

8.2 Mathematics Alt. A Paper 2 (121/2)

1.

No.	Log
83.46	1.9215
0.0054	$\begin{array}{r} + \\ \overline{3.7324} \\ 1.6539 \end{array}$
$1.56^2$	$\begin{array}{r} - \\ \underline{0.3862} \\ \overline{1.2677} \div 3 \end{array}$
<b>0.5700</b>	<b><math>\overline{1.7559}</math></b>

(4marks)

2. (a) cost of 1kg of mixture

$$= \frac{120 \times 3 + 90 \times 4 + 6 \times 5}{12}$$

$$= 85$$

b) Cost of 5kg of mixture

$$= \frac{108}{100} \times 85 \times 5$$

$$= 459$$

(4marks)

3.

$$w^3 = \frac{s+t}{s}$$

$$w^3 s = s + t$$

$$w^3 s - s = t$$

$$s = \frac{t}{w^3 - 1}$$

(3marks)

4. (a)

$$2x - 5 > -11 \Rightarrow 2x > -6 \Rightarrow x > -3$$

$$3 + 2x \leq 13 \Rightarrow 2x \leq 10 \Rightarrow x \leq 5$$

$$\therefore -3 < x \leq 5$$

(b) Integral values: -2, -1, 0, 1, 2,3,4,5.

(4marks)

5.  $\angle BAD = 30^\circ + 40^\circ = 70^\circ$   
 $\angle BCD = 180^\circ - 70^\circ = 110^\circ$

(2marks)

6. (a)

+	7	8	9	10	11
4	11	12	13	14	15
5	12	13	14	15	16
6	13	14	15	16	17
7	14	15	16	17	18
8	15	16	17	18	19

(b)  $P(\text{sum of at least 17}) = \frac{6}{25}$

(2marks)

7. (a)  $T = \begin{pmatrix} 6 \\ -2 \end{pmatrix} - \begin{pmatrix} 4 \\ 1 \end{pmatrix} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$

(b)

$$OA' = \begin{pmatrix} 1 \\ 2 \end{pmatrix} + \begin{pmatrix} 2 \\ -3 \end{pmatrix} = \begin{pmatrix} 3 \\ -1 \end{pmatrix}$$

$$A' = (3, -1)$$

$$OB' = \begin{pmatrix} 3 \\ 5 \end{pmatrix} + \begin{pmatrix} 2 \\ -3 \end{pmatrix} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$$

$$B'(5, 2)$$

(3marks)

8.

$$\sin 45^\circ = \frac{1}{\sqrt{2}}$$

$$\begin{aligned} \frac{\sqrt{8}}{1 + \sin 45} &= \frac{2\sqrt{2}\left(1 - \frac{1}{\sqrt{2}}\right)}{\left(1 + \frac{1}{\sqrt{2}}\right)\left(1 - \frac{1}{\sqrt{2}}\right)} \\ &= \frac{2\sqrt{2} - 2}{\frac{1}{2}} \\ &= 4(\sqrt{2} - 1) \end{aligned}$$

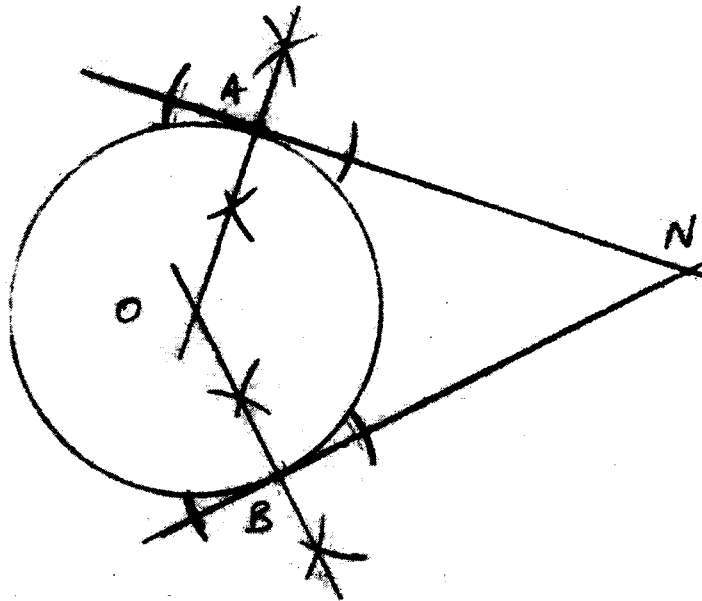
(3marks)

9. Maximum area =  $4\pi \times 7.5^2$   
 Minimum area =  $4\pi \times 6.5^2$   
 Absolute error =  $\frac{4\pi(7.5^2 - 6.5^2)}{2}$   
 $= 28\pi$

$$\begin{aligned} \% \text{ error} &= \frac{28\pi}{4\pi \times 7 \times 7} \times 100\% \\ &= 14.29\% \end{aligned}$$

(4marks)

10.



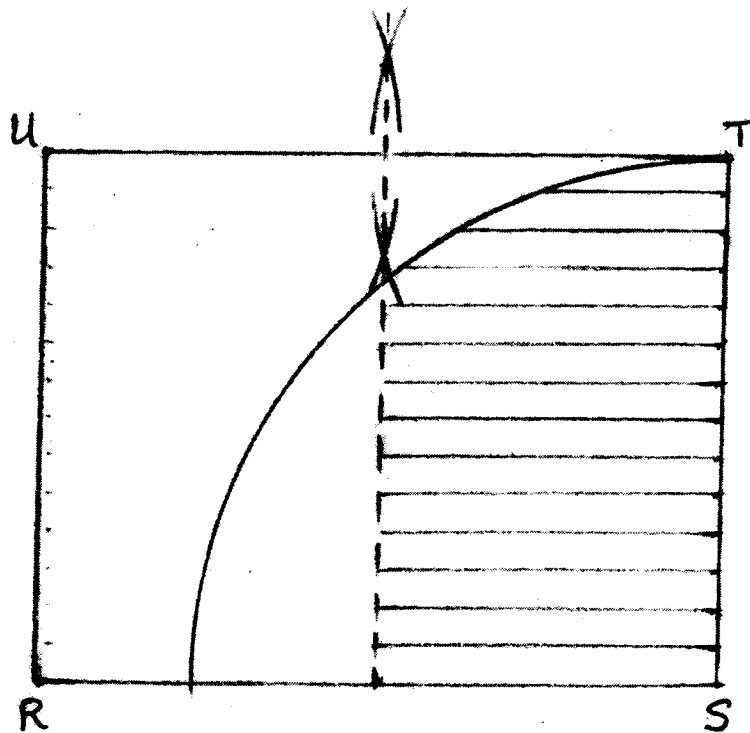
(3marks)

11.

$$\begin{aligned} \left(a + \frac{1}{2}\right)^4 + \left(a - \frac{1}{2}\right)^4 &= \left[ a^4 + 4a^3\left(\frac{1}{2}\right) + 6a^2\left(\frac{1}{2}\right)^2 + 4a\left(\frac{1}{2}\right)^3 + \left(\frac{1}{2}\right)^4 \right] - \\ &\quad \left[ a^4 + 4a^3\left(-\frac{1}{2}\right) + 6a^2\left(-\frac{1}{2}\right)^2 + 4a\left(-\frac{1}{2}\right)^3 + \left(-\frac{1}{2}\right)^4 \right] \\ &= 2a^4 + 3a^2 + \frac{1}{8} \end{aligned}$$

(3marks)

12.



(3marks)

13.  $PQ = -6i - j - 2i + 5j = -8i + 4j$   
 $PN = \frac{3}{4}(-8i + 4j) = -6i + 3j$

(3marks)

14. (a) let longitude difference be  $\theta^\circ$   
 $\theta \times 60 \cos 60^\circ = 630$   
 $\theta = \frac{630}{60 \cos 60^\circ}$   
 $= 21^\circ$   
 (b)  $21^\circ$  due east of  $18^\circ E$  is the longitude  $(18^\circ + 21^\circ) E$   
 Location of N is  $(60^\circ N, 39^\circ E)$

(3marks)

15.

$$x^2 + y^2 - 6x - 10y + 30 = 0$$

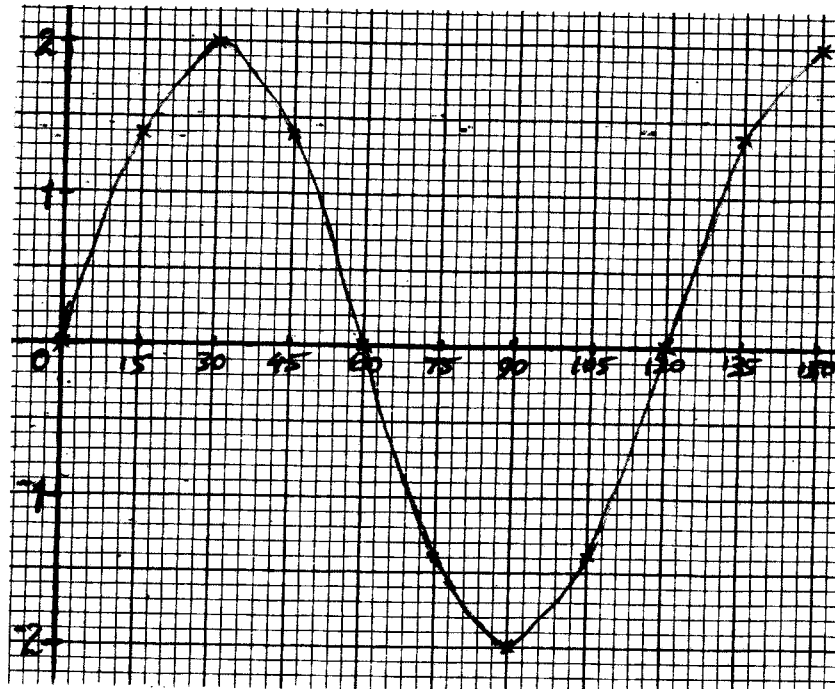
$$x^2 - 6x + 9 + y^2 - 10y + 25 = 4$$

$$(x-3)^2 + (y-5)^2 = 2^2$$

$$a=3, b=5$$

(3marks)

16.



Period =  $120^\circ$

(3marks)

17. (a) (i)  $7500 + 11 \times 6000 = 73500$

(ii)  $\frac{73500 - 60000}{60000} \times 100 = 22.5\%$

(b)  $60000 \times 25 \times 0.95 = 1425000$

(c) Institution X

$$73500 \times 25 = 1837500$$

Institution Y

$$60000 \times 25 \times (1.12)^2 = 1881600$$

$$\text{Difference} = 1881600 - 1837500 = 44100$$

(10marks)

18. (a) (i)  $64 + 4d = 64r$   
 $64 + 6d = 64r^2$

(ii) From (i)

$$d = 16r - 16$$

$$64r^2 = 64 + 6(16r - 16)$$

$$64r^2 = 64 + 96r - 96$$

$$2r^2 - 3r + 1 = 0$$

$$(2r - 1)(r - 1) = 0$$

$$r = \frac{1}{2} \text{ or } r = 1$$

For decreasing GP,  $r = \frac{1}{2}$

Substituting  $r = \frac{1}{2}$  in (i)

$$64 \times \frac{1}{2} = 64 + 4d$$

$$d = -8$$

(b) (i) A.P

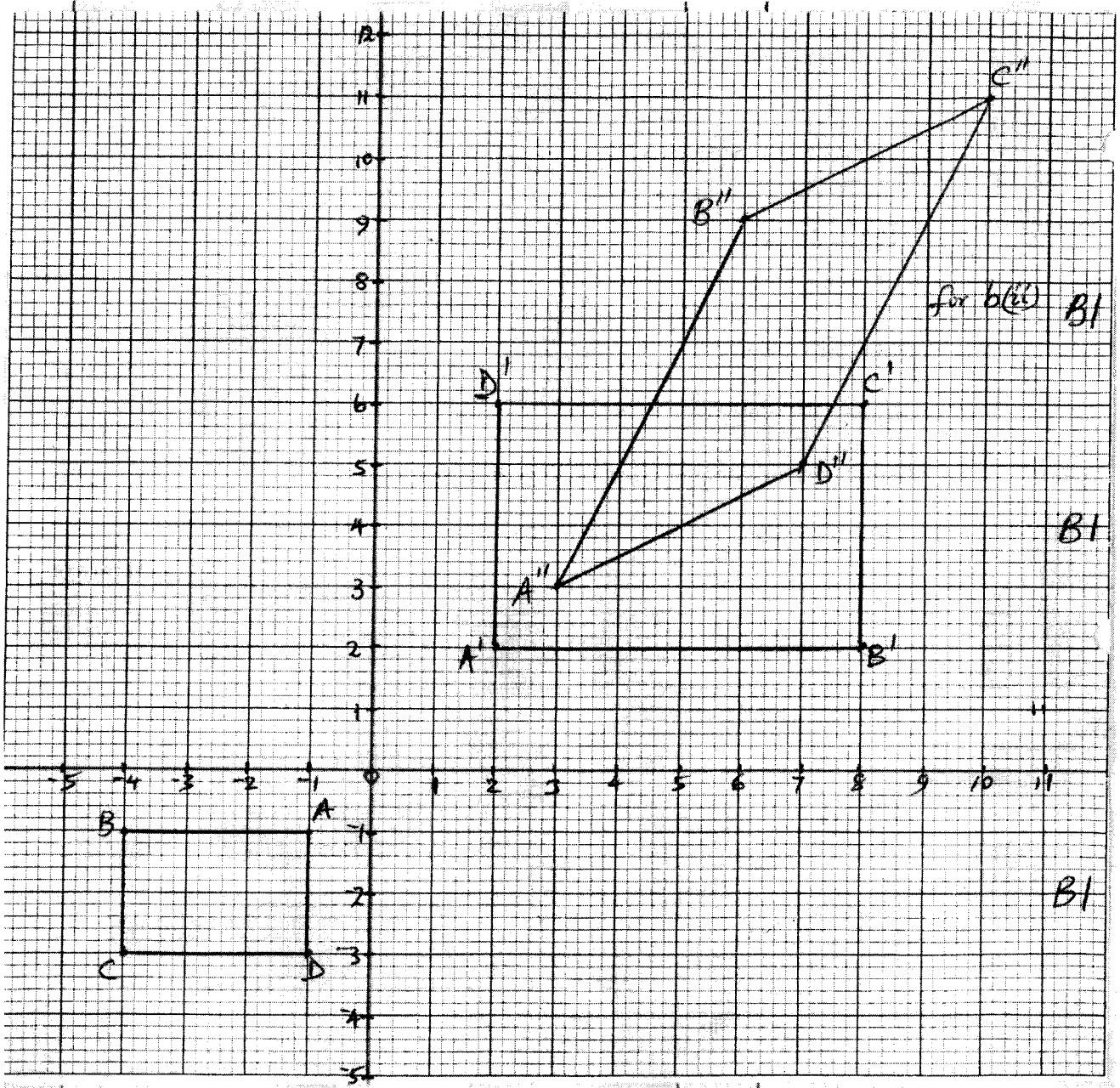
$$S_{10} = \frac{10}{2} \{ 2 \times 64 + 9 \times -8 \} = 280$$

(ii) G.P

$$S_{10} = \frac{64 \left( 1 - \frac{1}{2^{10}} \right)}{1 - \frac{1}{2}} = \frac{64 \left( \frac{1023}{1024} \right)}{\frac{1}{2}} = 127.875$$

(10marks)

19. (a)  $\begin{pmatrix} -2 & 0 \\ 0 & -2 \end{pmatrix} \begin{pmatrix} -1 & -4 & -4 & -1 \\ -4 & -1 & -3 & -3 \end{pmatrix} = \begin{pmatrix} 2 & 8 & 8 & 2 \\ 2 & 2 & 6 & 6 \end{pmatrix}$



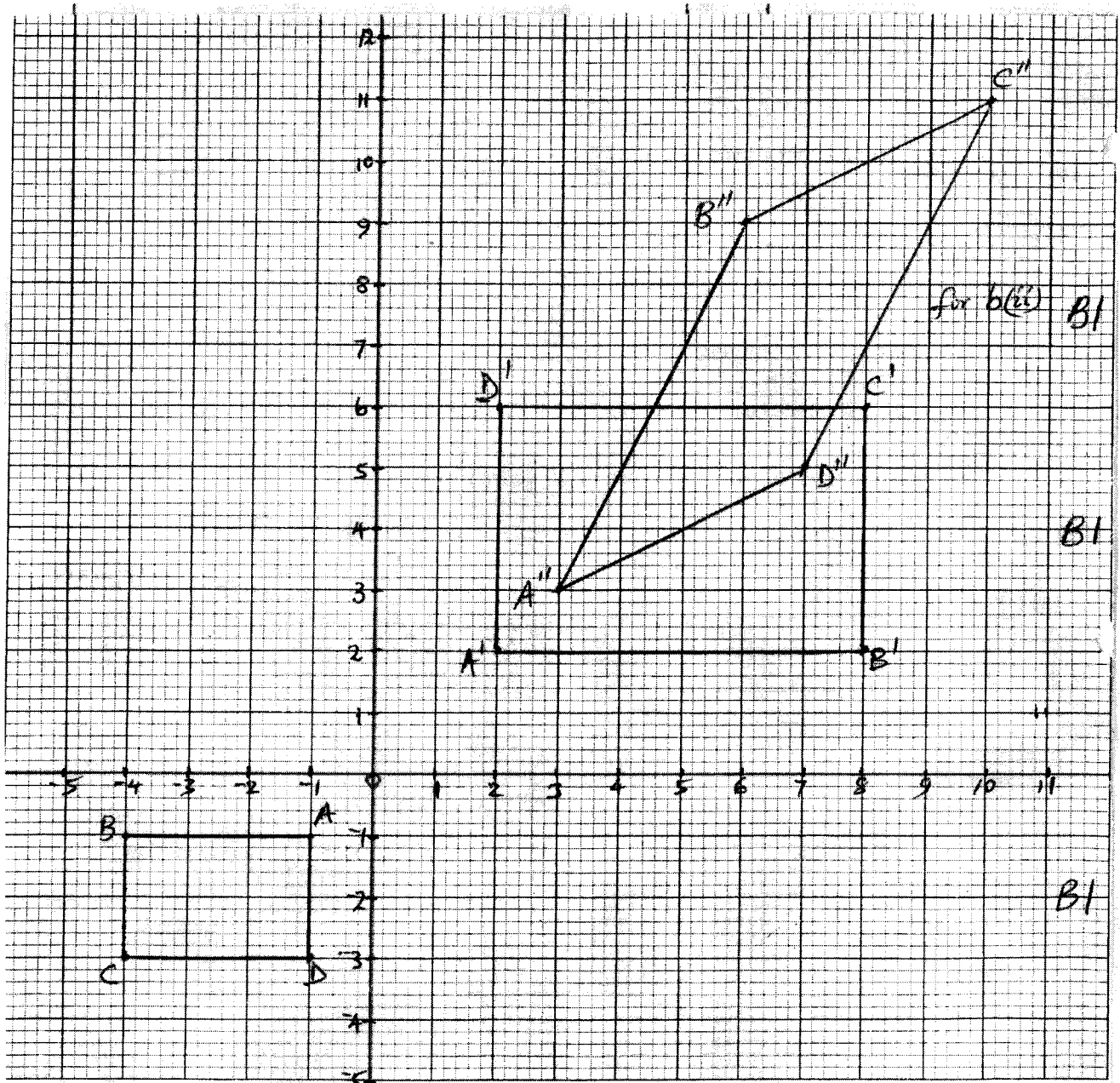
(b)

Coordinates;  $A''(3,3), B''(6,9), C''(10,11), D''(7,5)$

(c) Determinant of matrix  $P = \frac{1}{2} \times \frac{1}{2} - 1 \times 1$   
 $= -\frac{3}{4}$

Area of  $A''B''C''D'' = \frac{3}{4} \times 6 \times 4 = 18$  sq units

(10 marks)



(b)

Coordinates;  $A''(3,3), B''(6,9), C''(10,11), D''(7,5)$

(c) Determinant of matrix  $P = \frac{1}{2} \times \frac{1}{2} - 1 \times 1$   
 $= -\frac{3}{4}$

Area of  $A''B''C''D'' = \frac{3}{4} \times 6 \times 4 = 18$  sq units

(10 marks)



20. (a) (i)  $x - 5$   
 (ii)  $[x + (x - 5)] \times 2 = 4x - 10$

(b) (i)  
 $(x + 20)(x + 15) = 15(4x + 10)$   
 $x^2 - 25x + 150 = 0$   
 $(x - 10)(x - 15) = 0$   
 $x = 10$  or  $x = 15$

(ii) Parents' possible ages  
 $4 \times 10 - 10 = 30$   
 or  $4 \times 15 - 10 = 50$

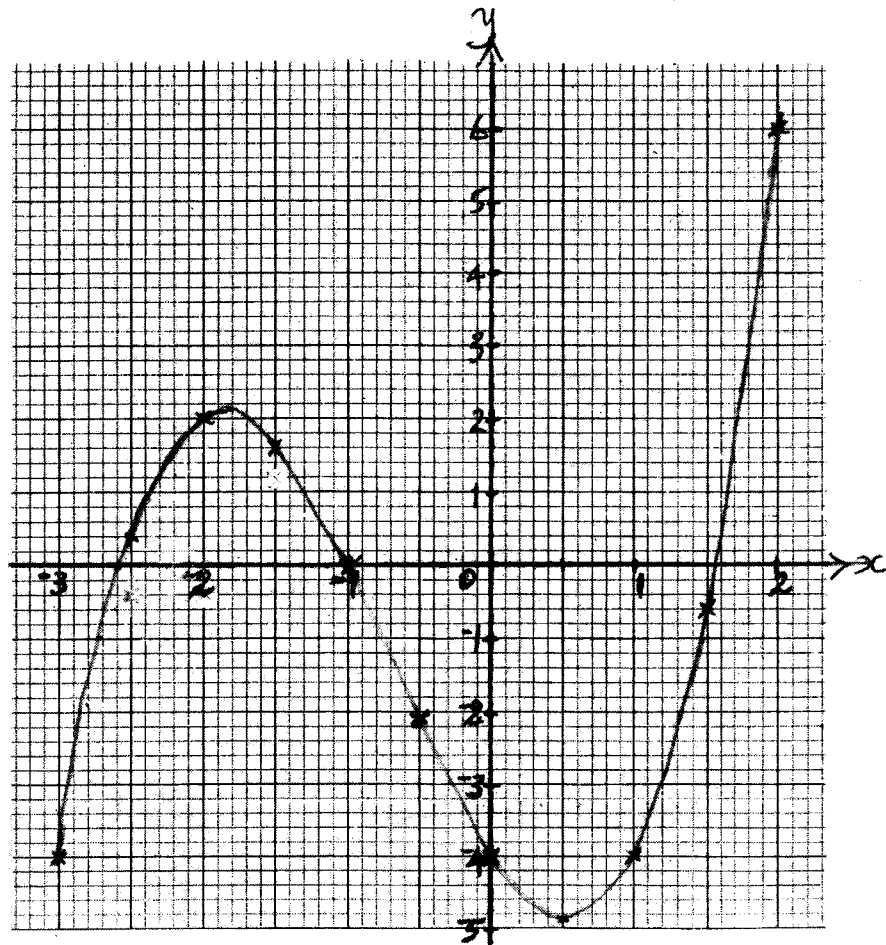
(iii) Possible ages of younger child in 20 years time  
 $(10 - 5) + 20 = 25$   
 or  $(15 - 5) + 20 = 30$

(10marks)

21. (a) (i)

$x$	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
$y = x^3 + 2x^2 - 3x - 4$			2			-2.1			-4	-0.6	

(ii)

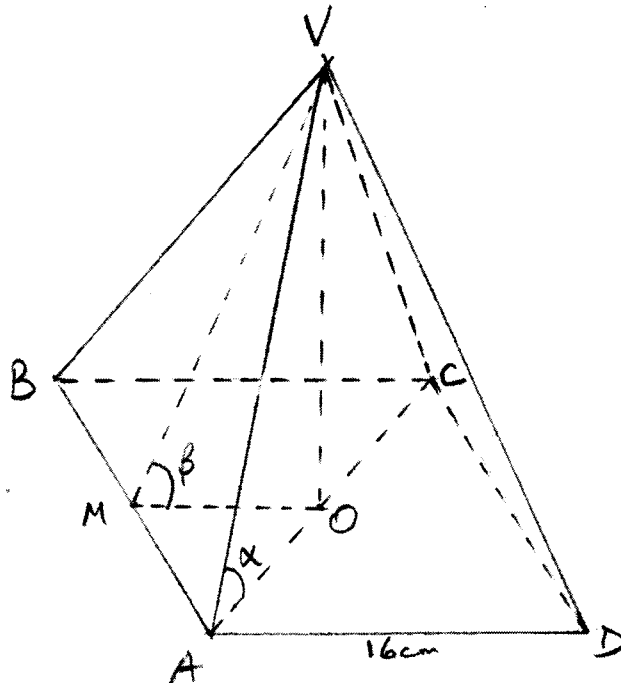


(b) (i)  $x = -2.6, -1, 1.55$

(ii) Coordinates of turning points  
 $(-1.85, 2.1)$  and  $(0.5, 4.9)$

(10marks)

22.



(a) Height VO

$$AC^2 = 16^2 + 12^2 = 400$$

$$AC = 20$$

$$AO = 20 \div 2 = 10$$

$$VO = \sqrt{26^2 - 10^2} = 24$$

(b) Angle between edge VA and Plane ABCD = angle VAO =  $\alpha$

$$\frac{h}{10} = \tan \alpha$$

$$\alpha = \tan^{-1} 2.4$$

$$= 67.38^\circ$$

(c) Angle between planes VAB and ABCD = Angle VMO =  $\beta$

$$\frac{h}{8} = \tan \beta$$

$$\beta = \tan^{-1} 3$$

$$= 71.57^\circ$$

(10marks)

$$23. (a) c = an + \frac{b}{n}$$

$$135 = 2a + \frac{b}{2}$$

$$140 = 2a + \frac{b}{3}$$

$$270 = 4a + b$$

$$\underline{420 = 9a + b}$$

$$150 = 5a \Rightarrow a = 30$$

$$270 = 120 + b \Rightarrow b = 150$$

$$c = 30n + \frac{150}{n}$$

(b)

$$c = 30 \times 10 + \frac{150}{10}$$
$$= 315$$

(c)  $756 = 30n + \frac{150}{n}$

$$756n = 30n^2 + 150$$

$$5n^2 - 126n + 25 = 0$$

$$(5n - 1)(n - 25) = 0$$

$$n = \frac{1}{5} \text{ or } n = 25$$

*number of items = 25*

**(10marks)**

24. (a)

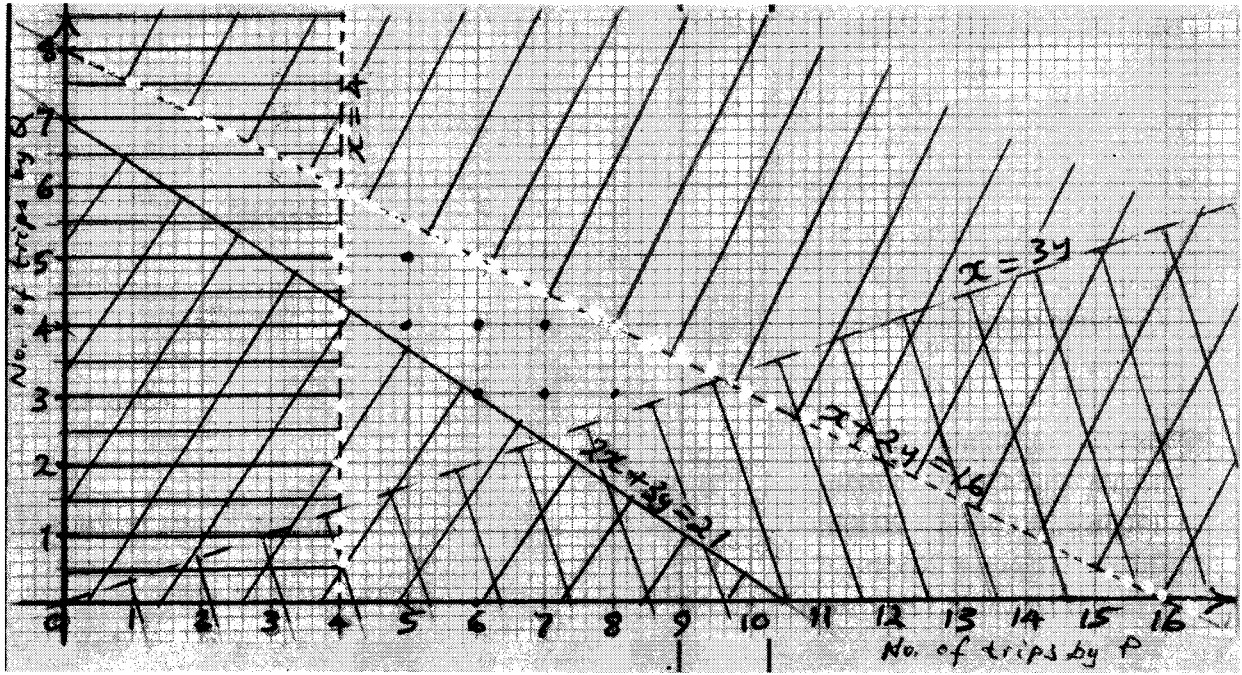
$$4x + 6y \geq 42 \Leftrightarrow 2x + 3y \geq 21$$

$$2x + 4y < 32 \Leftrightarrow x + y < 16$$

$$x < 3y$$

$$x > 4$$

(b)



- (c)  $x = 5, y = 5 \Rightarrow 5 \times 4 + 5 \times 6 = 50$  tons  
 $x = 6, y = 4 \Rightarrow 6 \times 4 + 4 \times 6 = 48$  tons  
 $x = 7, y = 4 \Rightarrow 7 \times 4 + 4 \times 6 = 52$  tons

7 trips by P and 4 trips by Q

(10marks)

### 8.3 Mathematics Alt.B Paper 1 (122/1)

1. 
$$\frac{-3 \times +6 +^{-}2}{-4 + +5 -^{-}3} = \frac{-18 +^{-}2}{1+3} = -5$$

(3marks)

2.  $1890 = 2 \times 3 \times 3 \times 3 \times 5 \times 7$   
 $1008 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 7$   
Common prime factors  
3, 5, 7

(2marks)

3.  $0850h + 6h 30min = 1520h$   
 $1520h + 1h 45min = 1705h$   
 $1705h + 3h 15min = 2020h$   
 $2020h + 35min = 2055h$   
Time of arrival in 12h system  
 $2055 - 12 = 8.55pm$

(3marks)

4.  $(4.321 \times 10^{-1})^3 = 80.68 \times 10^{-3}$   
 $= 0.08068$

(3marks)

5.  $\pi r^2 \times 45 = 25000$   
 $r = \sqrt{\frac{25000}{\pi \times 45}}$   
 $= 13.29807601$   
 $= 13.3$

(3marks)

6.  $3x \leq 2x + 3$   
 $x \leq 3$   
 $2x + 3 < 4x + 5$   
 $-x < 1$   
 $x > -1$   
Integral values: 0, 1, 2, 3.

(3marks)

7.  $234 = 2 \times 3^2 \times 13$   
 $270 = 2 \times 3^2 \times 5$   
 $324 = 2^2 \times 3^4$   
 $\therefore \text{HCF of } 234, 270 \text{ \& } 324 = 2 \times 3^2 = 18$   
Number of pieces  
 $\frac{234}{18} + \frac{270}{18} + \frac{324}{18} = 46$

(4marks)

8.

$$\frac{\frac{6}{5} - \frac{3}{8} \times \frac{3}{2} = \frac{6}{9} - \frac{9}{16}}{\frac{6}{7} \times \frac{3}{2} - \frac{3}{8} = \frac{9}{7} - \frac{3}{8}}$$

$$= \frac{\frac{51}{80}}{\frac{51}{56}}$$

$$= \frac{7}{10}$$

9.

$$h^2 = 6.5^2 - 2.5^2$$

$$h = \sqrt{6.5^2 - 2.5^2}$$

$$= \sqrt{36}$$

$$= 6$$

Height of pole  
 = 6 + 0.9  
 = 6.9m

(3marks)

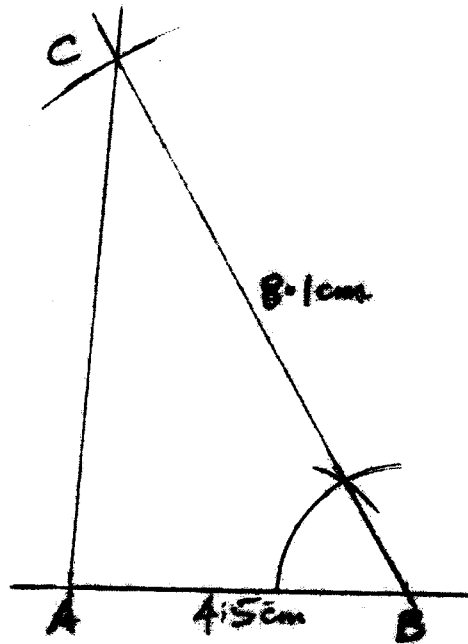
10.

No.	Log
2.5	0.3979 <sub>+</sub>
0.064	$\bar{2}.8062$
8.1	$\bar{1}.2041$
	0.9085
0.1405	$\bar{2}.2956 \times \frac{1}{2}$ $\bar{1}.1478$

$$= 0.1405$$

(3marks)

11.



$$\angle CBA = 86 \pm 1^\circ$$

(3marks)

12. Linear scale factor =  $\sqrt{\frac{16}{25}} = \frac{4}{5}$

Volume scale factor =  $\left(\frac{4}{5}\right)^3$

$\therefore$  Volume of smaller cylinder =  $\frac{64}{125} \times 800 = 409.6 \text{ cm}^3$

(4marks)

13.  $x^2 + 8x - 384 = 0$   
 $(x + 24)(x - 16) = 0$   
 $x = -24$  or  $x = 16$

(3marks)

14. Sum of angles of regular polygon  
 $(2n - 4) 90 = 1620$   
 $2n - 4 = 18$   
 $n = 11$

(2marks)

15.  $p = 3 + q$   
 $(3+q)^2 - q^2 = 21$   
 $9 + 6q + q^2 - q^2 = 21$   
 $q = 2$   
 $p = 5$

(4marks)

$$16. \quad \text{Area of sector} = \frac{120^\circ}{360^\circ} \times 3^2 \times \pi$$

$$= 9.42$$

$$\text{Area of rhombus} = \frac{1}{2} \times 3^2 \times 2 \times \sin 120$$

$$= 7.79$$

$$\text{Area of shaded region} = 9.42 - 7.79$$

$$= 1.63$$

(4marks)

$$17. \quad (a) \quad 800000 - 500000 = 300000$$

$$48000 + \frac{3}{100} \times 300000 = 57000$$

$$(b) \quad 780000 - 48000 = 30000$$

$$30000 \times \frac{100}{3} + 500000 = 1500000$$

$$(c) \quad \frac{40}{100} \times \frac{3}{100} \times (2500000 - 500000) = 24000$$

$$24000 + 48000 = 72000$$

(10marks)

$$18. \quad (a) \quad (i) \quad \frac{y-5}{x-0} = 2$$

$$y = 2x + 5$$

$$(ii) \quad \text{Gradient of } L_2$$

$$m_1 \times m_2 = -1$$

$$2 \times m_2 = -1$$

$$m_2 = -\frac{1}{2}$$

Equation of  $L_2$

$$\frac{y}{x+2.5} = -\frac{1}{2}$$

$$y = -\frac{1}{2}x - \frac{5}{4}$$

(iii) Equation of  $L_3$

$$\frac{y-2}{x-1} = -\frac{1}{2}$$

$$y = -\frac{1}{2}x + 2\frac{1}{2}$$



b) At intersection of  $L_1$  and  $L_3$

$$2x + 5 = -\frac{1}{2}x + 2\frac{1}{2}$$

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

$$x = -1$$

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

Coordinates of point of intersection = (-1,3)

(10marks)

19. a) Nehema's fraction:

$$1 - \left(\frac{1}{3} + \frac{2}{5}\right) = 1 - \frac{11}{15} = \frac{4}{5}$$

Amount Nehema got

$$\frac{4}{5} \times 750000 = 200000$$

b) Profit realized after taxation:

Before taxation

$$\frac{36}{100} \times 750000 = 270000$$

After taxation

$$\frac{95}{100} \times 270000 = 256500$$

c) Amount to be shared after each received 20000

$$= 256500 - 60000$$

$$= 196500$$

Ratio of sharing

$$\text{Amani: Furaha: Nehema} = \frac{1}{3} : \frac{2}{5} : \frac{4}{15}$$

$$= 5:6:4$$

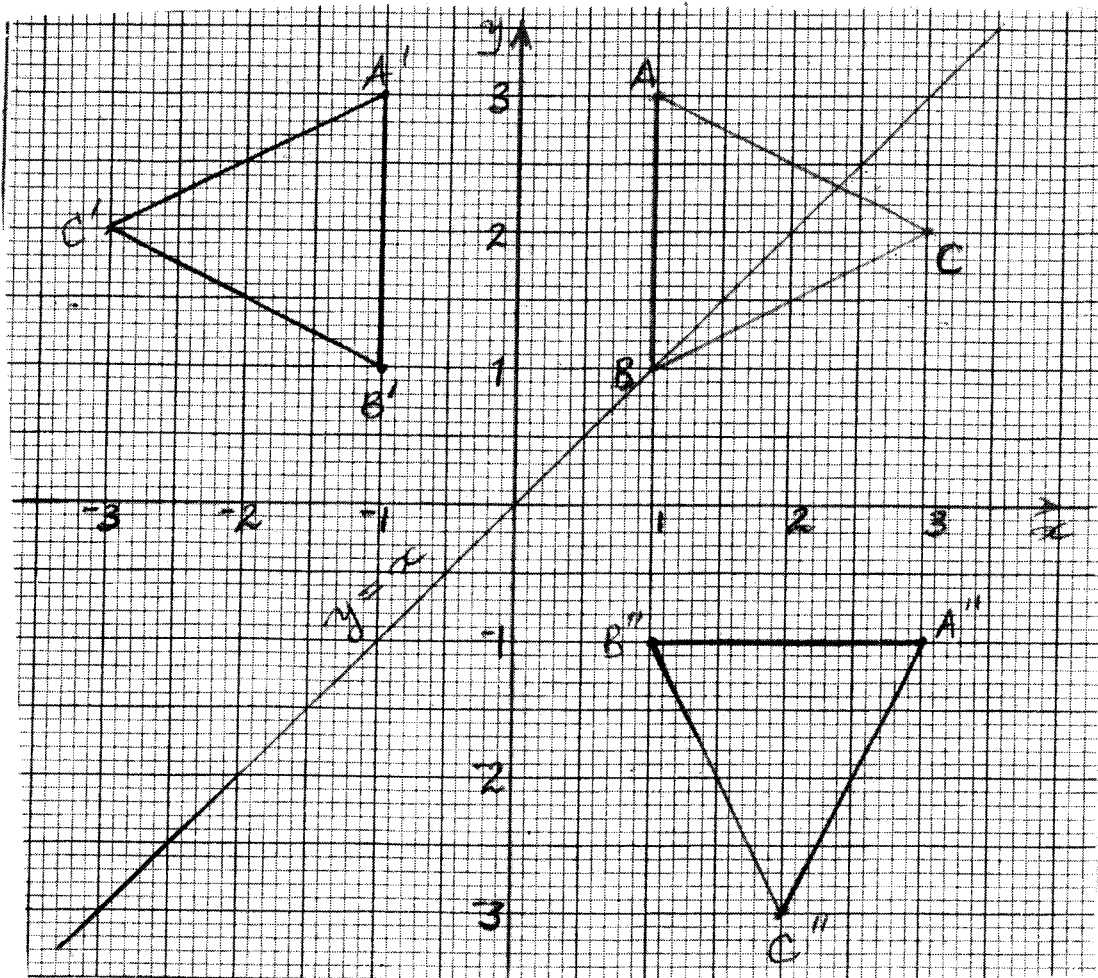
Furaha's share more than Nehema's

$$196500 \left( \frac{6-4}{15} \right) = 26200$$

(10marks)

20.

(a) and (b)



$$(c) \begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 1 & 1 & 3 \\ 3 & 1 & 2 \end{pmatrix} = \begin{pmatrix} 3 & 1 & 2 \\ -1 & -1 & -3 \end{pmatrix}$$

$$a + 3b = 3$$

$$c + 3d = -1$$

$$a + b = 1$$

$$c + d = 1$$

$$2b = 2 \Rightarrow b = 1$$

$$2d = 0 \Rightarrow d = 0$$

$$a + 3 = 3 \Rightarrow a = 0$$

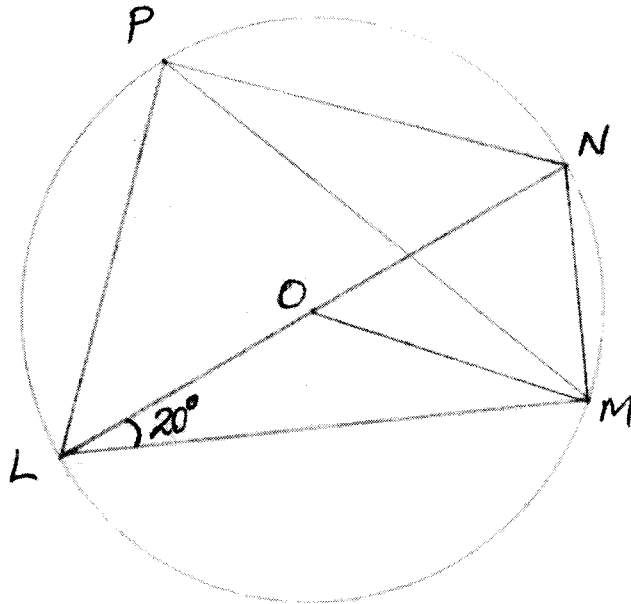
$$c = -1$$

$$\text{Matrix} \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$$

(d) Rotation of  $-90^\circ$  about point  $(0, 0)$

(10marks)

21.



- (a)  $\angle MPN = \angle MLN = 20^\circ$   
Angles subtended at the circumference by chord MN
- (b)  $\angle PLN = \frac{1}{2}(180^\circ - 90^\circ) = 45^\circ$   
Angle in semicircle equals  $90^\circ$  and base angles of isosceles triangle are equal.
- (c)  $\angle LPM = \angle LNM = 90^\circ - 20^\circ = 70^\circ$   
Complementary angles in a right angled triangle, angles subtended by chord LM equal to  $70^\circ$
- (d)  $\angle MNP = 180^\circ - (45^\circ + 20^\circ) = 115^\circ$   
Opposite angles of cyclic quadrilateral add up to  $180^\circ$
- (e)  $\angle PMO = 90^\circ - (45^\circ + 20^\circ) = 25^\circ$   
Base  $\angle$ s of isosceles triangle  $OLM = 20^\circ$   
(i.e.  $\angle NMP = \angle PLM$ )  
and  $\angle$ s subtended by chord PN at circumference equal.

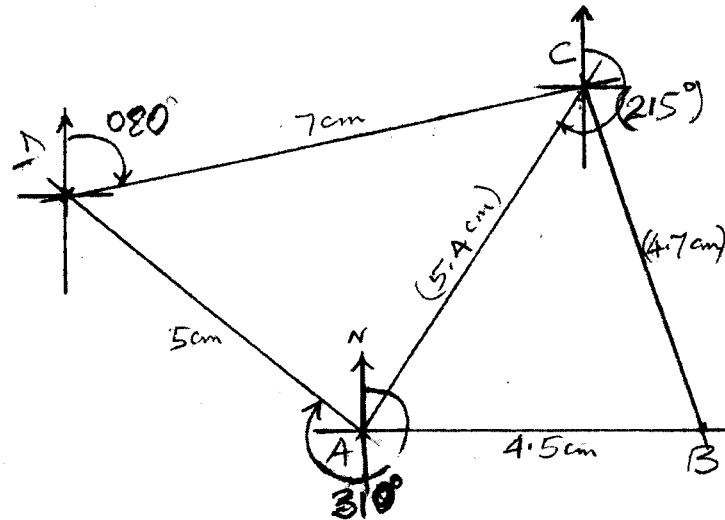
(10marks)

22. (a) i)  $AB = 12 \tan 40^\circ$   
 $= 10.07\text{cm}$
- ii)  $BD = 10.07 \tan 60^\circ$   
 $= 17.44 \text{ cm}$   
 $CD = 17.44 - 12 = 5.44 \text{ cm}$

(b)  $\angle CBE$   
 $CE = CD \tan 30$   
 $= 5.44 \tan 30 = 3.141$   
 $\therefore \angle CBE = \tan^{-1} \frac{3.141}{12}$   
 $= 14.67^\circ$

(10marks)

23.



(b) Perimeter,  $7 \text{ cm} + 4.5 \text{ cm} + 4.7 \text{ cm}$   
 $= 21.2 \text{ cm}$   
 Actual perimeter = 2120m

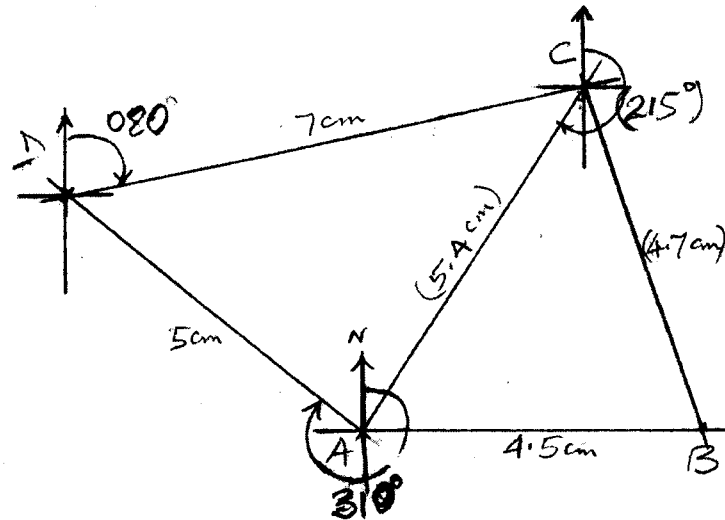
(c) i)  $5.4 \pm 0.1 \text{ cm} \rightarrow 540 \text{ m}$   
 ii)  $215^\circ \pm 1^\circ$

(10marks)

(b)  $\angle CBE$   
 $CE = CD \tan 30$   
 $= 5.44 \tan 30 = 3.141$   
 $\therefore \angle CBE = \tan^{-1} \frac{3.141}{12}$   
 $= 14.67^\circ$

(10marks)

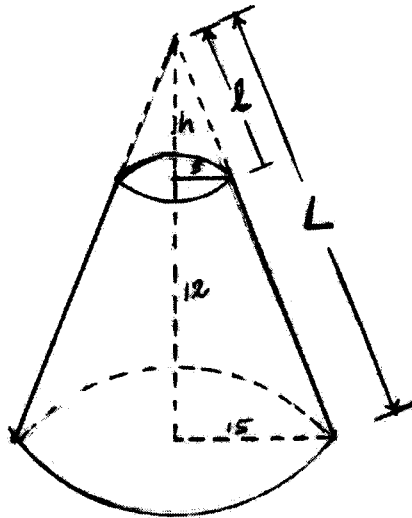
23.



(b) Perimeter,  $7 \text{ cm} + 4.5 \text{ cm} + 4.7 \text{ cm}$   
 $= 21.2 \text{ cm}$   
 Actual perimeter = 2120m

(c) i)  $5.4 \pm 0.1 \text{ cm} \rightarrow 540 \text{ m}$   
 ii)  $215^\circ \pm 1^\circ$

(10marks)



a) Circular surface area

Larger circle  $15^2\pi$

Small circle  $5^2\pi$

Area of circular surface

$$(15^2 + 5^2)\pi = 785.5\text{cm}^2$$

$$(b) \frac{h}{5} = \frac{h+24}{15}$$

$$15h = 5h + 120$$

$$10h + 120 \Rightarrow h = 12\text{cm}$$

(c) Slant height (l) of cut off cone

$$L = \sqrt{15^2 + 36} = 39$$

Curved area

$$\pi \times 15 \times 39 - \pi \times 5 \times 13 = \pi(585 - 65)$$

$$= 1633.84$$

$$= 1634$$

(10marks)