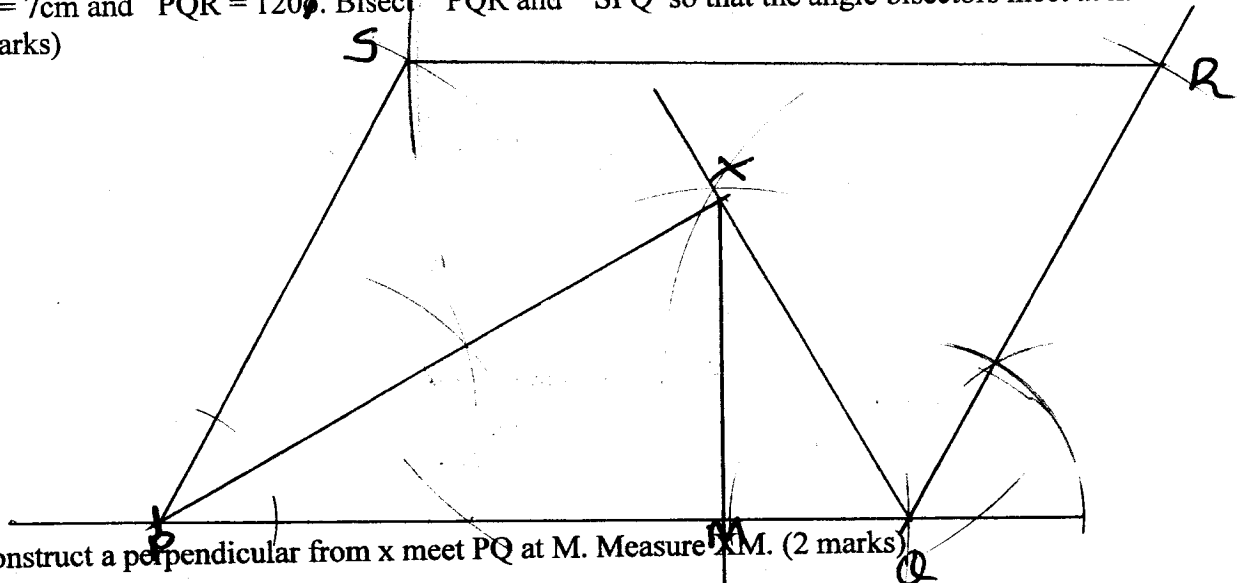
(b) Construct a perpendicular from x meet PQ at M. Measure XM. (2 marks)

$$XM = 4.2$$

© Calculate the area of triangle PXQ. (2 marks)

$$\frac{1}{2} \times 4.2 \times 10^5$$

$$21 \, CM^2$$

22. Three traders John, Fatima and Rukia decided to buy a minibus. Marked price of the bus was sh2,800,000. They could pay a deposit of 60% of the money and the rest to be paid in within one year. John, Fatima and Rukia raised the deposit in the ratio 3:2:5 respectively. The balance was to be paid to the dealer from the proceeds of the bus in the same ratio as deposits. During the year the bus in the same ratio as deposits. During the year the bus realized sh 2,080,000.

a) How much deposit did each contribute? (4 marks)

$$2,800,000 \times \frac{60}{100}$$

$$Sh \ 1,680,000$$

$$J = \frac{3}{10} \times 1680,000$$

$$J = 504,000$$

$$F = \frac{2}{10} \times 1680000$$

$$336,000$$

$$R \Rightarrow \frac{5}{10} \times 1680,000$$

$$840,000$$

11

$$28\,00,000$$
$$-\,1680000$$
$$sh\ 1,120,000$$

b) How much of the remaining amount did Rukia pay at the end of the year? (2 marks)

$$\frac{5}{10} \times 1,120\,000\cancel{0}$$

$$sh\ 560,000$$

c) After paying the remaining amount at the end of the year, how much money was John left with. (4 marks)

$$\frac{3}{10} \times 112000\cancel{0}$$
$$= 336,000 \cancel{f}$$

$$\frac{3}{10} \times 2,080,00\cancel{0}$$
$$= 624,000$$

$$624\,000$$
$$-\,336,000$$
$$sh\ 288,000$$

23. The acceleration of a moving object is given as a = 6 - 2t m/s². The velocity at the starting point is 8m/s.
Determine.

a) It's velocity in terms of t. (2 marks)

$$a = 6 - 2t$$
$$v = 6t - t^2 + c$$
$$when\ t = 0 \quad v = 8$$

$$v = 6t - t^2 + 8$$

b) The distance covered after 3 seconds. (2 marks)

$$s = \int (6t - t^2 + 8)\,dt$$
$$s = 3t^2 - \frac{1}{3}t^3 + 8t + c$$
$$when\ t = 0$$
$$s = 0$$

$$s = 3t^2 - \frac{1}{3}t^3 + 8t$$
$$t = 3$$
$$s = 3 \times 9 - \frac{1}{3} \times (3)^3 + 8 \times 3$$
$$s = 27 - 9 + 24$$

$$s = 51 - 9$$
$$s = 42\,M$$

c) The distance covered during 3rd second. (3 marks)

$$s = 3t^2 - \frac{1}{3}t^3 + 8t$$
$$3 \times 9 - 9 + 24$$
$$s = 42cm$$
$$3 \times 4 - \frac{8}{3} + 16$$

$$12 + 16 - \frac{8}{3}$$
$$28 - \frac{8}{3}$$
$$\frac{72 - 8}{3} = \frac{64}{3}$$
$$21.33.$$

$$\begin{array}{r}42.0\\-21.33\\\hline 20.67\end{array}$$
$$\frac{84 - 8}{3}$$
$$\frac{76}{3} = 25.33.$$
$$42.0$$
$$25.33$$
$$\overline{16.67\,M}$$

d) Maximum velocity of the object. (3 marks)

12

24. a) Show by shading the unwanted region the area represented by

$$4y < x + 11, \quad x > 1, x + y < 9, 5y > 3x - 3$$

b) Calculate, the enclosed area.

$4y - x = 11$

x	-1	0	1	2	3
y	2.5	2.75	3		4

$x = 1$

$x + y = 9$

x	-1	0	1	2	3
y	10	9	8	7	6

$5y - 3x = -3$

$5y = -3 + 3x$

$y = \dfrac{3}{5}x - \dfrac{3}{5}$

x	1	6
y	0	3

13

$$\tfrac{1}{2} \times 3 \times 5 +$$

$$\tfrac{1}{2} \times 5 \times 1$$

$$\frac{15}{2} + \frac{5}{2} = \frac{20}{2}$$

(Area $=10$ units)

14