MATHEMATICS SCHEME K.C.S. E PAPER 2 2008

No.
6.373
0. 6944
0.004636

1. Log
0. 8043 M1 All 3 logs correct
T. 8416 +
0. 6459
3.6661 ÷ 2 M1 2nd log and all operation
2. 8331 (+, ÷, -)
1. 8128

64.98 A1

3

2. q – n + q = 1 + rh
q- 1 = rh + htq M1 Grouping

B1 Construction of 45^0 and completion of Δ

B1 Bisecting two angles to determine
The centre

B1 Dropping a perpendicular from centre
To a side and drawing the circle

$q - 1 = h(r + tq)$

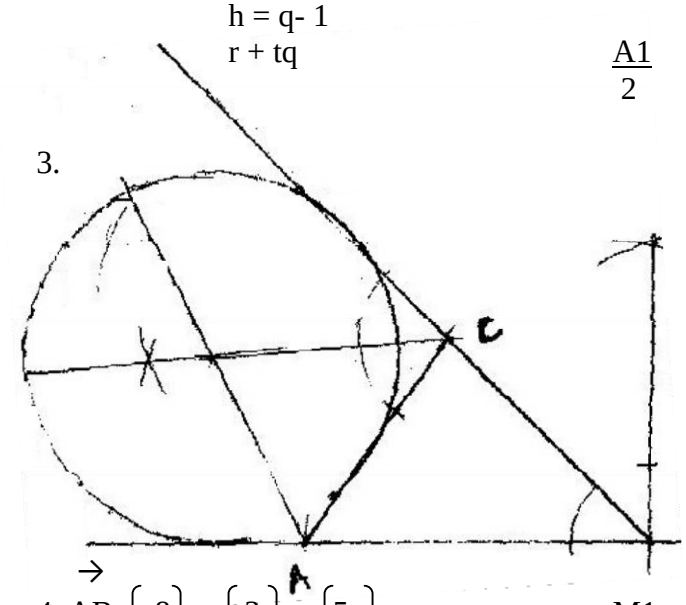
$h = q - 1$

$r + tq$ A1

2

03

3.



Or $OP = {}^{3}/_{5}\begin{pmatrix}3\\-1\\4\end{pmatrix} + {}^{2}/_{5}\begin{pmatrix}8\\-6\\6\end{pmatrix}$ M1 M1

Ratio theorem

% error = $\frac{0.3}{50 \times 6} \times 100$ M1 A1

4. $AB = \begin{pmatrix}8\\-6\\6\end{pmatrix} - \begin{pmatrix}3\\-1\\-4\end{pmatrix} = \begin{pmatrix}5\\-5\\10\end{pmatrix}$ M1

$OP = OA + AP$

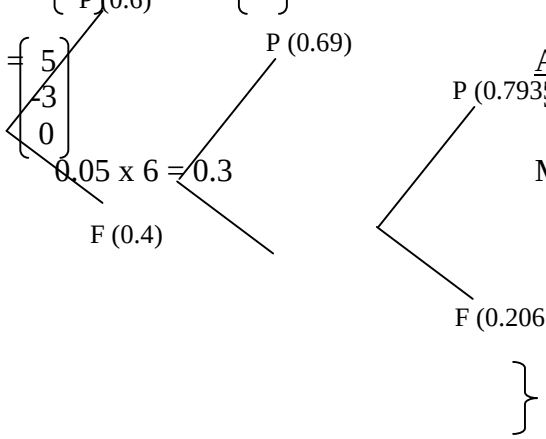
$= \begin{pmatrix}3\\-1\\-4\end{pmatrix} + {}^{2}/_{5}\begin{pmatrix}5\\-5\\10\end{pmatrix}$ M1

6.

$= \begin{pmatrix}5\\-3\\0\end{pmatrix}$ A1

3

5. $0.05 \times 6 = 0.3$ M1



$= 0.1\%$ 3

P passing in 2nd attempt) $0.4 \times 0.69 = 0.276$ M1 For either of the two

P passing in 3rd attempt $0.4 \times 0.31 \times 0.7935$

Passing in 2nd or 3rd attempt

$0.4 \times 0.69 + 0.4 \times 0.31 \times 0.7935$ M1 For adding the two probability

0.276 + 0. 098394 A1 Allow for (0.3 + 0.09)

= 0.374394 3 Accept 4 s.f.

7. (i) Distance = 500 x 9/4 = 1125 nm B 1 (ii) θ x 60 x 10553.4 = 1125 M1

$\theta = \frac{1125}{60 \cos 53.4^0}$

$= 31.45^0$

Longitude of θ = 71.45^0E A1 Allow without E

8. (a) $(10+ {}^2/_x)^5 = 10^5 + 10^{4/2}/x)^5 + 10^3({}^2/_x)^2 + 10^2({}^2/_x)^3 + 5.10\ ({}^2/x)^4$ M1

$= 100000 + \frac{100000}{x} + \frac{40000}{x^2} + \frac{2000}{x^3} + \frac{800}{x^4} + \frac{32}{x^5}$ M1

(b) $(14^5) = (10+ {}^2/_x)^5 \quad {}^2/_x = 4 \qquad x = {}^2/_4 = ½$

$= 100000 + \frac{100000}{½} + \frac{400000}{(½)^2} + \frac{2000}{(½)^3} + \frac{800}{(½)^4} + \frac{32}{(½)^5}$ M1 Give if any 4 terms in the expression are correct

$= 100000 + 200000 + 16000 + 64000 + 12800 + 1024$

$= 537824$ A1

4

9. Δ ADC and Δ BAC are similar

$\frac{AC}{BC} = \frac{4}{3}$

Area scale factor = $({}^4/_3)^2 = {}^{16}/_9$ M1 or equivalent

Area of Δ ADC = $({}^{16}/_9 \times 24$ M1

$= 42\ {}^2/_3\ cm^3$ A1 Accept 42.67 cm^2

3

10. Let $T = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} 2 & 4 \\ 3 & 8 \end{pmatrix} = \begin{pmatrix} 2 & 4 \\ 15 & \end{pmatrix}$

$2a + 2b = 2 \quad 2c + 2d = 8$

$4a + 3b = 4 \quad 4c + 3d = 15$

$4a + 4b = 4 \quad 4c + 4d = 16 \quad 4a + 3b = 4$

$4c + 3d = 15$

$b = 0 \quad d = 1$

$a = 1 \quad c = 3$

$$\therefore T = \begin{pmatrix} 1 & 0 \\ 3 & 1 \end{pmatrix}$$

11. $x^2 + y^2 - 2x + 5y = {}^7/_4$ B1 $x^2 - 2x + 1 + y^2 + 5y + \underline{25} = \underline{7} + 1 + \underline{25}$

4 4 4 B1

$(x-1)^2 + (y + {}^5/_2)^2 = 9$

Centre = (1 – 2 ½) B1

12. Log ($\underline{3y + 2}$) = log (y- 4) M1 Single logs

10

$\underline{3y + 2} = y - 4$ M1 Dropping of logs

10

$3y + 2 = 10y - 40$

$7y = 42$ A1

$y = 6$ 3

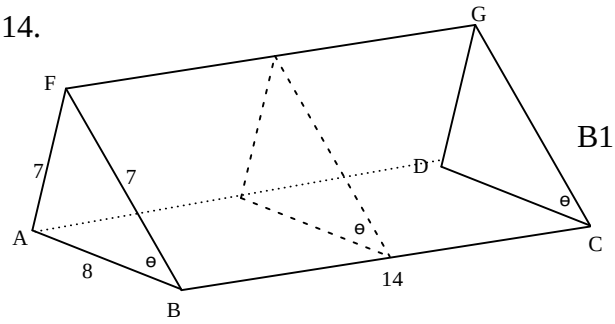
13. $\dfrac{\sqrt{3}}{1 - \cos 30^0} = \dfrac{\sqrt{3}}{1 - \sqrt{}\,{}^3/_2}$ B1 For $\cos 30^0 = \sqrt{3}$ in the expression 2

$= \dfrac{2\sqrt{3} - (2 + \sqrt{3})}{(2\sqrt{3})(2 + \sqrt{3}}$ M1 (Rationalization)

$= \dfrac{2\sqrt{3}(2 + \sqrt{3})}{4 - 3}$ A1

$= 4\sqrt{3} + 6$ 3

14.



B1 Identifying the angle may be implied

Cos θ = $^4/_7$ = 0.5714286 M1 or equivalent θ = 55.1500954^0 A1

$= 55.15^0$ 3

15. Distance traveled = $\left[\frac{9}{3} t^3 - \frac{4}{2} t^2 + t\right]_2^3$ M1 For integration

$(3 \times 3^3 - \frac{4}{2} \times 3^2 + 3) - (2 \times 2^3 - 2 \times 2^2 + 2)$ M1 Allow if two terms without units

= 66 – 18 A1

= 48M 3

16. $2 (1- \sin^2 x) \sin x = 1$ M1 Subtraction 2

$\sin^2 x + \sin x – 1 = 0$

$(2 \sin x – 1) (\sin x + 1) = 0$ M1 factors

Sin x = ½ or Sin x A1 Both

$X = \frac{1}{6}\pi_c, \frac{5}{6}\pi_c, \frac{3}{2}\pi_c$ B1 allow if C is omitted 4

17. (a) CP = 400 x 30 + 350 x 50 M1

29500

SP = $\frac{120}{100}$ x 29500 M1

= 35400

1 Bag = 35400 ÷ 80 = M1

= Ksh 442. 50 A1

(b) $\frac{400 x + 350y}{x + y}$ M1

$\underline{400x + 350y} = 383.50$ ALT $x + y$ M1 400 350

383.50

$400x + 350y = 383.5x + 383.5y$ M1 400 - 3805

$\Rightarrow 16.5x = 33.5y$ = 16.5

$x: y = 33.5 : 16.5$ 33.5 16.50

67: 33 A1

(c) $(3/8 + 67/100) : (5/8 + 33/100)$ M1

= 209: 191 A1

10

18.(a) $p = \frac{kq}{r^2}$ B1 May be implied

$q = k\frac{(12)}{4}$ $k = 3$ M1

$p = \frac{3\,(15)}{5^2}$ = 1.8 M1

A1

(b) $q = \frac{pr^2}{3}$ B1 Lost if k is not substituted

(c) $q = 1.2\ p\ (0.9r)^2$ M1 Allow if k is not substituted

$= 0.972\ \frac{pr^2}{3}$ M1

$\Delta q = 0.972\frac{pr^2}{3} - \frac{pr^2}{3}$

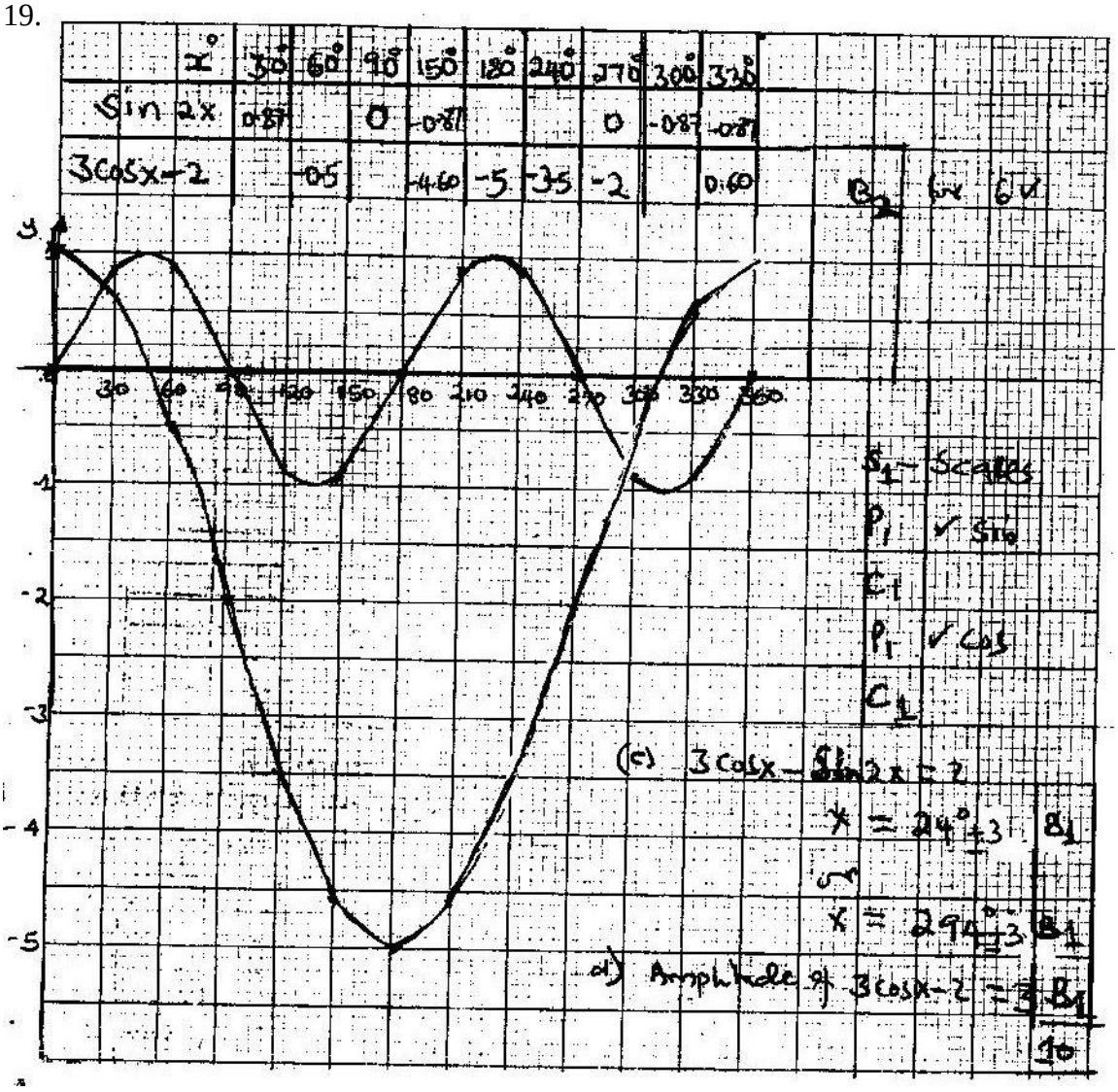
$= -0.028\ \frac{pr^2}{3}$ A1

$\% \Delta = (-0.028\frac{pr^2}{3} \div \frac{pr^3}{3}) \times 100$ M1 or $\frac{pr^2}{3} - 0.972\ \frac{pr^2}{3}$

$= 0.028\frac{pr^2}{3}$

= -2.8% A1 3

19.

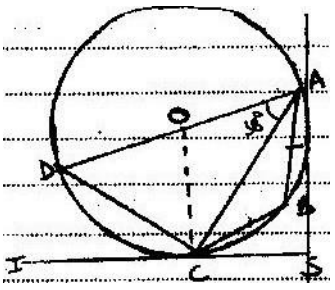


20. (a) (i) ∠ ADC = 52^0 or ∠ DCA = 38^0 or DCT = 38^0 B1

∠ ACS = 52^0 B1

(ii) ∠ CBA = 128^0 B1

∠ BCA = 26^0 B1



(b) (i) AC = 20 cos 38^0 M1 or equivalent

= 15.76 cm A1

(ii) AB = $\frac{15.76}{\text{Sin } 26^0 \quad \text{Sin } 128^0}$ M1 AB subject

AB = $\frac{15.76 \sin 26^0}{\sin 128^0}$ M1 May or implied with Answer

$= \frac{15.76 \times 0.4384}{0.7880}$ M1 4 s.f

= 8.768 cm A1

21. (a) B1 2.5/ 90^0 must be marked

x B1

(b) (i) $x^2 + y^2 = 2.5$ B1

$y/2.4 = x/3.2$

M1 Are the subject

(ii) $y = \frac{3}{4} x$

$x^2 + (\frac{3}{4} x)^2 = 2.5^2$ M1 Substitution

$16x^2 + 9x^2 = 6.25 \times 16$

$x^2 = \frac{6.25 \times 16}{25}$ A1

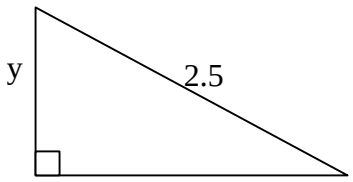
x = 2 km B1

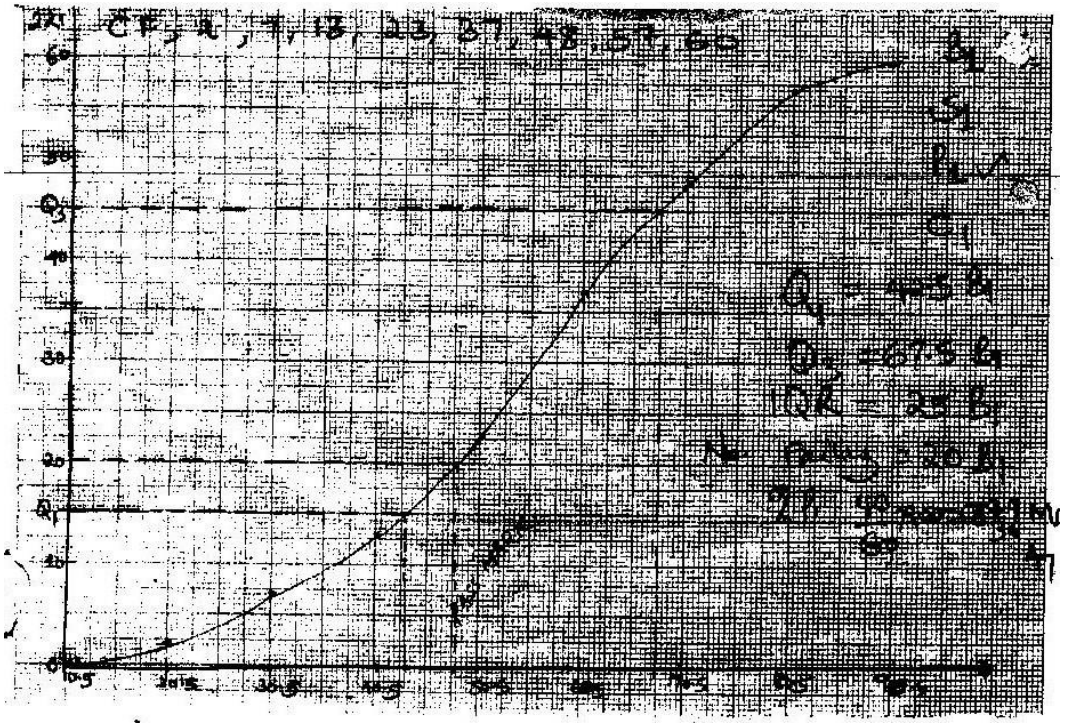
y = ¾ x 2 = 1.5 km

(iii) Time taken = $^2/_{32}$ or $^{1.5}/_{2.4}$ A1

M1

= 0.625 hours A1 or 37 ½ min or $^5/_8$ hrs 10





22.

23. (a) Internet = 10937 x $^{8}/_{100}$ x 2 M1

= 17500

Amount = 109375 + 17500 M1 Summation

Kshs 126 875 A1

(b) (i) 1st yr value = $\frac{96}{100}$ x 126 875 M1

Kshs 121 800 A1

(ii) 4th year value = 121 800 $(1 + {}^{6}/_{100})^{9}$ B1 n = 9 been in formula

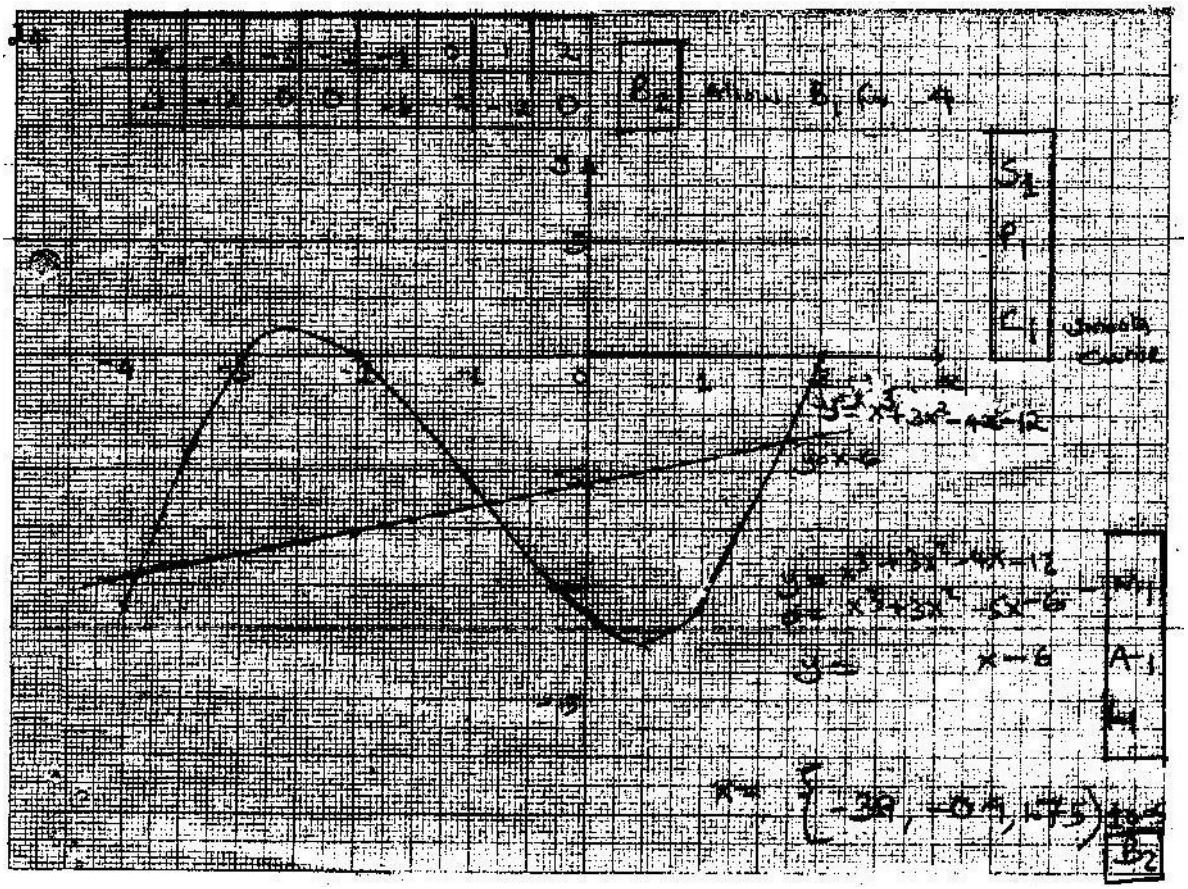
M1

= 205779 A1

(c) % gain = $\frac{205779 - 126875}{126875}$ x 100 M1 Whole expression

= 62.19% A1 C.A.O

24.



MATHEMATICS PAPER 1
MARKING SCHEME - 2009

1	$\sqrt{5184}$ $6x - 18 \div 9 + (5 - -3)$ $= \frac{\sqrt{2^6 \times 3^4}}{6x - 18 \div 9 + 8}$ $= \frac{2^3 \times 3^2}{6x - 2 + 8}$ $= \frac{72}{-4}$ $= -18$	M_1 M_1 A_1 03	✓ Method of $\sqrt{5184}$ without the prime. ✓ order of operations
2	$\frac{2\frac{1}{4} + \frac{3}{5} \div \frac{5}{6} \text{ of } 2\frac{2}{5}}{1\frac{7}{10}}$ $= \frac{2\frac{1}{4} + \frac{3}{5} \times \frac{6}{5} \times \frac{5}{12}}{1\frac{7}{10}}$ $= \frac{2\frac{1}{4} + \frac{3}{5} \times \frac{1}{2}}{\frac{17}{10}}$ $= \left(2\frac{1}{4} + \frac{3}{10}\right) \div \frac{17}{10}$ $= 51/20 \times \frac{10}{17}$ $= 3/2 \text{ or } 1\frac{1}{2}$	M_1 M_1 A_1 03	✓ order for operations in numerator Multiplying by $10/17$
3	$x : y = 2 : 3 \Rightarrow \frac{x}{y} = \frac{2k}{3k}$ where k is a constant $x = 2k \quad ; \quad y = 3k$ Now $(5x - 2y) : (x + y)$ $[5(2k) - 2(3k)] : (2k + 3k)$ $4k : 5k$ $\Rightarrow 4 : 5$	B_1 M_1 A_1 03	Alt. 1 $\frac{x}{y} = \frac{2}{3}$ M_1 $x = \frac{2}{3}y$ or $y = \frac{3}{2}x$ M_1 $\left\{5\left(\frac{2}{3}\right)y - 2y\right\} : \left(\frac{2}{3}y + y\right)$ $4 : 5$ A_1 Alt. 2: $x = 2 \quad y = 3$ M_1 $\therefore 5(2) - 2(3) : 2 + 3$ M_1 $4 : 5$ A_1

4.	Distance covered by bus		Alt. 1.
	$= 63 \times (10.45 - 8.15)$	M_1	Extra distance
	$= 63 \times 2.5$		$63 \times \frac{3}{4} = 47.25$
	$= 157.5$		Relative speed M_1
	Speed of car $\frac{157.5}{1.75}$	M_1	$x - 63$
	$= 90$ km/h		$\frac{47.25}{x-63} = \frac{7}{4}$ M_1
		A_1	$x = 90$
		03	$\frac{63 \times 150}{105} = 90$ km/h
5	$64^{-\frac{1}{2}} \times 27000^{\frac{2}{3}}$		
	$2^{-4} \times 3^3 \times 5^2$		
	$= \frac{1}{\sqrt{64}} \times (\sqrt[3]{27000})^2$	M_1	Removal of -ve indices
	$\frac{1}{16} \times 3^3 \times 25$	M_1	Removal of roots.
	$= \frac{1}{8} \times 900 \times \frac{16}{25}$	A_1	Simplification
	$= 72$	B_1	
		04	
6	$AC = \sqrt{85^2 - 75^2} = \sqrt{1600}$	M_1	
	$= 40$		
	Area of quad. ABCD		
	$\frac{1}{2} \times 40 \times 75 + \sqrt{75(75-60)(75-50)(75-40}$	M_1	Sum of both areas
	$= 1500 + \sqrt{984375}$		
	$= 1500 + 992$		
	$= 2492\ m^2$	A_1	
	$= 0.25$ ha	B_1	
		04	
7.	Time between Monday 0545h and Friday 1945h		
	$= 4 \times 24 + 14$	M_1	Expression leading to 110hrs
	$= 110$ h		
	Time lost $= 0.5 \times 110 = 55$ Min		
	Time shown in 12hour system		
	$1945 - 55 = 1850$ h	M_1	
	$= 6.50$ p.m	A_1	
		03	

8 $\dfrac{12x^2 + 9x - 6a^2}{9x^2 - 4a^2}$

$\dfrac{(4x + 3a)(3x - 2a)}{(3x + 2a)(3x - 2a)}$

$= \dfrac{4x + 3a}{3x + 2a}$

M1 √ Factorising numerator fully

M1 " denominator √ly.

A1

03

9 $y = -\frac{2}{5}x + 2$

gradient $= -\frac{2}{5}$

$\dfrac{k - 5}{3 - -2} = -\dfrac{2}{5}$

$k - 5 = -2$

$\Rightarrow k = 3$

$5y + 2x = 10$

B1 $5(5) + 2(-2) = 21$

M1 $5k + 6 = 21$

(k,3) $5k = 15$

$k = 3$

A1

03

10 let exterior ∠ = ∠at the centre) be x

$\therefore 6.5x + x = 180$

$7.5x = 180$

$x = 24°$

$\therefore$ No. of sides $= \dfrac{360}{24}$

$= 15$ sides

Alt. 1.

M1 let the no. of sides = n

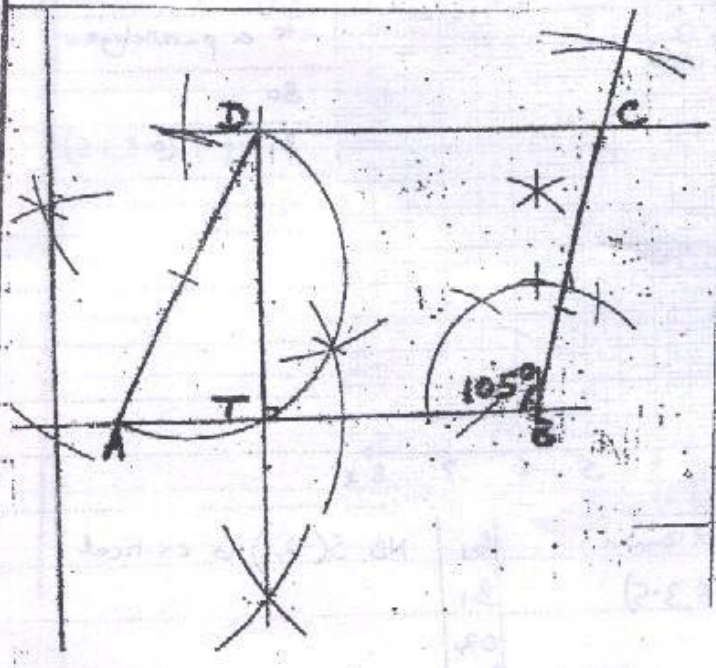
$\dfrac{360}{n} \times 6.5 + \dfrac{360}{n} = 180$ M1 M1

M1 $180n = 2700$

A1 $n = 15$ A1

03

11



- construction of 105° B1
- fixing point C and constructing line parallel to AB through C B1
- completion of trapezium ABCD B1
- location of point T from D only if any above B above last B1

04

12. let angle between ground and wire be $\theta°$

$\therefore \theta + \frac{1}{3}\theta = 90$

$\Rightarrow \theta = 90 \times \frac{3}{4} = 67.5$ — B1 or 22.5°

let the wire be x cm in length

$\therefore \cos 67.5 = 6/x$

$x = \frac{6}{\cos 67.5} = \frac{6}{0.38268432}$ — M1

$= 15.68$m or 1568cm — A1

03

13. $\sin(3x+30) = \sin 60°$ — B1 for 60°

$\sin(3x+30) = \sin 120°$ — B1 for 120°

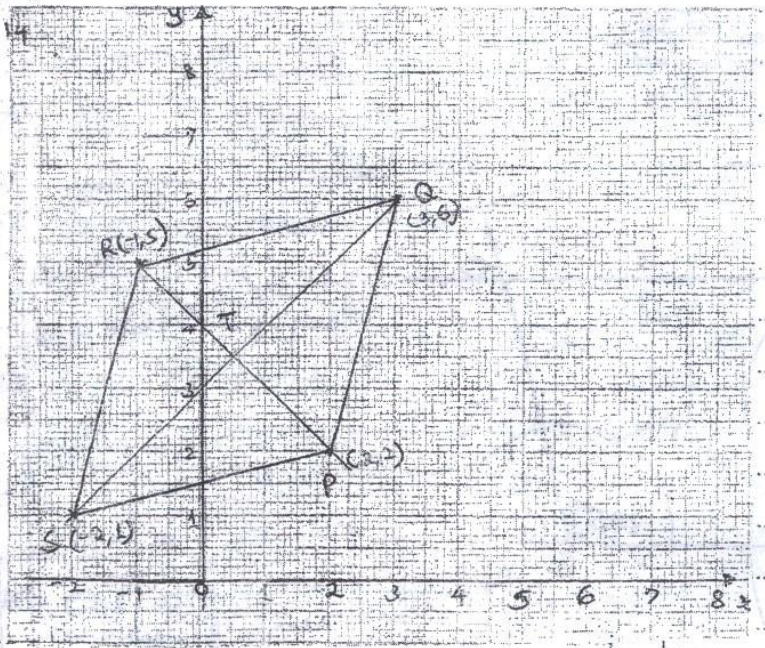
$3x + 30 = 60$

$3x + 30 = 120$

$x = 10°$, $x = 30°$ — B1 for 10°; B1 for 30°

04

14.



Different scales on x and y axis leads to a parallelogram. B0

B1 if T(0.5, 3.5)

(a) Rhombus PQRS Vly drawn — B1 NB S(-2,1) is critical

(b) Co-ordinates of T(0.5, 3.5) — B1

02

15 Commission earned

$0.225 \times 0.2 \times 3800$

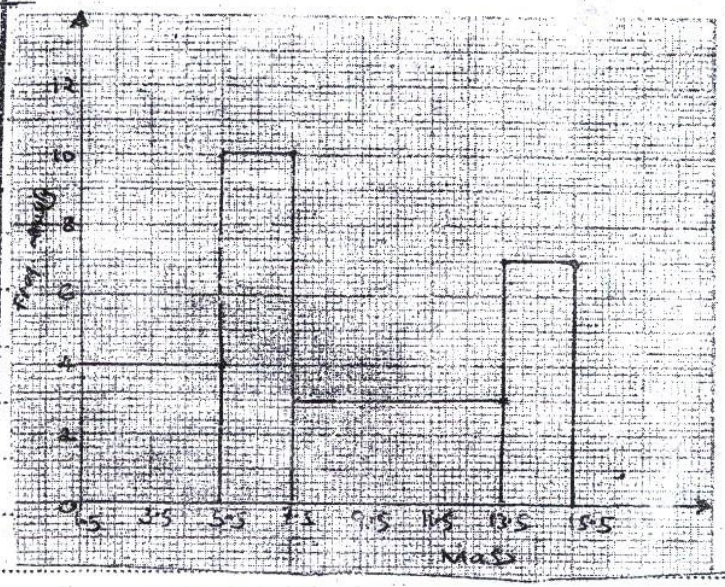
171

M1

A1

02

16



Frequency density = $\frac{\text{freq.}}{\text{C. Width}}$

1.5 – 5.5 ✓ bar B1

5.5 – 7.5 ✓ bar B1

7.5 – 13.5 bar B1

Check weights

Check weights

1.5 – 5.5 — 4 ✓

5.5 – 7.5 — 10 ✓

7.5 — 13.5 — 3 ✓

13.5 – 15.5 — 7 given.

17 a) $BC^2 = 6^2 + 8^2 - 2\times6\times8\times\cos 5°$ — M1

$= 100 - 61.71$

$BC = \sqrt{38.2912} = 6.19$ — A1

If drawn to scale the line DB is not a straight line there are too many possibilities

b) let $\angle ABC$ be $B°$

$\frac{\sin B}{6} = \frac{\sin 50°}{6.19}$ ∴ $\sin B = \frac{6\sin 50}{6.19}$ — M1

Accept 48.16, 48.15

$\therefore B = 47.95°$ — M1 A1

47.94°, 47.96° dependent on method used.

c) let $\angle CAD$ be $\alpha°$

$2.82^2 = 7^2 + 6^2 - 2\times7\times6\cos\alpha$ — M1

$\cos\alpha = \frac{49+36-7.9524}{84}$ — M1

$\alpha = 23.48°$. — A1

22.84 is possible

d) Area of $\triangle ACD = \frac{1}{2}\times7\times6\times\sin 23.48°$ — M1

Heron's formula $S = 7.91$

$\sqrt{7.91\times1.42\times2.91\times5.10}$

$= 8.37$

$= 8.37\ cm^2$ — A1

10

18 (a) (i) Modal Class 60–69 — B1

(ii) Class where Median mark lies

0–9	
10–19	3
20–29	7
30–39	14
40–49	24
50–59	40
60–69	60
70–79	66
80–89	69
90–99	70

Median is 35

Median class is 50–59 — B1

B1 for cf column or implied

class	centres x	fd	d = x − 1
0–9	4.5	−49.9	−46.9
10–19	14.5	−79.8	−39.9
20–29	24.5	−119.6	−29.9
30–39	34.5	−139.3	−19.9
40–49	44.5	−99.0	−9.9
50–59	54.5	1.6	0.1
60–69	64.5	20.2	10.1
70–79	74.5	120.6	20.1
80–89	84.5	90.3	30.1
90–100	94.5	40.1	40.1

B1 ✓ class centres

M1 ✓ deviations

B1 ✓ fd.

$\Sigma f = 70$ B1

$\Sigma fd = -33$ A1

Mean $= 54.4 - \frac{33}{70}$ M1

$= 53.93$ A1

9 (c) (i) Original price $= \frac{16200}{x}$	B1	
(ii) Price after discount $\frac{16200}{x+3}$	B1	
(b) (i) $\frac{16200}{x} - 60 = \frac{16200}{x+3}$	M1	or equivalent
$\Rightarrow (16200 - 60x)(x+3) = 16200x$	M1	Removal of denominators
$16200x + 48600 - 60x^2 - 180x = 16200x$		
$60x^2 + 180x - 48600 = 0$	M1	For quadratic equation
$x^2 + 3x - 810 = 0$		
$(x+30)(x-27) = 0$	M1	For factorization of quad. eqn.
$x = -30$ or $x = 27$		
No. of calculators bought = 30	A1	C.A.O or avoids -ve
(c) Initial cost of calculators		
$\frac{16200}{27} = 600$	M1	
Discount offered as a percentage		
$\frac{\frac{16200}{27} - \frac{16200}{30}}{600} \times 100$	M1	
$= 10\%$	A1	
	10	
20 (a) (i) $\underset{\sim}{ON} = \frac{1}{2}\begin{pmatrix}-8\\5\end{pmatrix} = \begin{pmatrix}-4\\2.5\end{pmatrix}$		Alt. 20 (a) (ii) $\vec{MN} = \begin{pmatrix}-6\\2.5\end{pmatrix}$ B1
N is $(-4, 2.5)$	B1	$\lvert\vec{MN}\rvert = \sqrt{-6^2 + 2.5^2}$ M1
$M = \left(\frac{-8+12}{2}, \frac{5-5}{2}\right)$	M1	$= 6.5$ A1
M is $(2, 0)$	A1	
(ii) $\underset{\sim}{NM} = \begin{pmatrix}6\\-2\frac{1}{2}\end{pmatrix}$	B1	
$\lvert NM\rvert = \sqrt{6^2 + (2.5)^2}$	M1	
$= 6.5$	A1	
(b) $\underset{\sim}{OB} = \begin{pmatrix}12\\-5\end{pmatrix}$, $\underset{\sim}{NM} = \begin{pmatrix}6\\-2\frac{1}{2}\end{pmatrix}$		Apply OW^{-1} If vector sign missing
$\therefore NM = \frac{1}{2}OB$	B1	
(c) $\underset{\sim}{OP} = \begin{pmatrix}2\\0\end{pmatrix} + 2\begin{pmatrix}-6\\2\frac{1}{2}\end{pmatrix} = \begin{pmatrix}-10\\5\end{pmatrix}$	M1	
$OP' = \begin{pmatrix}-10\\5\end{pmatrix} + \begin{pmatrix}-5\\8\end{pmatrix} = \begin{pmatrix}-15\\13\end{pmatrix}$	M1	
$\therefore P'$ is $(-15, 13)$	A1	
	10	

21 (a) Volume of water $\frac{6}{9+x} = \frac{2}{x}$ $x = 4.5$ M1

$\therefore$ Vol $= \frac{1}{3} \times 3.142 (6^2 \times 13.5 - 2^2 \times 4.5)$ M1

$= 508.94 - 18.25 = 490.09$ A1

(b)(i) Volume of Sphere

Top radius $\frac{r}{14.5} = \frac{2}{4.5}$ $r = 6.44\dot{4}$ M1

Volume $= \frac{1}{3} \times 3.142 (6.444^2 \times 14.5 - 6^2 \times 13.5)$ M1

$= 121.6 \Rightarrow 121\frac{11}{15}$ A1

(ii) $\frac{4}{3} \pi r^3 = 121.6$ M1

$r^3 = 121.6 \times \frac{3}{4\pi}$

$r = 3.073$ A1

Follow through

ALT 1:

LSF $14.5 : 4.5$

$29 : 9$

VSF $24389 : 729$

$\frac{24389}{729} = \frac{V}{18.849}$ (M1)

$V = \frac{24389}{729} \times 18.849 = 630.619$ (A1)

Volume of marble $= 630.619 - 508.938$ (M1)

$= 121.681$ (A1)

b(i) $V = \frac{1}{3} h (R^2 + Rr + r^2)$ M1

$= \frac{9}{3} (6^2 + 6 \times 2 + 2^2)$ (M1 M1)

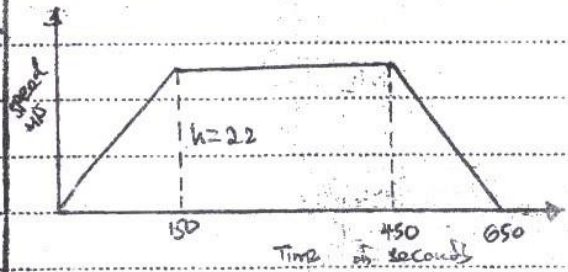
$= 156 \pi = 490.088$ (A1)

(ii) $\frac{1}{3} \times \frac{22}{7} (6.44^2 \times 14.5 - 6^2 \times 13.5)$

$= 630.79 - 509.14$

$= 121.65$

22



(a) $\frac{1}{2} \times 150h + \frac{1}{2} \times 200h + 300h = 10450$ M1 or equivalent.

$475h = 10450$

$h = 22$ M/S A1

Max speed $= \frac{22 \times 60 \times 60}{1000} = 79.2$ km/h B1 C.A.O

(b) Acceleration $\frac{22}{150}$ M/S M1

$= \frac{11}{75}$ A1 or $0.1467 M/S^2$ or $1900.8 km/h^2$

(c) $\frac{1}{2} \times 100 \times 11$ M1

$= 550$ A1

(d) Time for half of journey

$\frac{1}{2} \times 22 (150 + t + t) = \frac{1}{2} \times 10450$ M1

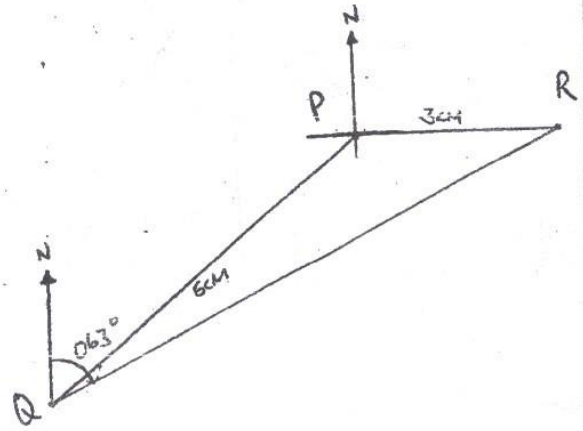
$t = 162.5$ A1

Total time $= 150 + 162.5$

$= 312.5$ B1

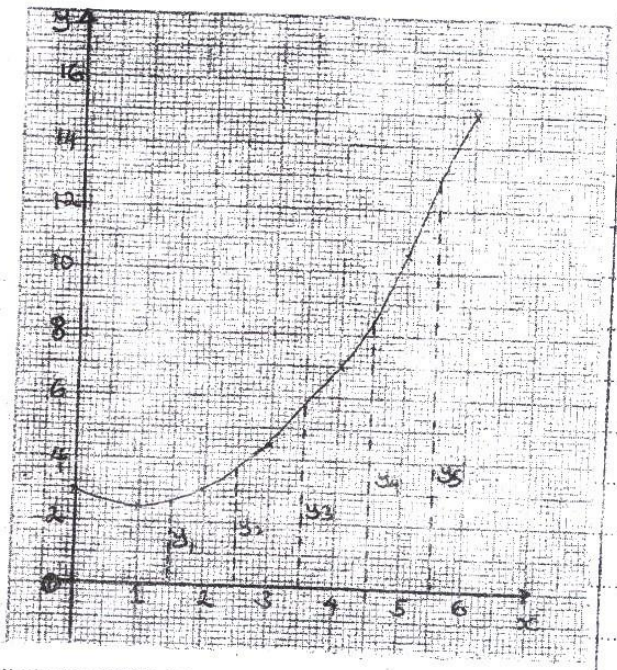
10

23



a) Direction and distance of Q from P	B_1	
- Direction and distance of R from P	B_1	
(i) Distance conversion		
8.5×40	M_1	8.5 ± 0.1 . $8.4 \times 40 = 336$ or $8.6 \times 40 = 344$
$= 340$	A_1	
(ii) ✓ North line at Q	B_1	
bearing 063° stated	B_1	$\pm 1°$ N 62°E or N63°E or N64°E
(i) Distance from the top of the post at Q to the tip of post at P		Follow through
$x = \frac{240}{\cos 9°}$ or $x \cos 9° = 240$	M_1	if calculation
$= 243M$	A_1	B_1 for calculated angle
		B_1 for angle in form of bearing.
(ii) Speed of bird	M_1	$\frac{240}{\sin 81°} = x$
$\frac{243 \times 60 \times 60}{1000 \times 18}$	A_1	
$= 48.6$ km/h	10	

22.	x	0	1	2	3	4	5	6	
	$y=\frac{1}{2}x^2-x+3$	3	$2\frac{1}{2}$	3	$4\frac{1}{2}$	7	$10\frac{1}{2}$	15	B_1



P1 ✓✓ double tick for at least 5 correct scores on table

C1 C.A.O

(b) When $y_1 \ldots y_5$ are read from the graph

B0

M0

A0

$y_1 = \frac{1}{2}\times 1.5^2 - 1.5 + 3 = 2.625$

$y_2 = \frac{1}{2}\times 2.5^2 - 2.5 + 3 = 3.625$

$y_3 = \frac{1}{2}\times 3.5^2 - 3.5 + 3 = 5.625$

$y_4 = \frac{1}{2}\times 4.5^2 - 4.5 + 3 = 8.625$

$y_5 = \frac{1}{2}\times 5.5^2 - 5.5 + 3 = 12.625$

B1 ✓ ordinates calculated

Approximate area $= 1(2.625+3.625+5.625+8.625+12.625)$ M1

$= 33.125$ square units A1

Area $= \int_1^6 (\frac{1}{2}x^2 - x + 3)\,dx = \left[\frac{x^3}{6} - \frac{x^2}{2} + 3x\right]_1^6$ M1

$= \left[\frac{6^3}{3} - \frac{6^2}{2} + 3\times 6\right] - \left[\frac{1^3}{6} - \frac{1^2}{2} + 3\right] = 33.3$ M1

% error $\frac{33.\dot{3} - 33.125}{33.3} \times 100 = 0.615\%$ M1 A1

$\frac{33\frac{1}{3} - 33\frac{1}{8}}{33\frac{1}{3}} \times 100\% = 0.625\%$

151 10