NAME .... ADM NUMBER ....

SIGNATURE ....

DATE ....

121/1
MATHEMATICS
PAPER 1
OCTOBER/NOVEMBER 2015
TIME: 2½ HRS

KANDARA SUB-COUNTY SECONDARY SCHOOLS FORM 3 2015 JOINT EXAMINATION
KENYA CERTIFICATE OF SECONDARY EDUCATION (K.C.S.E)

MATHEMATICS
Paper 1
October/November 2015
Time: 2½ hours

INSTRUCTIONS TO CANDIDATES

a) Write your name and Admission number in the spaces provided above.
b) Sign and write date of examination in the spaces provided above..
c) This paper consists of **two** sections: Section **I** and section **II**
d) Answer **all** the questions in Section **I** and only **five** questions from Section **II**.
e) All answers and workings must be written on the question paper in the spaces provided below each question.
f) Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question.
g) Marks may be given for correct working even if the answer is wrong.
h) Non programmable silent electronic calculators and K.N.E.C Mathematical tables may be used, except where stated otherwise.
i) This paper consists of **16** printed pages.
j) Candidates should check the question paper to ascertain that the pages are printed as indicated and that no questions are missing.

FOR EXAMINER'S USE ONLY

SECTION I

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

SECTION II

QUESTION	17	18	19	20	21	22	23	24	TOTAL
MARKS									

GRAND TOTAL

1. A woman travelled on a journey by walking, by bus and by matatu. She travelled by bus for $^4/_5$ of the distance, then by matatu for $^2/_3$ of the rest of the distance then walked the remaining distance. The distance travelled by bus was 55km more than the distance walked. Find the total distance. (4 marks)

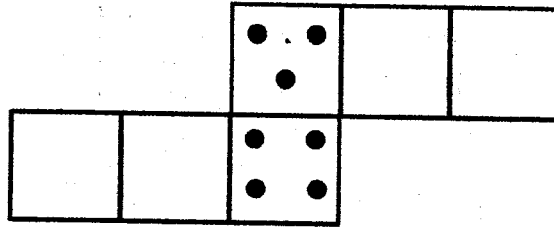2. Use the prime factors of 2800 and 2744000 to evaluate. (3 marks)

$$\frac{\sqrt[3]{2744000}}{2800}$$

3. Solve the inequalities, $4x - 3 \leq 6x - 1 < 3x + 10$ and state all the integral values that satisfy the inequalities. (3 marks)

4. The figure below is a net of a cube with some dots on two faces.

Given that the number of dots on pairs of opposite faces add up to 6, fill in the appropriate dots in each of the empty faces.

(2marks)

5. Peter paid sh 180 for a shirt after getting a discount of 10%. The shopkeeper made a profit of 20% on the sale of this shirt. What percentage profit would the shopkeeper have made if no discount was allowed?

(3 marks)

6. Simplify $\dfrac{23^{\frac{1}{3}} \div 9^{\frac{-1}{3}}}{\left(\frac{3}{4}\right)^{-1}}$

(3 marks)

7. Elimu Bookshop received US $ 150,000. The money was converted into Kenya shillings in a bank which buys and sells foreign currency as follows.

	Buying in Ksh	Selling in Ksh
1 US $	87.55	88.75
1 Sterling Pound	149.75	150.25

a) Calculate the amount in Kshs Elimu bookshop received. (2 marks)

b) The business lady converted the money into Sterling pounds to pay fees for her daughter in London. Calculate the amount of fees paid to the nearest pound. (2 marks)

8. Factorise and simplify completely. (3 marks)

$$\frac{2my + x\overset{y}{y} - y^2 - 2\overset{x}{m}x}{y^2 - 4m^2}$$

$$\frac{+xy - 2mx + 2my - y^2}{(y-2m)(y+2m)}$$

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

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

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

$$\frac{y-x}{y-2m}$$

9. A regular polygon has internal angle of 150° and a side of length 10cm.
    a) Find the number of sides of the polygon.   (2 marks)

    b) Find the perimeter of the polygon.   (1 mark)

10. A circle of radius 4.9cm fits exactly inside a square. Find the area of the space between the circle and square to 2 decimal places.   (3 marks)

11. The image of a point Q(1, 2) after a translation is Q^1(-1, 3). What is the co-ordinate of the point R whose image is R^1(-3, -3) after undergoing the same translation.   (3 marks)

12. Given that Sin A = $^4/_5$, Cos B = $^5/_{13}$ A and B are acute angles, without using tables calculate

Sin B Cos A + Sin A tan B

(3 marks)

13. 30 men working for eight hours a day can complete picking tea in ten days. Determine how long it would take twenty men working twelve hours a day to complete the same task. (3 marks)

14. Use logarithm tables to evaluate to 4 significant figures. (4 marks)

$$\frac{0.5241^2 \times 83.59}{\sqrt[3]{0.3563}}$$

15. A positive two digit number is such that the product of the digit is 20. When the digits are reversed, the number so formed is greater than the original number by 9; Find the number.   (3 marks)

16. A small cone of height 8cm is cut off from a bigger cone to leave a frustum of height 16cm. If the volume of the smaller cone is 160cm^3, find the volume of the frustum.   (3 marks)

17. Koech and Otieno contributed sh 600,000 and sh $\dot{X}$ respectively to start a business. They employed a manager and agreed to pay him a salary of sh 45000 a month from profits made each year. They also agreed that 20% of the remaining, profits made each year would be put back into the business. The remaining profits would be shared between partners in the ratio of their contribution. During the first year the business made a gross profit of sh 3,650,000.
If the ratio of Koech's to Otieno's contribution was 2:3, determine ;

a) How much Koech contributed. (3 marks)

b) The amount of money put back into the business. (3 marks)

c) How much each partner received at the end of the year. (4 marks)

18. The table below shows the ages in years of 60 people who attended a workshop.

Age in years	30-39	40 - 49	50 - 59	60 - 69	70 - 79
No. of people	10	12	18	17	3

a) State the modal frequency. (1 mark)

b) Calculate the mean age. (5 marks)

c) Calculate the median age. (4 marks)

19. a) Find the equation of a straight line passing through the points (3, 2) and (3, 6) giving your answer in the form $\dfrac{x}{a} + \dfrac{y}{b} = 1$ where a and b are constant.

(4 marks)

b) State the co-ordinates of point A and B, at which the line in (a) above crosses the x-axis and y-axis respectively.

(2 marks)

c) Using the information in (a) and (b) above, find the area of triangle AOB, where O is the origin.

(2 marks)

d) Find the acute angle the line in (a) above makes with the x-axis.

(2 marks)

20. In the figure below OA = a, OB = b. K and N are mid-points of OB and AB respectively. Point C divides OA in the ratio 2:5, while D divides AB in the ratio 2:3.
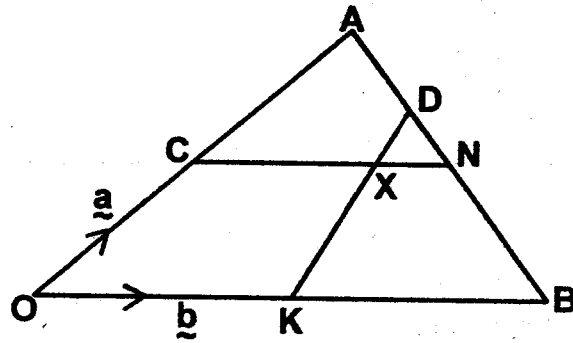
a) Express in terms **a** and **b**.

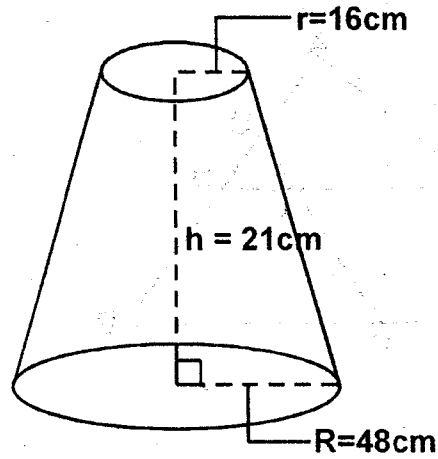   i) CN   (2 marks)

   ii) KD   (2 marks)

b) If OX = OC + pCN and also OX = OK + qKD where p and q are scalars, find the value of p and q.

                                                            (5 marks)

c) Deduce the ratio in which x divides KD.   (1 mark)

21. The figure below represents a frustum of a solid cone of base radius 48cm and top radius 16cm. The height of the frustum is 21cm. (Take $\pi = \frac{22}{7}$)

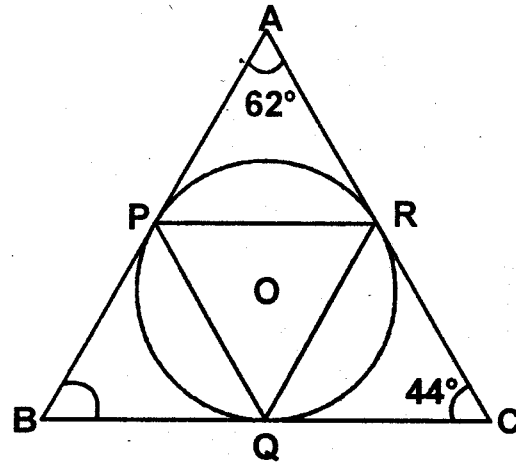Calculate;

a) The height of the solid cone.   (2 marks)

b) The volume of the solid frustum.   (3 marks)

c) The total surface area of frustum.   (5 marks)

22. In the figure below, the circle centre O is the circumference of triangle PQR and also the inscribed circle of triangle ABC.

Given that angle BAC = 62° and angle ACB = 44°, calculate;

a) ∠PQR   (2 marks)

b) ∠QPR   (2 marks)

c) ∠POQ   (2 marks)

d) If BC = 10cm, calculate the radius of the circle.   (4 marks)

23. The boundaries PQ, QR and SP of a ranch are straight lines such that; Q is 16km on a bearing of 040° from P. R is directly South of Q and East of P and S is 12km on a bearing of 120° from R.

a) Using a scale of 1cm to represent 2km, show the above information in a scale drawing. (3 marks)

b) From the scale drawing determine;

i) the distance in kilometres of P from S. (2 marks)

ii) the bearing of P from S. (2 marks)

c) Calculate the area of the ranch PQRS in square kilometres. (3 marks)

24. The table below shows values for the function $y = 5 + 8x - 2x^2$ for $-2 \leq x \leq 6$.
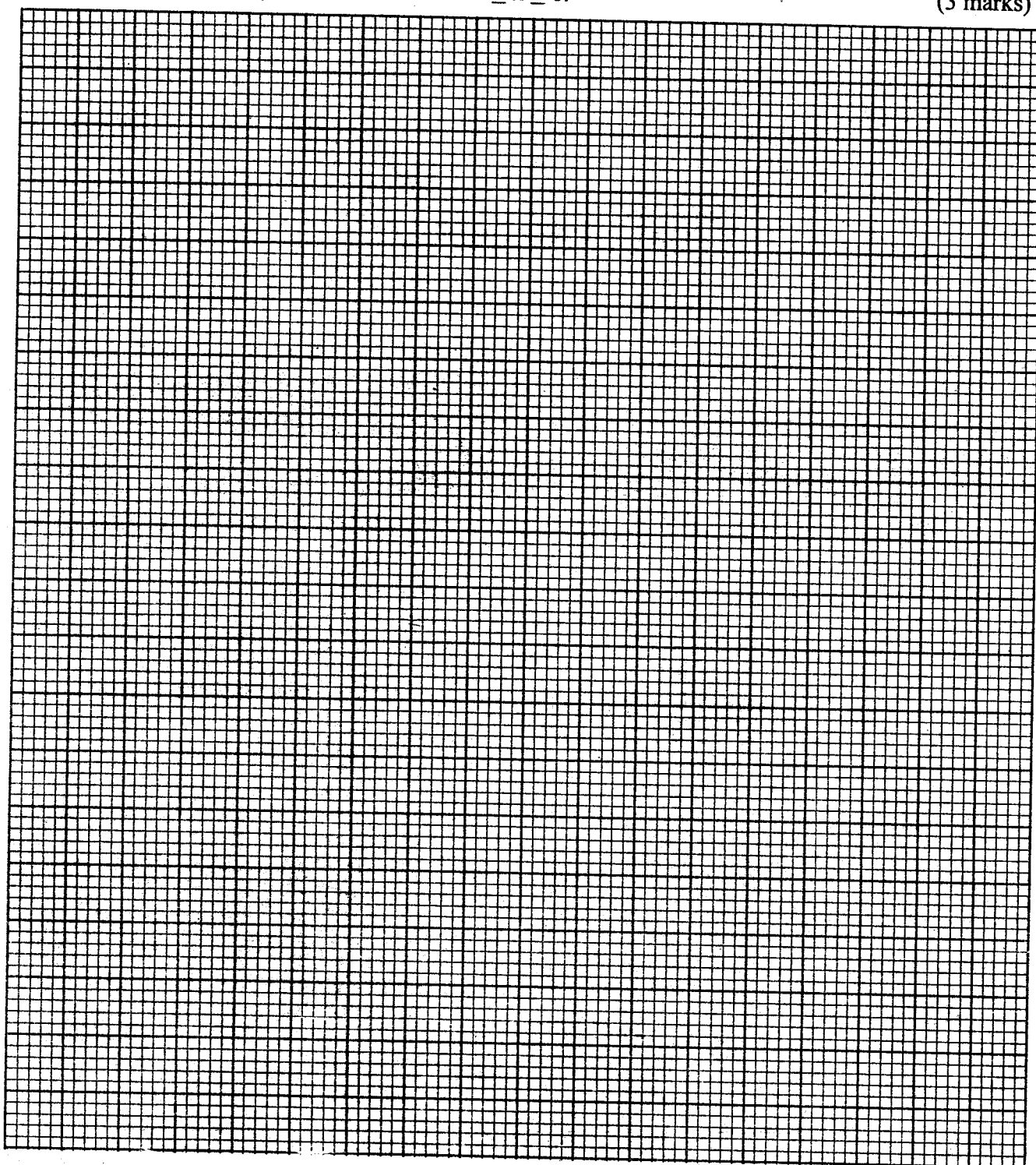
x	-2	-1	0	1	2	3	4	5	6
8x + 5									
-2x²									
y									

Complete the table above.

(2 marks)

b) Draw the graph of $y = 5 + 8x - 2x^2$ for $-2 \leq x \leq 6$.

(3 marks)

c) Use the graph to solve the equation;
   i) $5 + 8x - 2x^2 = 0$ (1 mark)

   ii) $-2x^2 + 5x + 3 = 0$ (3 marks)

d) State the equation of the line of symmetry of the curve $y = 5 + 8x - 2x^2$ (1 mark)
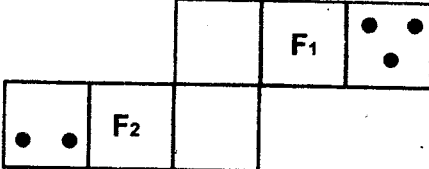
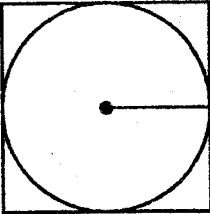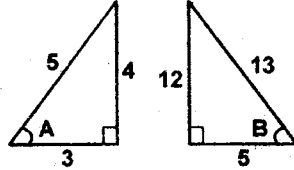# KANDARA SUB-COUNTY SECONDARY SCHOOLS FORM 3
2015 JOINT EXAMINATION
KENYA CERTIFICATE OF SECONDARY EDUCATION (K.C.S.E)

MATHEMATICS (121/1)
Oct/Nov 2015
MARKING SCHEME

1.	distance by matatu = $\frac{2}{3} \times \frac{1}{5} = \frac{2}{15}$ distance by walking = $1 - (\frac{4}{5} + \frac{2}{15}) = \frac{1}{15}$ Let the total distance = xkm $\frac{4}{15}x - \frac{2}{15}x = 55$ x = 82.5km	B1 B1 M1 A1	Bus = $\frac{4}{5}$, matatu = $\frac{2}{15}$ $\frac{10}{15}x = 55$ x= 82.5km
		4	
2.	$2800 = 2^4 \times 5^2 \times 7$ $2744000 = 2^6 \times 7^3 \times 5^3$ $\dfrac{\sqrt[3]{2744000}}{2800} = \dfrac{(2^6 \times 7^3 \times 5^3)^{\frac{1}{3}}}{2^4 \times 5^2 \times 7}$ $= \frac{1}{20} = 0.05$	B1 M1 A1	prime factors of 2800 and 2744000
		3	
3.	$4x - 3 \leq 6x - 1$ $-1 \leq x$ $6x - 1 < 3x + 10$ $x < 3\frac{2}{3}$ Integral values (3, 2, 1, 0, -1)	B1 B1 B1	$x \geq -1$ $3\frac{2}{3} > x$ $(3\frac{2}{3} > x \geq -1)$ (All the values)
		3	
4.		B1 B1	✓ pair ✓pair (1 & 5, 2&4, 3&3) (F1 + F2= 6 dots)
		2	
5.	Selling price = $\frac{180 \times 100}{90}$ = sh 200 Buying price = $\frac{180 \times 100}{120}$ = sh 150 Profit = 200 - 150 = sh 50 % profit = $\frac{50}{150} \times 100$ = 33.33%	B1 M1 A1	(for sh 200 and sh 150) ($33\frac{1}{3}$%)
		3	

6.

$$\frac{\left(2^3 \times 3\right)^{\frac{1}{3}} \div 3^{\frac{-2}{3}}}{\left(\frac{3}{2^2}\right)}$$

| | M1 | (prime factors) |

$$2 \times 3^{\frac{1}{3}} \times 3^{\frac{2}{3}} \times \frac{3}{2^2}$$

| | M1 | simplification |

$$\frac{2 \times 3 \times 3}{22} = 4\frac{1}{2} = 4.5$$

| | A1 | $^9/_2$ (A0) |
| | **3** | |

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7. a) .... received
  $= 150,000 \times 87.55$
  $= sh\ 1312500$
b) Fees paid $= \dfrac{1312500}{150.25}$
  $= £87404$

| M1 |
| A1 |
| M1 |
| A1 |
| **4** |

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8. $2my + xy - y^2 - 2mx$
  $(2m - y)(y - x)$
  $y^2 - 4m^2 = (y + 2m)(y - 2m)$
  $\dfrac{-(y - 2m)(y - x)}{(y + 2m)(y - 2m)} = \dfrac{x - y}{y + 2m}$

M1	factorisation of numerator
M1	denominator
A1	
3	

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9. $n = \dfrac{360}{30} = 12$ sides
  $P = 12 \times 10 = 120cm$

| M1A1 |
| B1 |
| **3** |

10.

  $9.8 \times 9.8 - ^{22}/_7 \times 4.9^2$
  $96.01 - 75.46$
  $A = 20.58cm^2$

| M1M1 |
| A1 |
| **3** |

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11. $T = \begin{pmatrix} -1 \\ 3 \end{pmatrix} - \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} -2 \\ 1 \end{pmatrix}$

  $R = \begin{pmatrix} -3 \\ -3 \end{pmatrix} - \begin{pmatrix} -2 \\ 1 \end{pmatrix} = \begin{pmatrix} -1 \\ 4 \end{pmatrix}$

  $R(-1, -4)$

| M1 |
| M1 |
| A1 |
| **3** |

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12. Sin B Cos A + Sin A tan B
  $(^{12}/_{13} \times ^3/_5) + (^4/_5 \times ^{12}/_5)$
  $= \dfrac{804}{325} = 2^{154}/_{325}$

| M1M1 |
| A1 |
| **3** |

13. Number of days =
$$\frac{8}{12} \times 110 \times \frac{30}{20}$$
= 10 days

M1	$(\frac{8}{10} \times 10)$ or $(10 \times \frac{30}{20})$
M1	seen
A1	
3	

14.

No	Log		
0.5241^2	$\overline{1}.7194 \times 2 = \overline{1}.4388$	M1	All logs ✓
83.59	1.9222		
	1.3610	M1	(addition and subtraction)
$\sqrt[3]{0.3563}$	$\overline{1}.5518 \div 3 = \overline{1}.8506$	M1	$\overline{1}.5518 = \underline{3+2.5518}$
$3.239 \times 10^1 3$ ←	1.5104	A1	
(32.39)		**4**	

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15. xy - Reversed yx = 10y + x
(10y + x) - (10x + y) = 9
    9y - 9x = 1   y - x = 1
x(x + 1) = 20
$x^2 + x - 20 = 0$
(x - 4) (x+5) = 0
x = 4 or -5 No = 45

M1	for xy = 20 and y-x=1
M1	factorisation
A1	
3	

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16. L.S.F = 8:24 = 1:3
V.S.F = 1:27
Volume of frustum
    V = 160 x 27 - 160
        = 4160cm³

B1	(V.S.F)
M1	Subtraction of two volumes
A1	
3	

SECTION II

17. a) 600,000 : x = 2:3
   x = $\frac{3}{2}$ x 600,000
   x = sh 900,000/-

b) Total salary = 45000 x 12
         = sh 540,000
Business = $\frac{20}{100}$ (3,650,000 - 540,000)
       = sh 622,000

c) Remaining profit
   = 3650000 - (622000 + 540,000)
   = 2,488,000
Koech = $\frac{2}{5}$ x 294,000
     = sh 995,200
Otieno = $\frac{3}{5}$ x 2,488,000
     = sh 1,492,800

M1
M1
A1
M1
M1
A1
M1
A1
B1
B1
10

20. a) i) $CN = \frac{5}{7}\mathbf{a} + \frac{1}{2}AB$

$\qquad = \frac{5}{7}\mathbf{a} + \frac{1}{2}(\mathbf{b} - \mathbf{a})$

$\qquad CN = \frac{3}{14}\mathbf{a} + \frac{1}{2}\mathbf{b}$ | M1

A1

ii) $KD = \mathbf{KB} + \mathbf{BD}$

$\qquad = \frac{1}{2}\mathbf{b} + \frac{3}{5}(BA)$

$\qquad = \frac{1}{2}\mathbf{b} + \frac{3}{5}(\mathbf{a} - \mathbf{b})$ | M1

$KD = \frac{3}{5}\mathbf{a} - \frac{b}{10}$ | A1

b) $OX = \frac{2}{7}\mathbf{a} + p\left(\frac{3}{14}\mathbf{a} + \frac{1}{2}\mathbf{b}\right)$ | M1 Vector OX

$\qquad OX = \left(\frac{2}{7} + \frac{3}{14}p\right)\mathbf{a} + \frac{p}{12}\mathbf{b}$

$\qquad OX = \frac{1}{2}\mathbf{b} + q\left(\frac{3}{5}\mathbf{a} - \frac{b}{10}\right)$ | M1 Vector OX

$\qquad OX = \left(\frac{1}{2} - \frac{q}{10}\right)\mathbf{b} + \frac{3q}{5}\mathbf{a}$

$\therefore \frac{1}{2} - \frac{q}{10} = \frac{p}{2}$

$\quad q + 5p = 5$ | M1 for two simultaneous eqns

$\quad \frac{2}{7} + \frac{3}{14}p = \frac{3q}{5}$

$\quad 42q - 15p = 20$ | M1 solving

$\quad \underline{3q + 15p = 15}$

$\quad 45q \quad = 35, \; q = \frac{7}{9}$ | A1 $(q = \frac{7}{9}, \; p = \frac{38}{45})$ both answers

$\qquad p = \frac{38}{45}$

c) $KX = \frac{7}{9}KD$

$\quad KX : XD = 7:2$ | B1

10

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21. a) $\frac{48}{16} = \frac{h + 21}{h}$ | M1

$\quad h = 10.5\text{cm}$ | A1

b) $V = \frac{1}{3} \times \frac{22}{7} \times 48^2 \times 31.5 - \frac{1}{3} \times \frac{22}{7} \times 16^2 \times 10.5$ | M1 for two volumes

$\quad V = 76032 - 2816$ | M1 subtraction

$\quad V = 73216\text{cm}^3$ | A1

c) $L = \sqrt{48^2 + 31.5^2} = 57.41$ | B1 for 57.41 and 19.14

$\quad L = \sqrt{16^2 + 10.5^2} = 19.14$

$S.A = \frac{22}{7} \times 48 \times 57.41 - \frac{22}{7} \times 16 \times 19.14$ | M1 two surface areas curved

$\quad = 8660.71 - 962.47$

$S.A = 7698.24\text{cm}^2$

Total S.Area

$\frac{22}{7} \times 48^2 + 16^2 + 7698.24$ | M1 surface area of upper and lower circles

Total S. A $= 15743.95\text{cm}^3$ | A1

10

22. a) ABC = 180 - (62 + 44) = 74°

$BQP = \dfrac{180 - 74}{2} = 53°$

$CQR = \dfrac{180 - 44}{2} = 68°$

∠PQR = 180 - (53 + 63) = 59°

b) $APR = \dfrac{180 - 62}{2} = 59°$

QPR = 180 - (53+ 59) = 68°

c) OBQ = $^{74}/_2$ = 37°

BOQ = 90 - 37 = 53°

POQ = 2 x 53 = 106°

d) $^r/_x$ = tan 37°, r = xtan37°

r = y tan 22° .... i)

x + y = 10 .... ii)

$x + \dfrac{x\tan 37°}{\tan 22°} = 10$

2.865x = 10

x = 3.49cm

r = 3.49 tan 39°

r = 2.63cm

B1	
B1	
B1	
B1	
B1	
B1	
B1	for two simultaneous eqns
M1	
A1	
B1	
10	

23. a) Given scale 1cm = 2km

b) i) Distance of P from S

= 10.8 ± 0.1cm

(21.6 ± 0.2)km

ii) ∠PSN = 74 ± 1°

Bearing of P from S = 286 ± 1°
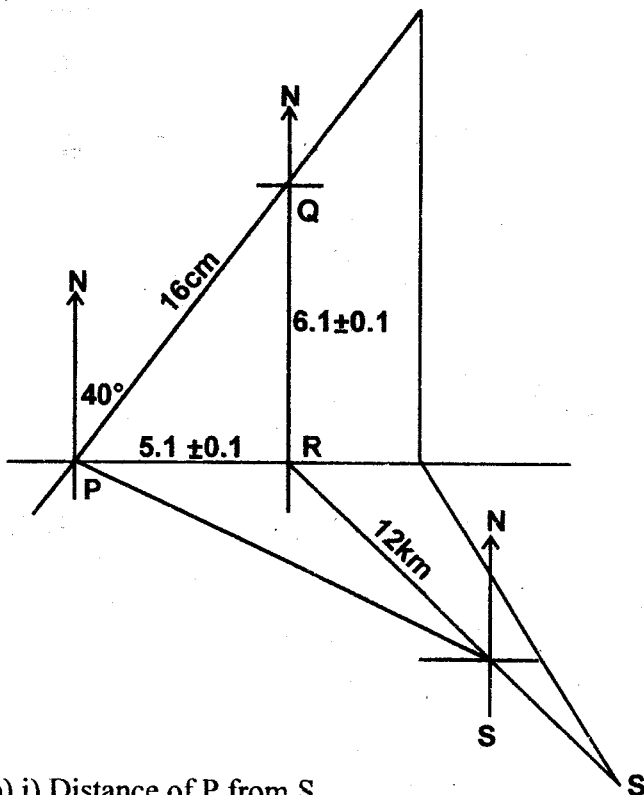
B1	for ✓ PQ(8 ± 0.1cm)
B1	for✓ QR (6.1 ± 0.1) am
B1	for ✓RS (6 ± 0.1)cm
B1	(10.7 - 10.9) cm
B1	(21.4 - 21.8)km
B1	
B1	

c) Area of $\triangle PQR = \frac{1}{2} \times 10.2 \times 12.2$

$\qquad = 62.22 \text{km}^2$

Area of $\triangle PRS = \frac{1}{2} \times 10.2 \times 12 \text{Sin } 150°$

$\qquad = 30.6 \text{km}^2$

Area of ranch PQRS $= 62.22 + 30.6$

$\qquad = 92.82 \text{km}^2$

		M1
		M1
		A1
		10

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24. $y = 5 + 8x - 2x^2$

x	-2	-1	0	1	2	3	4	5	6
8x + 5	-11	-3	5	13	21	29	37	45	53
$-2x^2$	-8	-2	0	-2	-8	-18	-32	-50	-72
y	-19	-5	5	11	13	11	5	-5	-19

B2 — for all values

B1 — ✓values for atleast 5 values
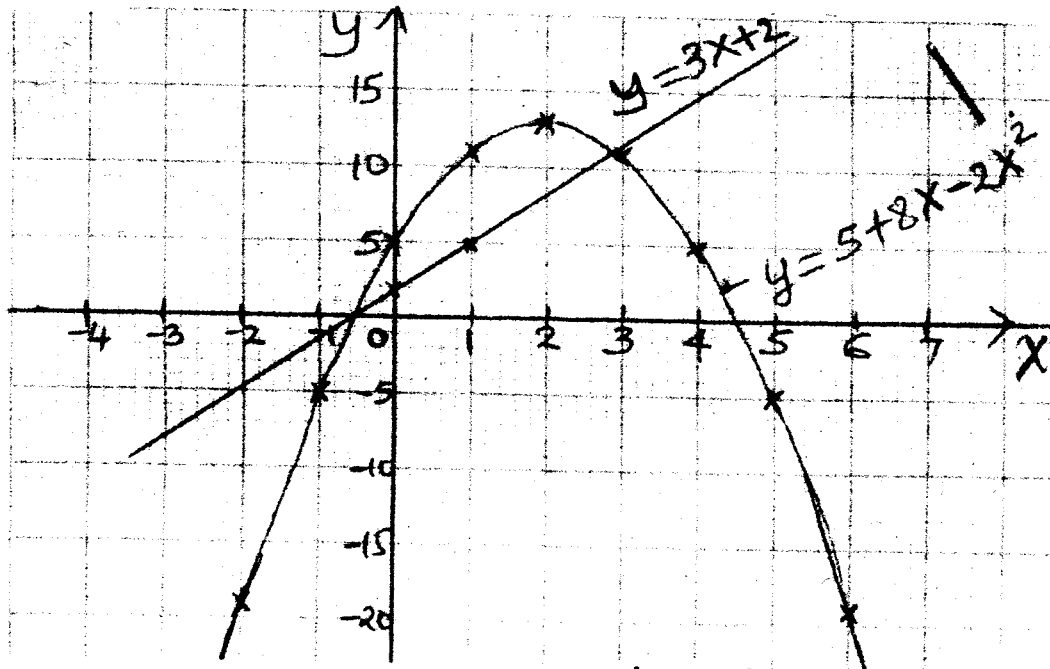
✓S1
✓P1
✓C1
✓L1

c) i) $x = -0.6 \pm 0.1$ and $x = 4.6 \pm 0.1$ ✓ — B1

ii) $y = 5 + 8x - 2x^2$

$\underline{0 = 3 + 5x - 2x^2}$

$y = 3x + 2$ ✓ — B1

x	0	1	-1
y	2	5	-1

$x = -0.6 + 0.1$ or 3.0 ± 0.1 ✓ — B1

d) Line of symmetry $x = 2$✓ — B1

10