

4.3 MATHEMATICS (121 AND 122)



4.3.1 Mathematics Alternative A Paper 1 (121/1)

1.	<p>Cows = 32 Sheep = 32×12 = 384 Goats = $384 + 1344$ = 1728 Number of goats that remained = $\frac{1}{4} \times 1728$ = 432</p>	<p>M1 M1 M1 a1 4</p>	
2.	$\frac{\sqrt{1764}}{\sqrt[3]{2744}} = \frac{\sqrt{2^2 \times 3^2 \times 7^2}}{\sqrt[3]{2^3 \times 7^3}}$ $= \frac{2 \times 3 \times 7}{2 \times 7}$ $= 3$	<p>M1 M1 a1 3</p>	<p>For prime factors of both 2, 3, and 7</p>
3.	<p>Volume = $\frac{1}{3} \times \frac{22}{7} \times 14^2 \times 18$ = 3696 cm^3 Density = $\frac{4.62 \times 1000}{3696}$ = 1.25 g/cm^3</p>	<p>M1 M1 a1 3</p>	

4.



Ecolebooks.com



DX = 5.3 ! 0.1

B1	: measurements and angles
B1	: complete net (labelled)
B1	
3	

5.

C.P. for carpet

$$= \frac{36000 \# 100}{120}$$

$$= 30000$$

% profit made during trade fair

$$= \frac{33600 - 30000}{30000} \# 100$$


$$= 12\%$$

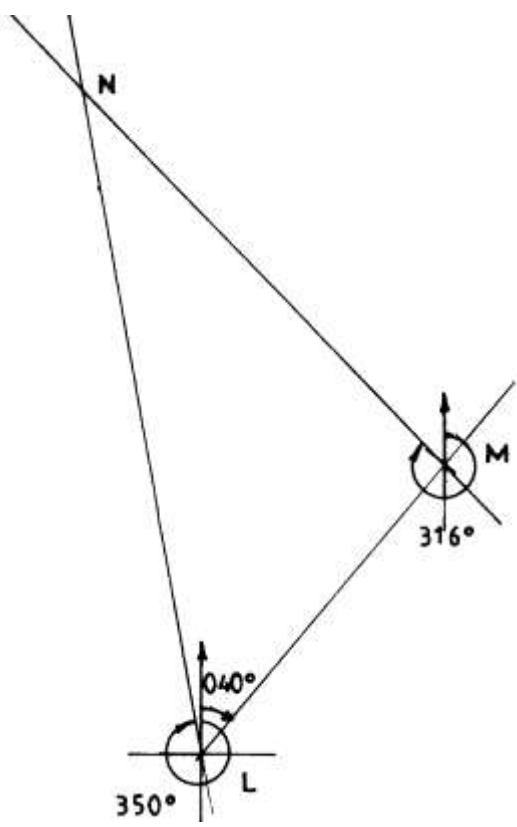
M1

M1

a1

3

6.	$= \frac{243^{-\frac{2}{5}} \# 125^{\frac{2}{3}}}{9^{\frac{-3}{2}}}$ <p>Ecolebooks.com</p> $= \frac{27 \# 25}{9}$ $= 75$	M1 M1 a1 3	 : manipulation of all indices or equivalent simplification
7.	$= \frac{\mathbf{i}}{2\mathbf{r}} \# \mathbf{r} \# 2.1 \# 2.1 = 2.31$ $\mathbf{i} = \frac{2.31 \# 2}{2.1 \# 2.1}$ $= 1.05^c$	M1 a1 2	
8.	$\wedge x + 2yh^2 - \wedge 2y - 3h^2$ $= \wedge x^2 + 4xy + 4y^2h - \wedge 4y^2 - 12y + 9h$ $= x^2 + 4xy + 12y - 9$	M1 a1 2	

<p>9.</p> <p><u>Ecole</u></p>	 <p>Distance MN = $6.8 \# 100$ = 680 km</p>	<p>B1</p> <p>B1</p> <p>M1</p> <p>a1</p> <p>4</p>	<p>: location of M</p> <p>: location of N</p> <p>MN = 6.8 ± 0.1 cm</p>
<p>10.</p>	$2n - 4h \# 90 = 1800$ $180n = 2160$ $n = 12$ <p>size of each exterior angle</p> $= \frac{360}{12} = 30c$	<p>M1</p> <p>M1</p> <p>a1</p> <p>3</p>	
<p>11.</p>	<p>let age of cow be x years</p> $xax - 4 \frac{2}{3}k = 8$ $3x^2 - 14x - 24 = 0$ $^3x + 4h^x - 6h = 0$ <p>$x = 6$ or $-\frac{4}{3}$</p> <p>age of cow = 6 years</p> <p>age of heifer = $1 \frac{1}{3}$ years</p>	<p>M1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>4</p>	

12.	$4 \times 3x - 2 = 12x - 2$ $19 + x$ $4 \times 3x - 2 = 12x - 2$ $19 + x$ 11 $x \times 2 = 2x$ $15 \frac{1}{2}$ $2 \times 15 \frac{1}{2}$ <p>integral values 2, 3, 4, 5</p>	M1 a1 B1 3	
13.	<p>Volume of water in container</p> $= \frac{80}{100} \times 90 \times 25 - r \times 7.5^2 h$ $= 59276.54975$ $\frac{59276.54975}{1000}$ $= 59.3$	M1 M1 M1 a1 3	for $\frac{80}{100} \times 90$ difference in volumes conversion into litres
14.	<p>angle for major arc = $360 - 105$ = 255°</p> <p>Length of arc = $\frac{255}{360} \times 2 \times 8.4 \times \frac{22}{7}$ = 37.4 cm</p>	B1 M1 a1 3	
15.	<p>amount of work = $25 \times 16 \times 9$ Machines required</p> $= \frac{25 \times 16 \times 9}{12 \times 10}$ $= 30$	M1 M1 a1 3	\div by 12×10
16.	$ AB = \sqrt{(-3 + 2h^2)^2 + (7 - 2h^2)^2} = \sqrt{26}$ $ A'B' = \sqrt{4^2 + (-20h^2)^2} = \sqrt{416}$ <p>Scale factor = $\frac{ A'B' }{ AB } = \frac{\sqrt{416}}{\sqrt{26}}$ = 4</p>	M1 M1 a1 3	for $ AB $ and $ A'B' $

17.	<p>(a) equation of L</p> <p><u>Ecolebooks.com</u> gradient $= \frac{6-3}{-1-2}$</p> <p>$= 3$</p> <p>equation $= \frac{y-6}{x+1} = 3$</p> <p>& $y - 3x = 9$</p> <p>(b) equation of P</p> <p>$= \frac{y-6}{x+1} = -\frac{1}{3}$</p> <p>$3y + x = 17$</p> <p>(c) equation of Q</p> <p>$= \frac{y-2}{x-1} = 3$</p> <p>$y = 3x - 1$</p> <p>x intercept when $y = 0$ & $x = \frac{1}{3}$</p> <p>y intercept when $x = 0$ & $y = -1$</p> <p>(d) intersection of lines P and Q</p> <p>$3y + x = 17..(i)$</p> <p>$y - 3x = -1..(ii)$</p> <p>$3y + x = 17$</p> <p>$3y - 9x = -3$</p> <p>$10x = 20$ & $x = 2$</p> <p>subset $3y + 2 = 17$ & $y = 5$</p> <p>∴ point of intersection $(2, 5)$</p>	<p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>10</p>	<p>for both $x = 2$ and $y = 5$</p>
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18.

(a)

Class	3-5	6-8	9-11	12-14	15-17	18-20
Frequency	3	8	13	10	4	2

Ecolebooks.com

B1

B1



(b) (i) mean length = $\frac{Rfx}{Rf}$

$$= \frac{4 \# 3 + 7 \# 8 + 10 \# 13 + 13 \# 10 + 16 \# 4 + 19 \# 2}{40}$$

$$= 10.75$$

(ii)

$$= \frac{23}{40} \# 100$$

$$= 57.5\%$$

B1

M1

a1

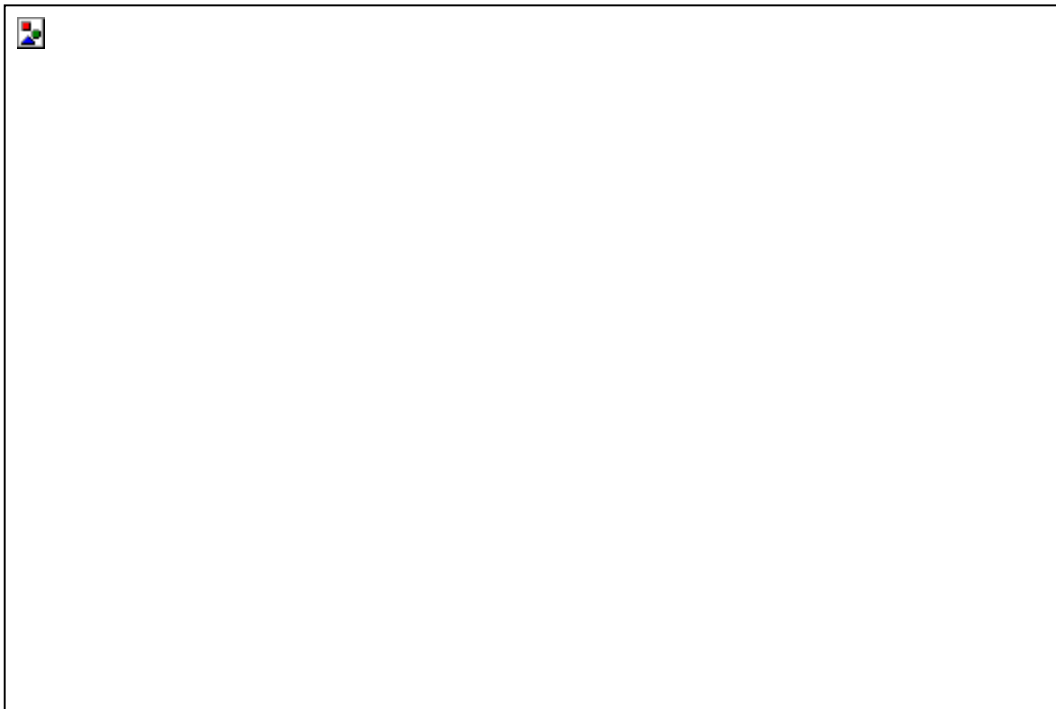
for all : mid points - i.e 4, 7, 10, 13, 16, and 19

B1

for 23

B1

(c)





S1

P1

C1

10

19.	<p>(a) 15 m/s</p> <p><u>Ec</u>olebooks.com maximum speed</p> $\frac{1}{2} \times 15^2 + 15h + \frac{1}{2} \times 10^2 + 30h = 825$ $75 + 5h + 20h = 825$ $25h = 750$ $h = 30 \text{ m/s}$ <p>(c) (i) $= \frac{30 - 15}{10}$</p> $= 1.5 \text{ m/s}^2$ <p>(ii) $= \frac{0 - 30}{20} = -1.5 \text{ m/s}^2$</p> <p>(d) $:\frac{1}{2} \times 15^2 + 30h + 10 + 10 + 30 \times 20$</p> $= 225 + 300h + 20$ $= 26.25 \text{ m/s}$	<p>B1</p> <p>M1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>B1</p> <p>10</p>	 <p>for distance covered in first 20 seconds</p>
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20.	<p>(a) base area $= \frac{1}{2} \times 15 \times 15 \sin 72 \times 5$ <u>Ecolebooks.com</u> $= 534.97$</p> <p>(b) Length aV $= \sqrt{36^2 + 15^2} = 39$</p> <p>(c) area of triangular faces: $\frac{AB}{\sin 72} = \frac{15}{\sin 54}$ $AB = \frac{15 \sin 72}{\sin 54}$ $= 17.63$ $\hat{\text{ area}}$ $= \sqrt{\frac{1}{2} \times 39 \times 39 + 17.63 \times 30.185 \times 8.815^2} \times 0$ $= 334.89$ Total area = $334.89 \times 5 + 534.97$ $= 2209.42$</p> <p>(d) volume of pyramid $= \frac{1}{3} \times 534.97 \times 36$ $= 6419.63 \text{ cm}^2$ $= 6420 \text{ (4 s.f.)}$</p>	<p>B1 M1 a1 B1 M1 M1 a1 M1 a1 10</p>	<p>use of 72° </p> <p>: application of Herons formula</p>
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21. (a)

Ecolebooks.com

x	0	1	2	3	4	5	6	7	8		
y	16	10	6	4	4	6	10	16	24	34	46

B2 y values
(B1 for at least 6 correct)

(b) area using trapezium rule

$$= \frac{1}{2} \# 16 + 46 + 2 \wedge 10 + 6 + 4 + 4 + 6 + 10 + 16 + 24 + 34 h$$

M1

$$= \frac{1}{2} 662 + 2 \wedge 114 h$$

M1 simplification

$$= 145$$

a1

(c) area using mid-ordinate rule

$$= 2 \# \wedge 10 + 4 + 6 + 16 + 34 h$$

M1

$$= 140$$

a1

(d) area using integration method



M1 : integration

$$= : \frac{512}{3} - \frac{192}{2} + 48 - : \frac{-8}{3} - \frac{3 \# 4}{2} - 12$$

M1

$$= 122 \frac{2}{3} + 20 \frac{2}{3}$$

$$= 143 \frac{1}{3}$$

a1

10

22. (a) (i)



Ecolebooks.com



- B1 construction of 30°
- B1 construction of 105°
- B1 completion of $\triangle ABC$

(ii)

$$\text{radius} = 3.5 \pm 0.1$$

(iii) height construction
height = 3.4 ± 0.1

- B1 \perp bisectors
- B1 circle
- B1
- B1 height constructed
- B1

(b) area of circle outside triangle


$$= r \left[3.5^2 - \frac{1}{2} \cdot 3.4 \cdot 5 \right]$$


$$= 29.98$$

M1

a1

10


23.	<p>(a) $\tan i = \frac{70}{240}$ $= 0.2917$ $i = 16.26^\circ$</p> <p>(b) $aC = \boxed{\text{[redacted]}}$ $= 250 \text{ m}$</p> <p>$+ aCD = 150^\circ - 90^\circ - 16.26^\circ$ $= 76.26^\circ$</p> <p>$aD^2 = 200^2 + 250^2 - 2 \cdot 200 \cdot 250 \cos 76.26^\circ$ $aD = \sqrt{40000 + 62500 - 100000 \cos 76.26^\circ}$ $= 280.6$</p> <p>(c) area of plot $= \frac{1}{2} \cdot 240 \cdot 70 + \frac{1}{2} \cdot 250 \cdot 200 \sin 76.26^\circ$ $= 8400 + 24284.59$ $= 32684.59 \text{ m}^2$ $= \frac{32684.59}{10000}$ $= 3.27 \text{ ha}$</p>	<p>M1</p> <p>a1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>a1</p> <p>10</p>	
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24.	<p>(a) Value of y when $x = -1$ $y = -1 - 4 + 3 = -2$</p> <p>Ecolebooks.com</p> <p>(b) Stationary points $\frac{dy}{dx} = 3x^2 - 8x - 3$</p> <p>for stationary points $3x^2 - 8x - 3 = 0$ $^3x + 1h^x - 3h = 0$ $x = -\frac{1}{3}$ or $x = 3$ when $x = -\frac{1}{3}$, $y = \frac{14}{27}$ when $x = 3$, $y = -18$ \sim stationary points $a - \frac{1}{3}, \frac{14}{27}k$ and $(3, -18)$</p> <p>(c) equation of normal to curve: gradient of tangent at $x = 1$</p> $\frac{dy}{dx} = 3 - 8 - 3 = -8$ <p>gradient of normal $= \frac{1}{8}$</p> \sim equation of normal at $x = 1$ $\frac{y+6}{x-1} = \frac{1}{8}$ $y+6 = \frac{1}{8}x - \frac{1}{8}$ $y = \frac{1}{8}x - 6\frac{1}{8}$	<p>B1</p> <p>M1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>a1</p> <p>10</p>	
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4.3.2 Mathematics Alternative A Paper 2 (121/2)




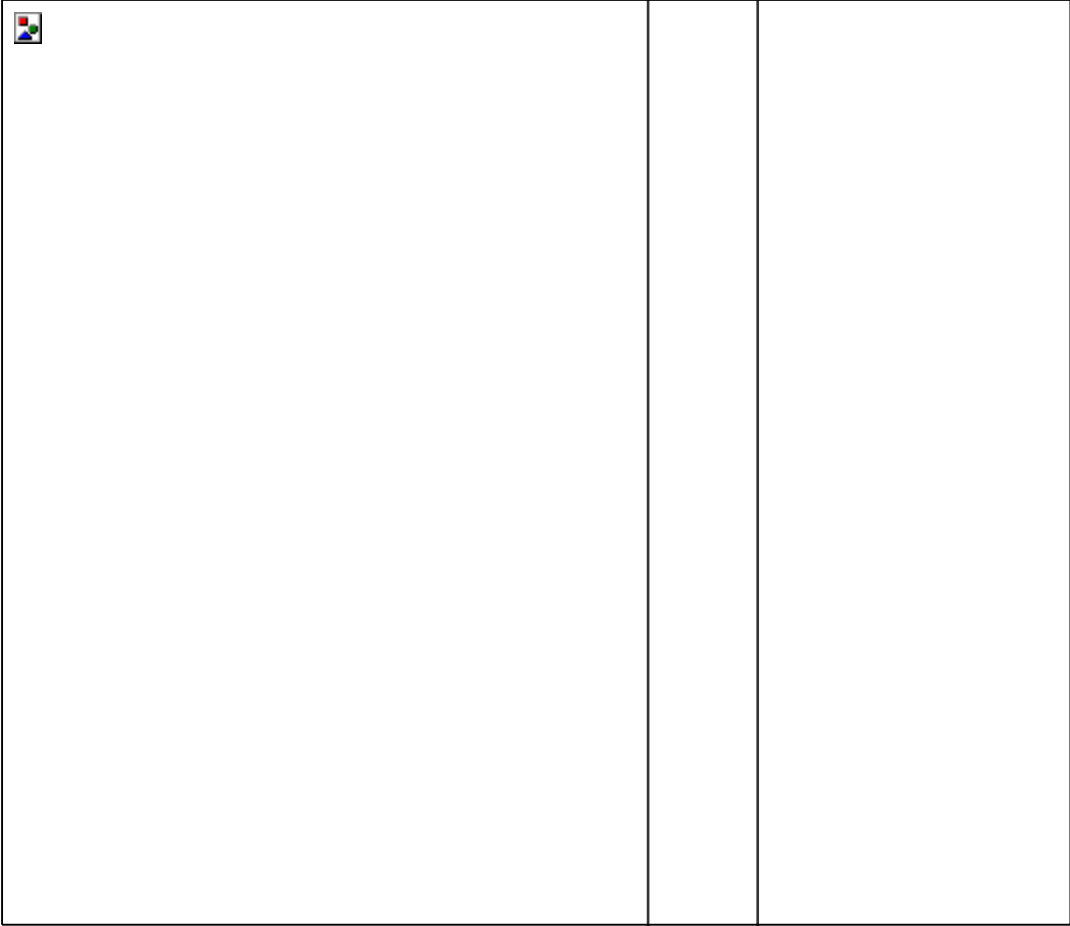
1.	<p>Ecolebooks.com 12.55 m and 9.23 ± 0.005 m</p> <p>Maximum difference $= 12.55 - 9.225$ $= 3.325$ m</p>	<p>B1</p> <p>M1</p> <p>a1</p> <hr/> <p>3</p>																			
2.	<p>a) First 6 terms $-7, -4, -1, 2, 5, 8$</p> <p>b) Sum of 1st 50 terms $S_{50} = \frac{50}{2} \times 2 \neq -7 + 49 \neq 3,$ $= 3325$</p>	<p>B1</p> <p>M1</p> <p>a1</p> <hr/> <p>3</p>																			
3.	<p>a) $+BAC = 70c - 30c = 40c$</p> <p>Reflex $+BOC = 360c - 80c$ $= 280^\circ$</p> <p>b) $+ACO = 40c - 30c = 10c$</p>	<p>B1</p> <p>B1</p> <p>B1</p> <hr/> <p>3</p>																			
4.	<p>$L = \frac{kM}{N^2}$</p> <p>$2 = \frac{k \neq 12}{36}$</p> <p>$k = 6$</p> <p>equation $L = \frac{6M}{N^2}$</p>	<p>B1</p> <p>M1</p> <p>a1</p> <hr/> <p>3</p>																			
5.	<table border="1" data-bbox="160 1290 707 1564"> <thead> <tr> <th>Marks</th> <th>Frequency</th> <th>c.f</th> </tr> </thead> <tbody> <tr> <td>1 - 10</td> <td>2</td> <td>2</td> </tr> <tr> <td>11 - 20</td> <td>4</td> <td>6</td> </tr> <tr> <td>21 - 30</td> <td>11</td> <td>17</td> </tr> <tr> <td>31 - 40</td> <td>5</td> <td>22</td> </tr> <tr> <td>41 - 50</td> <td>3</td> <td>25</td> </tr> </tbody> </table> <p>Median $= 20.5 + \frac{12.5 - 6}{11} \neq 10$ $= 20.5 + 5.91$ $= 26.41$ $- 26$</p>	Marks	Frequency	c.f	1 - 10	2	2	11 - 20	4	6	21 - 30	11	17	31 - 40	5	22	41 - 50	3	25	<p>B1</p> <p>for c.f</p> <p>M1</p> <p>M1</p> <p>a1</p> <hr/> <p>4</p>	
Marks	Frequency	c.f																			
1 - 10	2	2																			
11 - 20	4	6																			
21 - 30	11	17																			
31 - 40	5	22																			
41 - 50	3	25																			

6.	amplitude = 2 Period = $\frac{360}{3} = 120$ Ecolebooks.com	B1 B1 2	
7.	Area scale factor = $\frac{30}{5} = 6$ $4x - 2x + 2 = 6$ $2x = 4$ $x = 2$	B1 M1 a1 3	
8.	$^3 3 - xh^7 = 3^7 - 7(3)^6 x + 21(3)^5 x^2 - 35(3)^4 x^3$ $+ 35(3)^3 x^4 + \dots$ $= 2187 - 5103x + 5103x^2 - 2835x^3 + 945x^4$ $(2.8)^7 = (3 - 0.2)^7$ $= 2187 - 5103(0.2) + 5103(0.2)^2$ $- 2835(0.2)^3 + 945(0.2)^4$ $= 1349.352$	B1 M1 a1 3	
9.	$\text{Log} \frac{15^2}{x} = \log 5^x - 4h$ $\frac{15^2}{x} = 5^x - 4h$ $x^2 - 4x - 45 = 0$ $(x - 9)(x + 5) = 0$ $x = 9$ or -5 $x = 9$	M1 M1 M1 a1 4	
10.	$PR = \sqrt{60^2 + 11^2} = 61$ $\text{Tan } \mathbf{i} = \frac{10}{61}$ $\mathbf{i} = 9.31^\circ$	B1 M1 a1 3	

11.	$3x - y = 9$ # x $x^2 - xy = 4$ <u>Ecolebooks.com</u> $3x^2 - xy = 9x$ $\frac{x^2 - xy = 4}{2x^2} = 9x - 4$ $2x^2 - 9x + 4 = 0$ $(2x - 1)(x - 4) = 0$ $x = \frac{1}{2}$ or $x = 4$ $y = 3a\frac{1}{2}k - 9$ or $3^4h - 9$ $= -7\frac{1}{2}$ or 3	M1 M1 a1 B1	attempt to solve Factors
12.	$1 + \frac{r}{100}j^4 = \frac{495000}{280000}$ $1 + \frac{r}{100} = 1.153$ $r = 15.3$	M1 M1 a1	
13.	$8008 = \frac{40 + \mathbf{i}}{360} \# 2 \# \frac{22}{7} \# 6370$ $40 + \mathbf{i} = \frac{8008 \# 360 \# 7}{2 \# 22 \# 6370} = 72$ $\mathbf{i} = 72c - 40c$ $= 32c$ Position of B(32° S, 20° W)	M1 M1 a1	or 32° seen
14.	$\mathbf{r} + \mathbf{s} = 6\mathbf{i} + 3\mathbf{j} - 2\mathbf{k}$ $ \mathbf{r} + \mathbf{s} = \sqrt{6^2 + 3^2 + (-2)^2}$ $= 7$	B1 M1 a1	

15.	$y = \int (x^2 - 4x + 3) dx$ $= \frac{1}{3}x^3 - 2x^2 + 3x + c$ $0 = \frac{1}{3} - 2 + 3 + c$ $\therefore c = -\frac{4}{3}$ $\therefore y = \frac{1}{3}x^3 - 2x^2 + 3x - \frac{4}{3}$	M1 M1 a1	
		3	
16.	Temperature at the 2nd minute = 60° Temperature at the 11th minute = 18° average rate of cooling $= \frac{60 - 18}{2 - 11}$ $= \frac{42}{ 9 }$ $= 4\frac{2}{3} \text{ C/min}$	B1 M1 a1	for both \checkmark
		3	
17.	a) $A = \frac{3}{4}B, C = 2B$ $\& A:B:C = \frac{3}{4}B:B:2B$ $= 3:4:8$ b) $a \frac{168}{8} \neq 4 \text{klitres}$ $= 84 \text{ l}$ c) (i) $\frac{3 \times 160 + 4 \times 205 + 8 \times 100}{3 + 4 + 8}$ $= \text{Ksh } 140$ (ii) $\frac{182 - 140}{140} \times 100\%$ $= 30\%$ (iii) $\text{Ksh } 140 \times \frac{125}{100}$ $= \text{Ksh } 175$	M1 a1 M1 a1 M1 a1 M1 a1	
		10	

18.	<p>a) (i) $(50 + 40)(50) = 30(30 + x)$ $4500 = 900 + 30x$ $30x = 3600$ $QS = x = 120 \text{ cm}$</p> <p>(ii) $RS = \frac{1}{2}QS$ $= \frac{1}{2}(120) = 60 \text{ cm}$ $OR = \sqrt{61^2 - 60^2}$ $= 11 \text{ cm}$</p> <p>b) (i) $\sin i = \frac{60}{61}$ $i = 79.6^\circ$</p> <p>(ii) angle at the centre $= 2 \times 79.6^\circ$ $= 159.2^\circ$</p> <p>Length of minor arc QS $= \frac{159.2}{360} \times 2\pi \times 61$ $= 169.5 \text{ cm}$</p>	<p>M1</p> <p>a1</p> <p>B1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>10</p>	 <p>or equivalent</p>
19.	<p>a) (i) $38392 + 2108$ $= \text{Ksh } 41000$</p> <p>(ii) $10164 \times 0.1 + 9576 \times 0.15 + 9576 \times 0.2$ $+ 9576 \times 0.25 + 2108 \times 0.3$ $= 1016.4 + 1436.4 + 1915.2 + 2394 + 632.4$ $= \text{Ksh } 7394.4$</p> <p>monthly income tax $= 7394.4 - 1162$ $= \text{Ksh } 6232.4$</p> <p>b) amount saved in coop society $= \frac{5}{100} \times 41000 - 15000$ $= \text{Ksh } 1300$</p> <p>Nett pay $41000 - (6232.4 + 1300)$ $= \text{Ksh } 33467.6$</p>	<p>M1</p> <p>a1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>a1</p> <p>10</p>	<p>$\sqrt{1^{\text{st}}}$ band</p> <p>$\sqrt{3}$ middle bands</p> <p>$\sqrt{\text{last } (5^{\text{th}})}$ band</p>

20.	<p>a) $y \geq x$ $y \leq 2x$ Ecolebooks.com</p> <p>$x + y \leq 20$ $x + y \geq 8$</p> <p>b) (i)</p>	<p>B1 B1</p> <p>B1 B1</p>	
	<p>(ii) Maximum area:</p> <p style="text-align: center;">9×10 $= 90 \text{ m}^2$</p>	<p>B1 B1 B1 B1</p> <p>M1 a1</p> <p>10</p>	<p>line $y = 2x$ and \surd shading broken line $x + y = 20$ and \surd shading broken line $x + y = 8$ and \surd shading broken line $y = x$ and \surd shading</p>

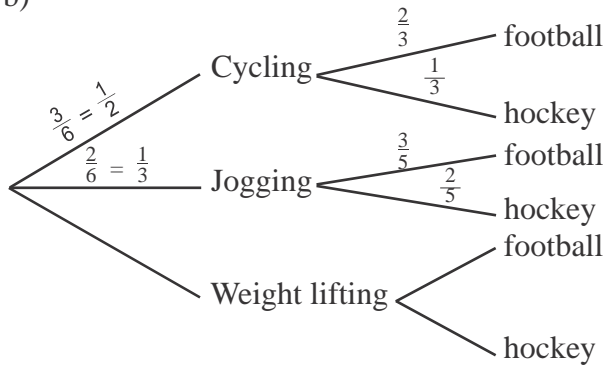
21. a) (i) $\frac{3}{6} + \frac{1}{6}$

Ecolebooks.com
 $= \frac{2}{3}$

(ii) $\frac{2}{6} \# \frac{2}{6}$

$= \frac{1}{9}$

b)



M1

a1

M1

a1

B1

B1

c) (i) P(Gataro plays football)

$= \frac{1}{2} \# \frac{2}{3} + \frac{1}{3} \# \frac{3}{5} + \frac{1}{6} \# \frac{1}{2}$

$= \frac{37}{60}$

M1

a1

(ii) P(neither jogs nor plays football)




$= \frac{1}{2} \# \frac{1}{3} + \frac{1}{6} \# \frac{1}{2}$

$= \frac{1}{4}$

M1

a1

10

22.	<p>a) (i) $\underline{BA} = \underline{a} - \underline{b}$</p> <p>E (ii) $\underline{BN} = \frac{1}{3}\underline{BA} = \frac{1}{3}(\underline{a} - \underline{b})$</p> <p>(iii) $\underline{ON} = \underline{b} + \frac{1}{3}(\underline{a} - \underline{b})$ $= \frac{1}{3}\underline{a} + \frac{2}{3}\underline{b}$</p> <p>b) $\underline{BX} = \underline{hBM} = \underline{ha} \frac{1}{2} \underline{a} - \underline{bk}$</p> <p>$\underline{OX} = \underline{kON} = \underline{ka} \frac{1}{3} \underline{a} + \underline{\frac{2}{3}bk}$</p> <p>also</p> <p>$\underline{OX} = \underline{OB} + \underline{BX}$ $= \underline{b} + \underline{ha} \frac{1}{2} \underline{a} - \underline{bk}$</p> <div data-bbox="200 756 759 1004" style="border: 1px solid black; height: 120px; margin: 10px 0;">  </div> <div data-bbox="278 1011 756 1143" style="border: 1px solid black; height: 64px; margin: 10px 0;">  </div> <p>Substituting $k = \frac{3}{2}h$ in (ii)</p> $\frac{2}{3}a \frac{3}{2}hk = 1 - h \implies h = \frac{1}{2}$ <p>Substituting $h = \frac{1}{2}$ in (i)</p> $k = \frac{3}{2}a \frac{1}{2}k = \frac{3}{4}$	<p>B1</p> <p>B1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>a1</p> <p>10</p>	 <p>for $h = \frac{1}{2}$ and $k = \frac{3}{4}$</p>
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23.



Ecolebooks.com



(i)

(ii)

b) (i) $9.2 \times 10 = 92 \text{ m}$

(ii) area of region bounded by locus of P,

locus of Q and line BQ_1

angle = 60° radius = 46 m

$$= \frac{1}{2} r^2 \theta = \frac{1}{2} \times 46^2 \times \frac{60}{360}$$

$$= 1107.94$$

$$- 92 \text{ m}^2$$

B2

B1

B1

B1

B1

B1

B1

M1



a1

10

locus of P
 construction of 30°
 identification of centre
 drawing of arc

identifying region


for radius and angle of sector

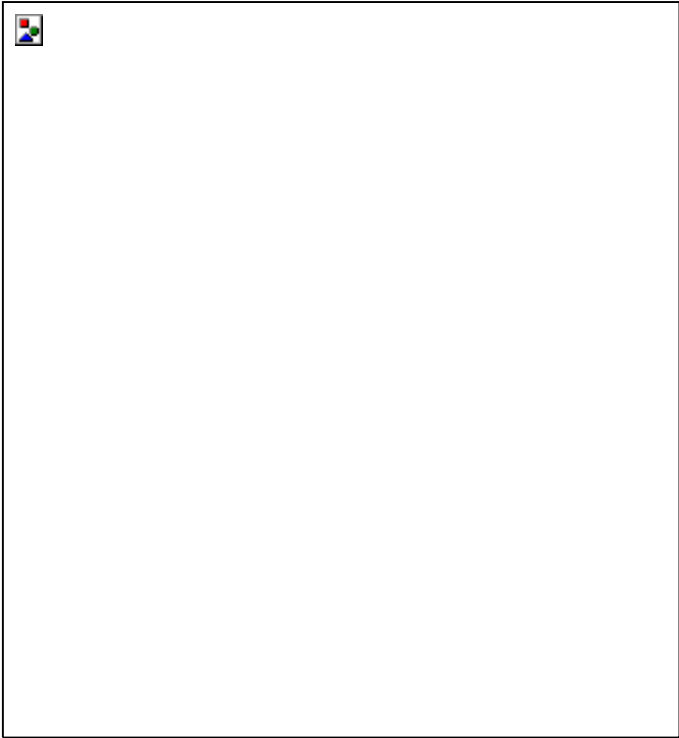

24.	a)		
	 <p>b) (i) value of a $= \frac{-0.7}{3.5}$ $= -0.2$ value of k = 1.7</p> <p>(ii) equation: $r = -0.2t + 1.7$</p> <p>(iii) value of t when $r = 0$ $0 = -0.2t + 1.7$ $0.2t = 1.7$ $t = \frac{1.7}{0.2} = 8.5$</p>	S1 P2 L1 M1 a1 B1 B1 M1 a1 10	√ scale (P1 for 4 points √ plotted) √ line


4.3.3 Mathematics Alternative B (122/1)



1.	$\frac{8 \# 0}{+18 \cdot -2 \# +3} = \frac{-27}{-27}$ $= 1$	M1 a1 2	
2.	Number of boys = $630 - 84$ $= 546$ Number of students = $630 + 546$ $= 1176$ Number of parents = $1176 \cdot 4$ $= 294$	M1 M1 a1 3	
3.	$3(78 - y) + 5y = 300$ $2y = 66$ $y = 33$ $x = 78 - 48 = 45$ $10x + 15y = 450 + 495 = 945$	M1 a1 B1 3	
4.	(a) $96 = 2^5 \# 3$ $84 = 2^2 \# 3 \# 7$ $36 = 2^2 \# 3^2$ GCD of 96, 84 and 36 = $2^2 \# 3 = 12$ (b) Number of packets of foodstuffs $= \frac{96}{12} + \frac{84}{12} + \frac{36}{12}$ $= 8 + 7 + 3 = 18$	M1 or equivalent a1 M1 a1 4	
5.	$\frac{128}{2^5 \cdot 2^8} = \frac{2^7}{2^{-3}}$ $= 2^{10}$	B1 : numerator B1 : denominator B1 3	

6.	 Ecolebooks.com	B1 : construction of 30° B1 : construction of aD = 6 cm B1 identifying C and completing parallelogram 3
7.	$4a + a + 10 = 90c$ $5a = 80c$ $a = 16c$ $\sin a = 0.276$	M1 a1 B1 3
8.	$\frac{0.375 \cdot 0.06 - 4.2}{3.96 + 2.8 \cdot 0.05} = \frac{6.25 - 4.2}{3.96 + 0.14}$ $= \frac{2.05}{4.1}$ $= 0.5$	M1 evidence of division and multiplication should be seen. M1 a1 3
9.	Mangoes: $2x + x + \frac{1}{3}x$ $= 3\frac{1}{3}x$ Oranges: $\frac{1}{3}y + y + \frac{2}{3}y = 2y$ Total Fruits = $3\frac{1}{3}x + 2y$	M1 M1 a1 3

10.	<p>(a) Cylinder</p> <p>Ecolebooks.com</p>  <p>Two circles of radius 1.4 touching the longer sides of a rectangle 4 cm by 8.8 cm.</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>3</p>	 <p>for correct circles</p> <p>for correct rectangle</p>
11.	<p>Fraction of circumference made = $\frac{12}{60}$</p> $\frac{22}{7} \times 2r \times \frac{12}{60} = 17.6$ $r = \frac{7}{22} \times \frac{60}{12} \times \frac{17.6}{2}$ $= 14$	<p>B1</p> <p>M1</p> <p>M1</p> <p>a1</p> <p>4</p>	<p>or equivalent</p>
12.	<p>+RQP = 147c</p> <p>+SRP = 90c</p> <p>+SRQ = 90 + 12 = 102c</p>	<p>B1</p> <p>B1</p> <p>B1</p> <p>3</p>	<p>or +RPS = 57c</p> <p>or 180 - 57 + 21h = 102c</p>

13.	$2x^2 + 6y - 3x - 4xy$ $2x^2 - 4xy - 3x + 6y$ $= 2x^2 - 3x - 4xy$ $= 2x^2 - 3x - 4xy$	M1 a1 2	 or equivalent
14.	$x^2 \sin 30^\circ = 34$ $x = \sqrt{\frac{34}{\sin 30^\circ}}$ = 8 cm	M1 M1 a1 3	

15.



Ecolebooks.com



- (a) 3 PQR
3 PIQIRI
- (b) Centre of enlargement $^1, - 2h$
Scale factor of enlargement = $\frac{10}{5} = 2$

B1
B1
B1
B1

4

16.

$$\frac{L}{2.1} = \frac{L+5}{3.5}$$

$$3.5L - 2.1L = 10.5$$

$$L = 7.5$$

$$L = 5 + 7.5 = 12.5$$

Curved area

$$= \frac{22}{7} \times 3.5 \times 12.5 - 2.1 \times 7.5h$$

$$= 88 \text{ cm}^2$$


M1


M1	for area
M1	for difference

a1

4

17.	(a) (i) Mumo's contribution: $\frac{25}{100} \times (30000 + 50000)$ $= 20000$ (ii) ratio - Keya : Limo : Mumo $= 30000:50000:20000$ $= 3:5:2$ (b) Mumo's share of profit $= \frac{2}{10} \times 25000$ $= 5000$ (c) (i) $20000 + x = 80000 \Rightarrow x = 60000$ $x = 50000$ (ii) Mumo's % contribution in business during 2 nd year $= \frac{70000}{150000} \times 100$ $= 46\frac{2}{3}\%$	M1 a1 M1 a1 M1 a1 M1 a1 M1 a1 a1 10	or $\frac{7}{15} \times 100\%$ M1 $= 46\frac{2}{3}\%$ a1
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18.	<p>(a) $1.54l = 1540 \text{ cm}^3$</p> <p>Volume $\frac{22}{7} \pi r^2 \cdot 10 = 1540$</p> $r = \sqrt{\frac{1540 \cdot 7}{22 \cdot 10}}$ $= 7$ <p>∴ Diameter = $2 \cdot 7 = 14 \text{ cm}$</p> <p>(b) (i) Length of ribbon</p> $= 2 \cdot \frac{22}{7} \cdot 14 + 2 \cdot 2$ $= 88 + 4 = 92$ <p>(ii) Surface area covered by ribbon</p> $= 88 \cdot 1.5 = 132 \text{ cm}^2$ <p>(c) Surface area</p> $= \frac{22}{7} \cdot 49 + \frac{22}{7} \cdot 14 \cdot 10$ $= 154 + 440$ $= 594 \text{ cm}^2$	<p>B1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>a1</p> <p>10</p>	 <p>addition of the overlap</p>
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19.	(a) Scale used:			
	<u>Ecolebooks.com</u> 90 m represent 90 m	B1		
	scale 1:1000	B1		
	(b) (i) perimeter of homestead			
	$2 \times 10 + 4$	M1		
	= 80 m	a1		
	(ii) area of piece of land in ha.			
	$AB = 13.8 \times 10 = 138;$ $BC = 6 \times 10 = 60$			
	$\frac{\frac{1}{2} \times 60 + 90 \times 138}{10000}$	M1 M1		conversion to Hectares
	= 1.035 ha	a1		
(c) = distance from centre of homestead to side CD shown	B1			
Distance, 3.6 cm, on map	B1			
actual distance $3.6 \times 10 = 36$ m	B1			
	10			

20.	<p>(a) Gradient of L_1</p> <p>Ecolebooks.com</p> $\frac{1-2}{6-3}$ $= \frac{1}{3}$ <p>equation of L_1</p> $= \frac{y-1}{x-6} = \frac{1}{3}$ $3y - 3 = x - 6$ $3y = x - 3$ $y = \frac{1}{3}x - 1$ <p>(b) Gradient of L_2</p> $= \frac{-1}{\frac{1}{3}}$ $= -3$ <p>equation $\frac{y-2}{x-1} = -3$</p> $y = -3x - 1$ <p>& $3x + y + 1 = 0$</p> <p>(c) equation of L_3</p> $\frac{y-1}{x-1} = -3$ $y - 1 = -3x - 1$ $y = -3x + 4$ <p>x intercept: when $y = 0$, $x = \frac{4}{3}$ coordinates of x intercepts $(\frac{4}{3}, 0)$</p> <p>y intercept: when $x = 0$, $y = 4$ coordinates of y intercept $(0, 4)$</p>	<p>M1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>B1</p> <p>10</p>	
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21.



Ecolebooks.com

(a) Lines PQ and Pr angle
75° constructed
completion of \triangle
PQr.

B1
B1
B1
B1

(b) (i) = bisector of Pr

(ii) angle bisector +
QPr
+ POM 60c ! 1c


B1

B1
B1

(iii) circle with radius OM
Xy = 4.3 ! 0.1

B1
B1
B1

10

22.	(a) (i) $\frac{400\text{m}}{64\text{s}}$ <u>Ecolebooks.com</u> = 6.25 m/s	M1	
		a1	
	(ii) speed during second lap		
	6.25 # 1.06	M1	
	6.625 m/s	a1	
	(b) (i) total time for two laps		
	time for 2 nd lap = $\frac{400}{6.625}$	M1	
	b 60.38 s		
	total time = 64 + 60.38	M1	
	= 124.38 s	a1	
(ii) average speed in km/h			
$\frac{800}{124.38}$ m/s	M1		
= $\frac{800}{124.38} \# \frac{3600}{1000}$	M1	: conversion	
= 23.15 km/h	a1		
	10		

23.	<p>(a) (i) amount of money spent</p> <p>Ecolebooks.com $\frac{420}{8} \# 20 + 50$</p> <p>$= 1100$</p> <p>(ii) number of bananas sold</p> <p>$= 420 + \frac{420}{70} - 14$</p> <p>$= 412$</p> <p>(b) (i) s.p. of bananas</p> <p>$= 1100 \# 1.6$</p> <p>$= 1760$</p> <p>let x be number of bananas sold at sh 30</p> <p>$\sim \frac{x}{5} \# 30 + \frac{412 - x}{3} \# 10 = 1760$</p> <p>$18x + 412 - 10x = 1760$</p> <p>$x = 145$</p> <p>(ii) No of bananas sold at sh 10</p> <p>$= 412 - 145 = 267$</p> <p>amount of money obtained</p> <p>$= \frac{267}{3} \# 10$</p> <p>$= 890$</p>	<p>M1</p> <p>a1</p> <p>B1</p> <p>M1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>M1</p> <p>a1</p> <p>10</p>	
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(a) (i) 3 rST : drawn

B1

(ii) area of 3 rST: $\frac{1}{2} \times 5^2$
= 12.5

M1
a1

(b) (i) Plotting point U
coordinates of point U $(2, 1)$

B1
B1

(ii) Plotting of point V
coordinates of point V $(7, 6)$

B1
B1

(c) area of quadrilateral rSTV
diagonals rT = $\sqrt{50}$
and SV = $\sqrt{200}$

B1 for rT and SV

$$\begin{aligned} \text{area} &= \frac{1}{2} \times \sqrt{50} \times \sqrt{200} \\ &= \frac{1}{2} \times 5\sqrt{2} \times 10\sqrt{2} \\ &= 50 \end{aligned}$$

M1

a1

4.3.4 Mathematics Alternative B Paper 2 (122/2)

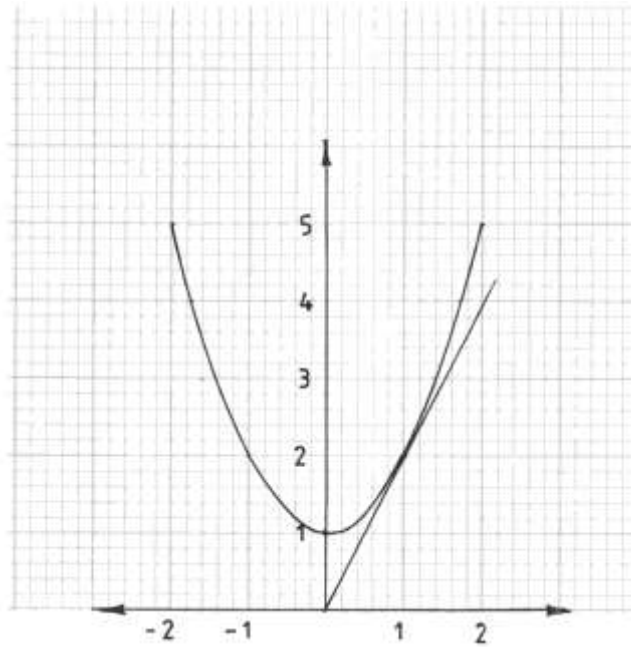


1.	<p>Ecolebooks.com</p> $\frac{(0.214)^{1/2} - (0.38)^3}{(0.817)^{1/4}} = \frac{0.40772934}{0.950726313}$ $= 0.4289$	<p>B1</p> <p>B1</p>	
		2	
2.	<p>(a) $\frac{ar^5}{ar^2} = \frac{5}{32} \# \frac{4}{5}$</p> $r^3 = \frac{1}{8} \quad \& \quad r = \frac{1}{2}$ <p>(b) $ar^2 = \frac{5}{4}$</p> $a \# \frac{1}{2} \cdot \frac{1}{2} = \frac{5}{4} \quad \& \quad a = \frac{5}{4} \# \frac{4}{1}$ $a = 5$	<p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p>	
		4	
3.	$\frac{1}{2} \# 4a \# 3a + (3a + 3) = 60$ $2a(6a + 3) = 60$ $12a^2 + 6a - 60 = 0$ $2a^2 + a - 10 = 0$ $(2a + 5)(a - 2) = 0$ $a = 2 \text{ or } a = -\frac{5}{2}$ $a = 2$	<p>M1</p> <p>M1</p> <p>a1</p>	
		3	
4.	<p>Complete squares = 12</p> <p>Part squares = 20</p> $\text{approx. area} = 12 + \frac{20}{2}$ $= 22$	<p>B1</p> <p>M1</p> <p>a1</p>	<p>for 12 and 20</p>

5.	$a = 48000 (1.05)^3$ <u>Ecolebooks.com</u> $= 55\ 566$ interest = $55\ 566 - 48\ 000$ $= 7\ 566$	M1 a1 B1 3	
6.	$3(4\hat{i} + 5\hat{j}) - 2(8\hat{i} - 3\hat{j}) = p\hat{i} + 3q\hat{j}$ $12\hat{i} + 15\hat{j} - 16\hat{i} + 6\hat{j} = p\hat{i} + 3q\hat{j}$ $-4\hat{i} + 21\hat{j} = p\hat{i} + 3q\hat{j}$ $\therefore p = -4$ $3q = 21 \ \& \ q = 7$	M1 M1 a1 3	for $-4\hat{i} + 21\hat{j}$ for both $p = -4$ and $q = 7$
7.	In 1h a does $\frac{1}{8}$ of work B does $\frac{1}{10}$ of work In 3h both a and B do $3 \cdot \frac{1}{8} + \frac{1}{10} \hat{j}$ $= \frac{27}{40}$ of work remaining piece of work $= 1 - \frac{27}{40}$ $= \frac{13}{40}$ Time for a to complete the remaining work $= \frac{13}{40} \cdot \frac{1}{\frac{1}{8}}$ $= 2 \frac{3}{5} \text{ h}$	M1 M1 M1 a1 4	

8.

Ecole



tangent at a

$$\begin{aligned} \text{gradient} &= \frac{4 - 0}{2 - 0} \\ &= 2 \end{aligned}$$

B1

M1

a1

3

9.

$$\tan^{-1} 3 = 60$$

$$2\theta - 30 = 60^\circ, 240^\circ, 420^\circ, 600^\circ$$

$$2\theta = 90^\circ, 270^\circ, 450^\circ, 630^\circ$$

$$\theta = 45^\circ, 135^\circ, 225^\circ, 315^\circ$$

B1

B1

B1

3

10.

$$\text{Longitude difference} = 50^\circ + 22^\circ$$

$$= 72^\circ$$

$$\text{Distance} = \frac{72}{360} \times \frac{22}{7} \times 2 \times 6370$$


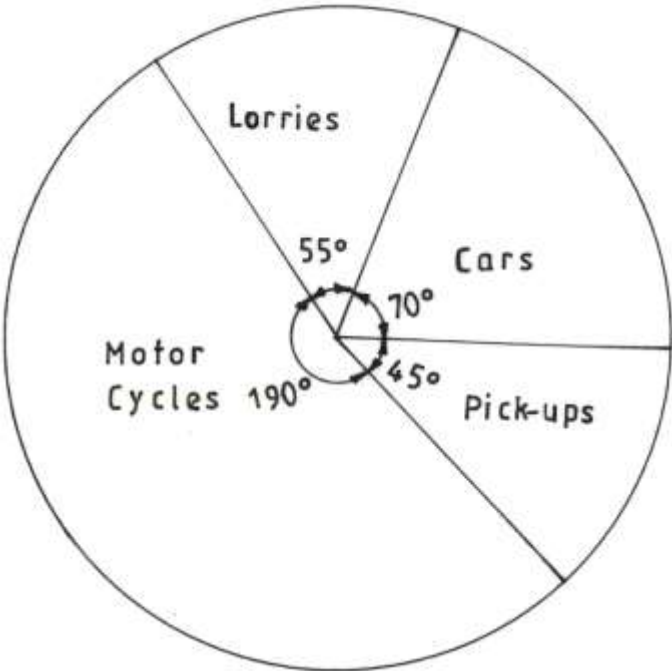
$$= 8008 \text{ km}$$


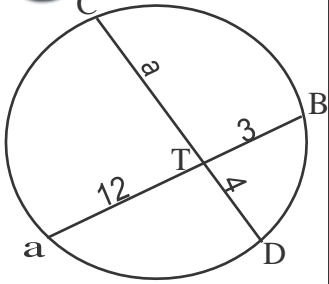
M1

M1

a1

3

11.	$\det c \begin{matrix} 8 & 3 \\ 4 & 2 \end{matrix} = 16 - 12 = 4$ Ecolebooks.com Matrix $N = \frac{1}{4} c \begin{matrix} 2 & -3 \\ -4 & 8 \end{matrix} m$ $= c \begin{matrix} \frac{1}{2} & -\frac{3}{4} \\ -1 & 2 \end{matrix} m$	B1 M1 a1 3	
12.	$5x + 6y = 50$ $7x + 5y = 53$ $42x + 30y = 318$ $25x + 30y = 250$ $17x = 68$ $x = 4$ $20 + 6y = 50$ & $y = 5$	M1 M1 a1 B1 4	for both equations set
13.	Angle for: Cars = $\frac{14}{72} \# 360c = 70c$ Lorries = $\frac{11}{72} \# 360c = 55c$ Motor cycle = $\frac{38}{72} \# 360c = 190c$ Pick ups = $\frac{9}{72} \# 360c = 45c$ 	B2 B1	all angles correct (allow B1 for 3 correct)

16.	<p>Let $CT = a$</p> <p>Ecolebooks.com</p> <p>$a \cdot TB = CT \cdot TD$</p> <p>$12 \cdot 3 = a \cdot 4$</p> <p>$a = \frac{12 \cdot 3}{4}$</p> <p>$= 9$</p> <p>$CT : TD = 9:4$</p>	<p>M1</p> <p>a1</p> <p>B1</p>	 
			3
17.	<p>(a) (i) $40000 \cdot \frac{20.5}{100}$</p> <p>$= 8200$</p> <p>(ii) total hire purchase price</p> <p>$= 8200 + 12 \cdot 4800$</p> <p>$= 65800$</p> <p>(iii) deposit as percentage of hire purchase price</p> <p>$= \frac{8200}{65800} \cdot 100\%$</p> <p>$= 12.46200608 = 12.5\%$</p> <p>(iv) h.p. price more than cash price</p> <p>$= 65800 - 40000 = 25800$</p> <p>(b) Bidii's deposit as percentage of cash price</p> <p>$= 65800 - (12 \cdot 4000)$</p> <p>$= 17800$</p> <p>%age $= \frac{17800}{40000} \cdot 100\%$</p> <p>$= 44.5\%$</p>	<p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>M1</p> <p>a1</p> <p>B1</p>	
			10

18.	<p>(a) EcoleBooks.com number of pieces be n</p> $15 = 0.5 + (n - 1) \times 0.25$ $0.25n = 14.75$ $n = 59$ <p>(ii) length of 10th piece</p> $= 0.5 + (10 - 1) \times 0.25$ $= 0.5 + 9 \times 0.25 = 2.75 \text{ m}$ <p>(iii) $S_{59} = \frac{59}{2} \times 2 \times 0.5 + 58 \times 0.25,$</p> $= 457.25 \text{ m}$ <p>(b)</p> $63 = \frac{n}{2} \times 2 \times 0.5 + (n - 1) \times 0.25,$ $126 = n \{1 + 0.25n - 0.25\}$ $0.75n + 0.25n^2 = 126$ $n^2 + 3n - 504 = 0$ $(n + 24)(n - 21) = 0$ $n = -24 \text{ or } 21$ $n = 21$	<p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>M1</p> <p>M1 or equivalent</p> <p>a1</p> <p>B1</p>	
		10	

19. (a)

Ecolebooks.com

x	-6	-5	-4	-3	-2	-1	0	1	2	3
y	13	5	(-1)	-5	-7	-7	(-5)	-1	5	13

B2 (allow B1 for 5 values :)

(b) (i)



(ii) -4.2, 1.2

c(i)

(-3.2, -4.5)

(2.2, 6.5)

S1
P1
C1
B1
B1
L1
B1
B1

: coordinates

10

20. (a) The mean:

Ecolebooks.com

$$\frac{2 \# 34.5 + 4 \# 44.5 + 10 \# 54.5 + 13 \# 64.5 + 14 \# 74.5 + 5 \# 84.5 + 2 \# 94.5}{50}$$

$$= \frac{3285}{50}$$

$$= 65.7$$

(b)

Marks	30-39	40-49	50-59	60-69	70-79	80-89	90-99
frequency	2	4	10	13	14	5	2
cf	2	6	16	29	43	48	50

B1
M1
a1

B1
: cfs



(c) (i) median : 66.5

(ii) position of student who scores 75 = 37th

S1
P1
C1

B1
B1
B1
25th pos
for 66.5

21.	<p>(a) $aD = \sqrt{9.2^2 - 6^2}$ <u>Ecolebooks.com</u> $= 7.0$</p> <p>(b) angle $aBD = \cos^{-1} \frac{6}{9.2}$ $= 49.3c$</p> <p>(c) $\frac{BC}{9.2} = \tan 40c$ $BC = 9.2 \tan 40$ $= 7.7$</p> <p>(d) Area of ΔACD: $+ADB = 90c - 49.3c = 40.7$</p> <p>Side DC: $\frac{9.2}{DC} = \cos 40c$ $DC = \frac{9.2}{\cos 40c} = 12 \text{ cm}$</p> <p>Area ΔACD $= \frac{1}{2} aD \# DC \sin (40 + 40.7)$ $= \frac{1}{2} \# 7 \# 12 \# \sin 80.7$ $= 41.4 \text{ cm}^2$</p>	<p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>B1</p> <p>B1</p> <p>M1</p> <p>a1</p> <p>10</p>
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22.	<p>(a) P(Daudi uses a train and is punctual)</p> <p>Ecolebooks.com</p> $= 0.24$ <p>(b) P(Daudi uses bus and is late for work)</p> $= 0.5 \times 0.3$ $= 0.15$ <p>(c) P(Daudi punctual)</p> $= 0.3 \times 0.8 + 0.5 \times 0.7 + 0.2 \times 0.9$ $= 0.24 + 0.35 + 0.18$ $= 0.77$ <p>(d) P(Daudi late)</p> $= 1 - 0.77$ $= 0.23$ <p>(e) P(Daudi uses train or bus and is punctual)</p> $= 0.3 \times 0.8 + 0.5 \times 0.7$ $= 0.59$	<p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p> <p>M1</p> <p>a1</p>	<p>10</p>
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23.



Ecolebooks.com



(a) (i)

$$(ii) \begin{pmatrix} -\frac{3}{5} & \frac{4}{5} & 2 & 2 & 6 \\ \frac{4}{5} & \frac{3}{5} & 4 & 9 & 2 \end{pmatrix} \begin{matrix} c \\ m \\ c \\ m \\ c \\ m \end{matrix} = \begin{pmatrix} 2 & 6 & -2 \\ 4 & 7 & 6 \end{pmatrix} \begin{matrix} c \\ m \\ c \\ m \\ c \\ m \end{matrix}$$

(b) Reflection in line $y = 2x$

(c) (i)

$$(ii) \text{ matrix of } H = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{matrix} c \\ m \\ c \\ m \end{matrix}$$

$$(d) HT = \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix} \begin{matrix} c \\ m \\ c \\ m \end{matrix} = \begin{pmatrix} -\frac{3}{5} & \frac{4}{5} \\ \frac{4}{5} & \frac{3}{5} \end{pmatrix} \begin{matrix} c \\ m \\ c \\ m \end{matrix} = \begin{pmatrix} \frac{3}{5} & -\frac{4}{5} \\ -\frac{4}{5} & -\frac{3}{5} \end{pmatrix} \begin{matrix} c \\ m \\ c \\ m \end{matrix}$$

B1 ΔABC drawn

M1

a1

B1 $\Delta A'B'C'$ \checkmark drawn

B1 reflection

B1 equation $y = 2x$ B1 $\Delta A''B''C''$ \checkmark drawn

B1

M1 or equivalent

a1

24.



Dr			Cr		
Date	Particulars	Sh Cts	Date	Particulars	Sh Cts
2014			2014		
January			January		
1	Balance	3250.00	3	Oranges	9000.00
5	Orange	11750.00	4	Pawpaw	1650.00
6	Pawpaw	1812.50	4	Vegetables	700.00
6	Vegetable	1140.00	4	Transport	200.00
			8	Market fees	150.00
			10	Wages	400.00
			11	Balance	5852.50
		17952.50			17952.50

Oranges sales = 11750.00
 Pawpaw sales = 1812.50
 Oranges purchase = 9000.00
 Pawpaw purchase = 1650.00
 all other entries correct

Totals
 Dr/Cr columns = 17952.50

Balance on 11/01/2011

= Sh 17952.50 - (900 + 1650 + 700 + 200 + 150 + 400)

= 5852.50

B1
 B1
 B1
 B1
 B2

M1
 a1

M1
 a1

10