K.C.S.E 2008
MATHEMATICS P1 121/1
MARKING SCHEME

1. $\frac{-8 + (-5) \times (-8) - (-6)}{-3 + (-8) \div 2 \times 4}$

$\frac{-8 + 40 + 6}{-3 + -4 \times 4}$ — M 1

$^{38}/_{-19}$ — A1

$=-2$ — 2

2. $\frac{(3^3)^{2/3} \div 2^4}{(2^5) - {}^3/_5} = \frac{3^2 \div 2^4}{2^{-3}}$ — M 1 or equivalent

$= \frac{3^2}{2^4 \times 2^{-3}}$ — M1 for $2^4 \times 2^{-3}$ or equivalent

$= {}^9/_2$ or 4.5 — A1 — 3 — $^9/_2$ is not simplified

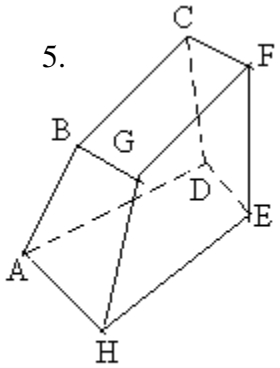
3. $\frac{a^4 - b^4}{a^3 - ab^2} = \frac{(a^2 + b^2)(a^2 - b^2)}{a(a^2 - b^2)}$ — M1 Factorization of numerator; M1 Factorization of denominator

$= \frac{a^2 + b^2}{a}$ or $a + \frac{b^2}{a}$ — A1 — 3

4. 23.50 + (7 h 15 min + 45 min + 5 h 40 min)

=1330h — B1

=1.30 pm on Monday — B1 — 2

5. 

CD parallel and equal to AB — B1 For trapezoidal x sectional faces

GH parallel and equal to fit — B1 for hidden lines dotted

Completion of sketch with Hidden edges dotted — B1 For 3 triangular faces — 3

6. Sales Petrol $^1/_3$ x 900,000
Diesel $^2/_3$ x 900,000 } M1

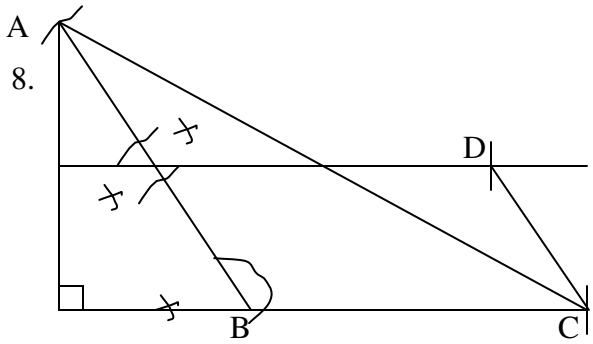
Profit $\frac{1}{3} \times \frac{900,000}{1000} \times 520 + \frac{2}{3} \times \frac{900,000}{1000} \times 480$ M1

= 15600 + 288000
= 444000 $\frac{A1}{3}$

7. Volume of liquid $= \frac{384}{0.6}$ M1

Height of liquid $= \frac{640}{X\ 3.2^2}$ M1
= 19.89 $\frac{A1}{3}$

8.



B1 < 120^0 completion
B1 Drop b from A to CB Produced
B1 (bisect height to determine E)
B 1 Determination of point D and completion of parallelogram
4

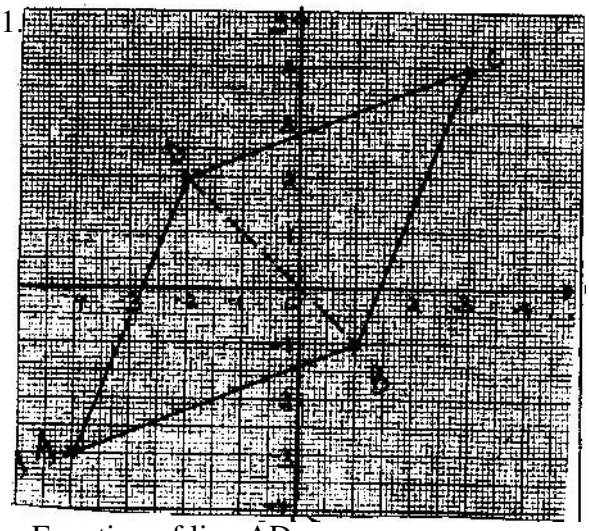
9. Volume of sphere = $^4/_3\ \pi$ x 4.2^3 M1

$\therefore$ Side of cube = $\sqrt[3]{^4/_3\ \pi \times 4.2^3}$ M1

= 6.77 $\frac{A1}{3}$

10. Radius of circle $\frac{23.4}{1.8}$ M1 Are length r θ^c where θ is in radians
= 13 cm A1 $\Rightarrow$ 243 = r x 1.8

Area of sector = $\frac{1.8}{2\pi}$ X π X 13^2 M1 $\therefore$ r = 24.3
152.1 cm^2 A1 1.8
Follow through
4

11. 

B1 Plotting points A, B and C
B1 Location of point D (-2, 2)

Equation of line AD

$\frac{y - -3}{x - -4} = \frac{5}{3}$ M1 or $y-2 = {}^{5}/_{2}$

$y = {}^{5}/_{2}\, x + 7$ A1

4

12. $AB = \begin{pmatrix} k & 4 \\ 3 & 2 \end{pmatrix} \begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} = \begin{pmatrix} k + 12 & 2k + 16 \\ 3 + 6 & 6 + 8 \end{pmatrix}$ M1

$= \begin{pmatrix} k + 12 & 2k + 16 \\ 9 & 14 \end{pmatrix}$

Del AB = (k + 12) (14) – (2k + 16) (9) = 4 M1 If brackets missing wait for

11k + 168 – 18k – 144 = 4 - 18 k – 144 + 14 k + 168 = 4

-4 k = -20

k = 5 A1

3

13. Area of rectangular part = 2 x 5.2 x π x 18 M1

= 187. 2π

Area of circular parts = 2 x 5.2^2 x π M1

54.08 x

π (187.2 + 54.08) = 241. 28π A1

3

14. Log 0.096 = log (4^2 x 6 x 10^{-3}) M1

= 2 (0.6021) + 3.7782 M1

= 2.9824 A1

Or (-1. 0.76) 3

15. $2y = 5x + 8$

$y = {}^{5}/_{2}\, x + 4$

Grad of $L_1 = {}^{5}/_{2}$ B1

Grad of L_2 $\frac{0+4}{-5-5} = +\frac{4}{-10} = \frac{-2}{5}$ B1 If the gradient of L_1 and L_2 Are negative reciprocals of each other then L_1 L_2

${}^{5}/_{2} \times -{}^{2}/_{5} = -1$

$\therefore L_1$ and L_2 are 1 B1

3

16. $2 \cos 2\theta = 1$

$\cos 2\theta = ½$

$\therefore 2\theta = 60^0, 300^0, 420^0, 660^0$ B1 B1

$\theta = 30^0, 150^0, 210^0, 330^0$ B1 B1

4

17. Juma's earnings before increase ALT

112% → 8400 M1 112J= 8400 M1

100% → 8400 x $\frac{100}{112}$ A1 J/A $= \frac{5}{3} = A = \frac{3}{5} \times \frac{100}{112} \times 8400$

= 7500 M1 = 4500A1

Akinyis earnings before increase

$= {}^{3}/_{5} \times 7500 = 4500$ M1 now 8400 + A = 14100

A = 5700 A1

Increase in Akinyis earnings

= 14,100 - 8 400 – 4 500 Increase $\frac{(5700-4500)}{4500} \times 100$ M

= 1200

% increase in Akinyis earnings $= \frac{12}{45} \times 100 \times 26^2/_3$

$\frac{1200}{4500} \times 100$ A1

$= 26\ ^2/_3$ M1

(b) No of bags bought M1 or equivalent

$= \frac{14100}{1175}$ Sale price 1762.50 x 12

= 21150 M1

= 12 bags

Profit = (1762.50 – 1175) x 12

= 7050

Ratio: 5700:8400 = 19:28 M1 Ratio: 84: 57 $= \frac{57}{141} \times 21150$

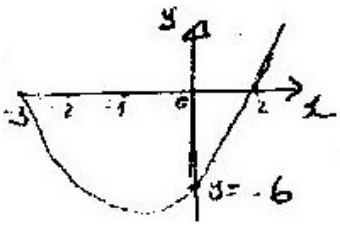
Profit for Akinyi = 7050 x ${}^{19}/_{47}$ = 2850

Total earning for Akinyi 5700 + 2850 A1 = 8550

= 8550

18. Trapezium rule

x	-1	-2	0	1
y	7	5	5	7



ALT

	x	y
B1	-3	0
	-2	4
M1	-1	6
A1	0	6
M1	1	4
	2	0

$y = 6$

$y = x^2 + x - 6$

M1 A1

A= ½ (0+2 M1

Are ½ x1 [(11 + 11) + 2 (7 + 5 + 5 + 7)]

= ½ (22 + 48) M1

= 35 A1

Are = 11 x 5 = 55 M1

(20)

= 55-35

= 20 (square unit) A1 B1 =

20A1

Mid ordinates

x	-2.5	-1.5	-0.5	0.5	1.5
y	8.75	5.75	4.75	5.75	8.75

AC = (8.75 + 5.75 + 4.75 + 5.75 + 8.75 x 1 B2 M1

= 33.75 M1 A1

A= 55 – 33.75 M1

21. 25

Difference = 21.25- 20

20

= 1.25 sq units A1 B1

Alt Xm	Ym	A= 1 x 21.25
-2.5	2.25	= 21.25
-1.5	6.25	
-0.5	6.25	Difference
0.5	5.25	= 21.25 -
1.5	2.25	= 1.25

10 B2

19. (i) $\overrightarrow{BD} = q - p$ B1

(ii) $\overrightarrow{BC} = {}^2/_3 (q - p)$ B1

(iii) $\overrightarrow{CD} = {}^1/_3 (q - p)$ B1

(iv) $\overrightarrow{AC} = p + {}^2/_3 q - {}^2/_3 p$ M1 If ratio theorem used M1 will

A1 Be implied give M1 A1

$= {}^1/_3 p + {}^2/_3 q$

(b) (i) CE = CD + DE M1 Ratio theorem could be

$= {}^1/_3 q - {}^1/_3 p + ½ p$ used or equivalent

A1

$= {}^1/_3 q + {}^1/_6 p$

$\overrightarrow{AC} = k ({}^1/_3 q + {}^1/_6 p)4$

${}^1/_3 p + {}^2/_3 q = {}^1/_3 kq + {}^1/_6 kp$ M1

$^1/_6\ k = {}^1/_3\ k = 2$ A1

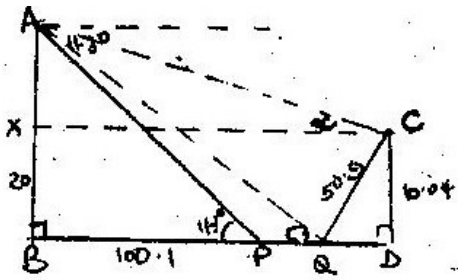
$\rightarrow$

(ii) AC = 2CE

AC: CE = 2.1 B1 With no vector sign used at ab

10

20. (a) $\text{Tan } 11.3^0 = \frac{20}{x}$ $x = \frac{20}{\text{Tan } 11.3^0}$ M1



$= \frac{20}{0.1998197} = 100.09022$

= 100.1m A1

(b) $PQ = \frac{36 \times 1000}{60 \times 60} \times 5$ M1

= 50M

BQ = 100.1 + 50 = 150.1 M

$\text{Tan } \theta = \frac{20}{150.1} = 0.133245$ M1

θ= 7.5896

$\theta = 7.59^0$

(c) (i) QD = 200 – 150.1 = 49.9 A1

$CD = \sqrt{50.9^2 - 49.9^2} = 10.03992$ M1

= 10.04 m A1

(ii) AX = 20- 10.4 = 9.96 M1

$\text{Tan} \propto = \frac{9.96}{200} = 0.0498$

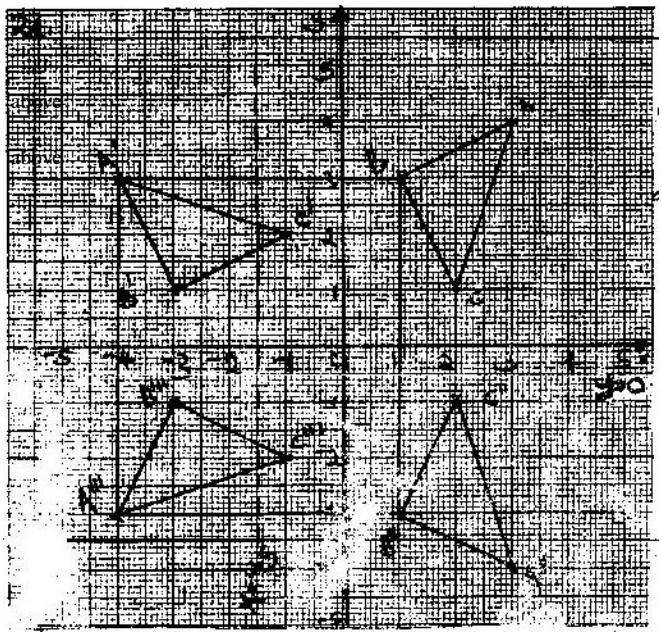
$\propto = 2.85097$ M1

$\propto = 3^0$ A1

10

21.

B1



(a) Δ $A^1B^1C^1$ √ 1y drawing	B2 Allow for two vertices
(b) Δ A"B"C" √ 1y drawing	B2 or B1
(c) Δ A"'B"' C"'√ 1y drawing	B2 for B1
(d) Reflection in line	B2 B0 if above
y= -x	
x= 1..5	B1
y = 0	B1
	10

22. (a) $^1/_3$ x $^{22}/_7$ x 21 x 21x 30 M1

= 13860 A1 13858.22 if π = 3.142

138544236 if π in the calculator used

(b) (i) $^8/_{21}$ = $^{36}/_{30}$ M1

r = $\frac{360 \times 21}{30}$

= 25.2 A1

(ii) $^1/_3$ x $^{22}/_7$ x 25. 2 x 25. 2 x 36 M1 Alt Ratio of height 30: 36 = 5:6

= 23950.08 U.S.F = 125: 216

= 23950.08 – 13860 Volume of big cone = $\frac{216}{125}$ x 13860

= 10090. 08cm^3 M1 =23950

(ii) $^4/_3$ x $^{22}/_7$ x 8^3 = 10090.08 A1 Vol of sphere = 10090.08 M_1A_1

r^3 = $\frac{10090.08 \times 21}{4 \times 22}$ M1 23950.08 – 13860 = 10090.08

ALT

$^4/_3$ πr^3 = 10090.08 M1

r = $\sqrt[3]{2407.86}$ r^3 = 10090.08 x ¾ x $^7/_{22}$

= 13.40 cm M1 r^3 = 2407.8 M1

A1 r = 13.40 cm A1

10

23. Let the original number be n Original B1 For either $\frac{2000\,000}{n}$ or $\frac{2000\,000}{n-40}$

Contribution $\frac{2000\,000}{n}$

Amount per member after withdrawal of 40 = $\frac{2000\,000}{n-40}$

$\frac{2000\,000}{n-40} - \frac{2000\,000}{n} = 2500$ M1 For removal of denominator and expression

$2000\,000\,n - 2000\,000 + 8000\,000 = 2500\,(n-40)$ M1

$2000\,000\,n = 2500n^2 + 2000\,000\,n - 1000\,000 - 80{,}000{,}000$ M1

$n^2 - 40\,n - 3200 = 0$

$(n-200)(n+160) = 0$

$n = 200$ A1

(b) New contribution $= \frac{55}{100} \times 2000\,000$ M1

Contribution per member

$= \frac{55}{100} \times 2000\,000 \times \frac{1}{160}$ M1

$= 6875$ M1

(c) Actual cash contribution by members M1

$\frac{55}{100} \times 2000\,000 \times \frac{19}{25} = 836{,}000$ A1

$= 836{,}000$ M1 or $6875 \times {}^{19}/_{25} \times 160$

10

24. (a) $\frac{ds}{dt} = 3t^2 - 12t + 9$ M1

$\frac{ds}{dt}(0.5) = 3(0.5)^2 - 12(0.5) + 9$ M1

$= 3.75$ A1

(b) $\frac{ds}{dt} \Rightarrow 0 \Rightarrow 3t^2 - 12t + 9 = 0$ M1

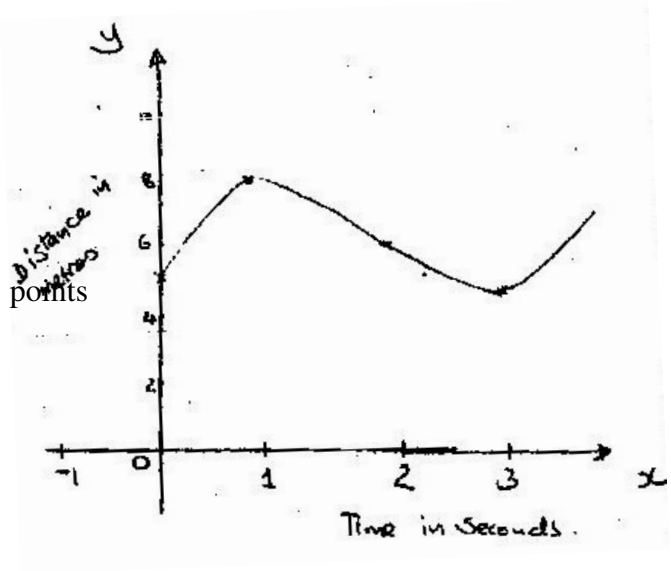
$t^2 - 4t + 3 = 0$

$(t-3)(t-1) = 0$ M1

$t = 3 \quad t = 1$ A1

When $t = 3$ $s = 3^3 - 6 \times 3^2 + 9 \times 3 + 5 = 5$

When $t = 1$ $s = 1^3 - 6 \times 1 + 9 \times 1 + 5 - 9$ B1



B1 y intercept

B1 Turning points

B1 Curve through the three points

10

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

1.

No.	Log		
6.373	0. 8043	M1	All 3 logs correct
0. 6944	T. 8416 +		
	0. 6459		
$\sqrt{0.004636}$	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

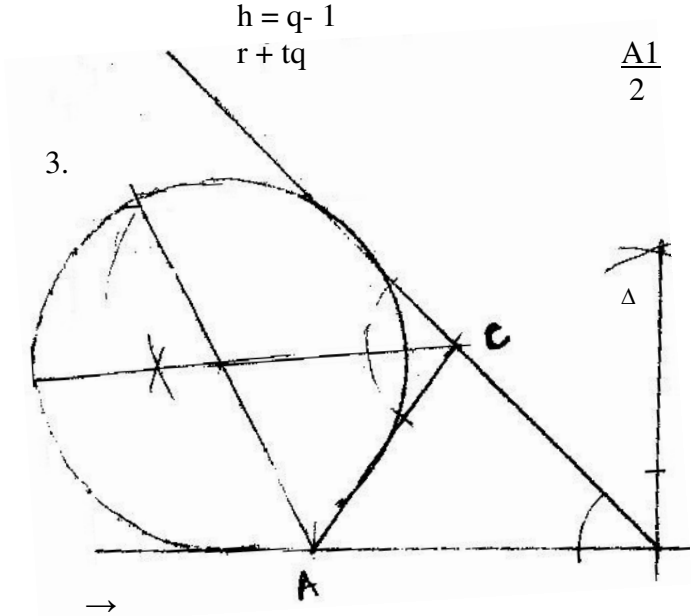
$q - 1 = h(r + tq)$

$h = q - 1$

$r + tq$ A1

2

3.



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

03

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

Or $OP = {}^3/_5 \begin{pmatrix} 3 \\ -1 \\ 4 \end{pmatrix} + {}^2/_5 \begin{pmatrix} 8 \\ -6 \\ 6 \end{pmatrix}$ M1 M1

$OP = OA + AP$ Ratio theorem

$= \begin{pmatrix} 3 \\ -1 \\ -4 \end{pmatrix} + {}^2/_5 \begin{pmatrix} 5 \\ -5 \\ 10 \end{pmatrix}$ M1

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

3

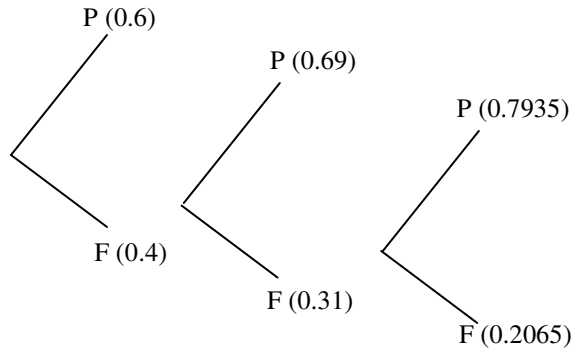
5. $0.05 \times 6 = 0.3$ M1

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

$= 0.1\%$ A1

3

6.



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 $= 500 \times 9/4 = 1125$ nm B 1

(ii) $\theta \times 60 \times 10553.4 = 1125$ M1

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

$= 31.45^0$

Longitude of $\theta = 71.45^0$E 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) $(14^5) = (10 + {}^2/_x)^5$ ${}^2/_x = 4$ $x = {}^2/_4 = ½$

$= 100000 + \frac{100000}{½} + \frac{400000}{(½)^2} + \frac{2000}{(½)^3} + \frac{800}{(½)^4} + \frac{32}{(½)^5}$ 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 $T = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$

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

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

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

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

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

$b = 0$ $\quad d = 1$

$a = 1$ $\quad c = 3$

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

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

$x^2 - 2x + 1 + y^2 + 5y + \frac{25}{4} = \frac{7}{4} + 1 + \frac{25}{4}$ B1

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

Centre = $(1 - 2\frac{1}{2})$ B1

12. $\text{Log}\left(\frac{3y+2}{10}\right) = \log(y - 4)$ M1 Single logs

$\frac{3y+2}{10} = y - 4$ M1 Dropping of logs

$3y + 2 = 10y - 40$

$7y = 42$ A1

$y = 6$ 3

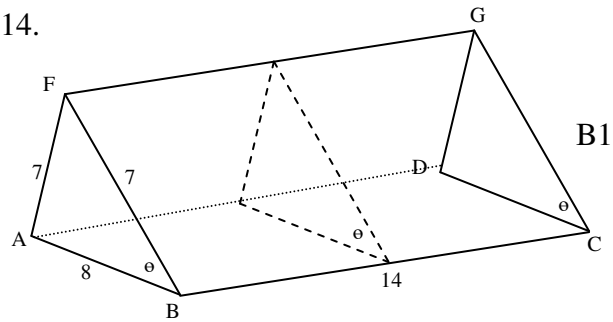
13. $\dfrac{\sqrt{3}}{1-\cos 30^0} = \dfrac{\sqrt{3}}{1-\sqrt{3}/2}$ B1 For $\cos 30^0 = \dfrac{\sqrt{3}}{2}$ in the expression

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

$\cos\theta = {}^4/_7 = 0.5714286$ M1 or equivalent

$\theta = 55.1500954^0$ A1

$= 55.15^0$ 3

15. Distance traveled $= \left(\dfrac{9}{3}t^3 - \dfrac{4}{2}t^2 + t\right)_2^3$ M1 For integration

$(3 \times 3^3 - \dfrac{4}{2} \times 3^2 + 3) - (2 \times 2^3 - 2 \times 2^2 + 2)$ 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

$X = \dfrac{1}{6}\pi^c, \dfrac{5}{6}\pi^c, \dfrac{3}{2}\pi^c$ B1 allow if C is omitted

4

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

29500

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

= 35400

1 Bag = 35400 ÷ 80 = M1

= Ksh 442. 50 A1

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

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

400 350
383.50
400 - 3805
= 16.5
33.5 16.50

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

$\Rightarrow 16.5x = 33.5y$

$x : y = 33.5 : 16.5$

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

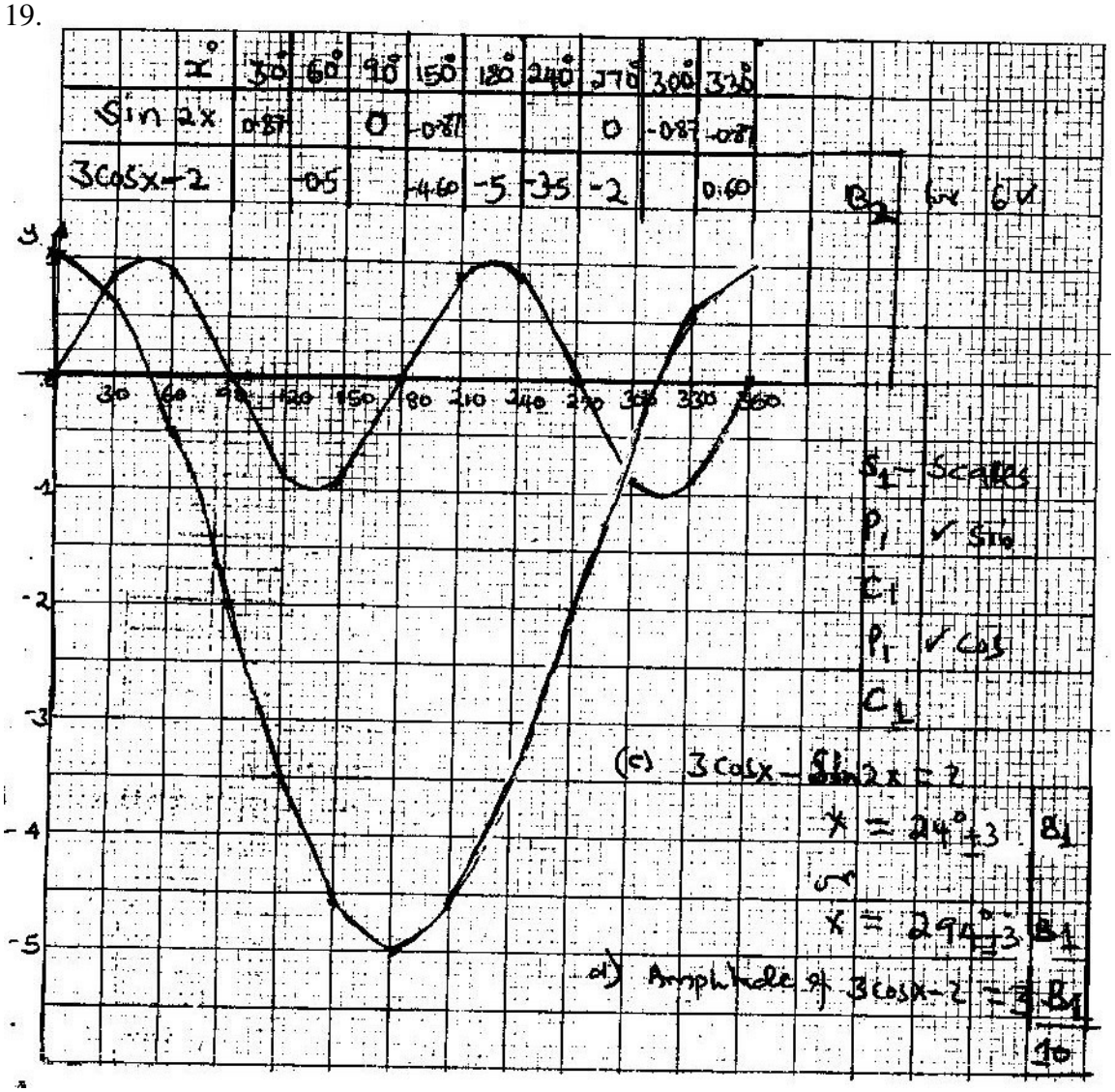
$\% \Delta = (-0.028\frac{pr^2}{3} \div \frac{pr^3}{3}) \times 100$ M1 or $\frac{pr^2}{3} - 0.972\,\frac{pr^2}{3}$

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

= -2.8% A1

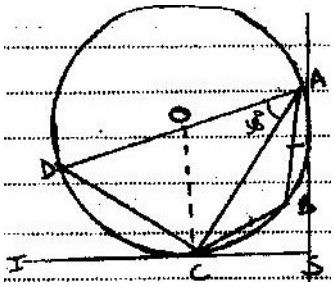
10

19.



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

$\angle ACS = 52^0$ B1



(ii) $\angle CBA = 128^0$ B1

$\angle BCA = 26^0$ B1

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

$= 15.76$ cm A1

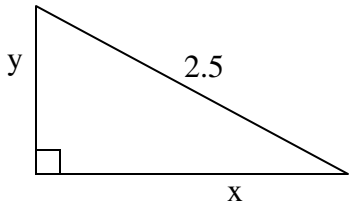
(ii) $AB = \dfrac{15.76}{\sin 26^0 \quad \sin 128^0}$ M1 AB subject

$AB = \dfrac{15.76 \sin 26^0}{\sin 128^0}$ 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



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

$y/2.4 = x/3.2$ B1

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

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

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

$x^2 = \frac{6.25 \times 16}{25}$ M1 Substitution

$x = 2$ km A1

$y = \frac{3}{4} \times 2 = 1.5$ km B1

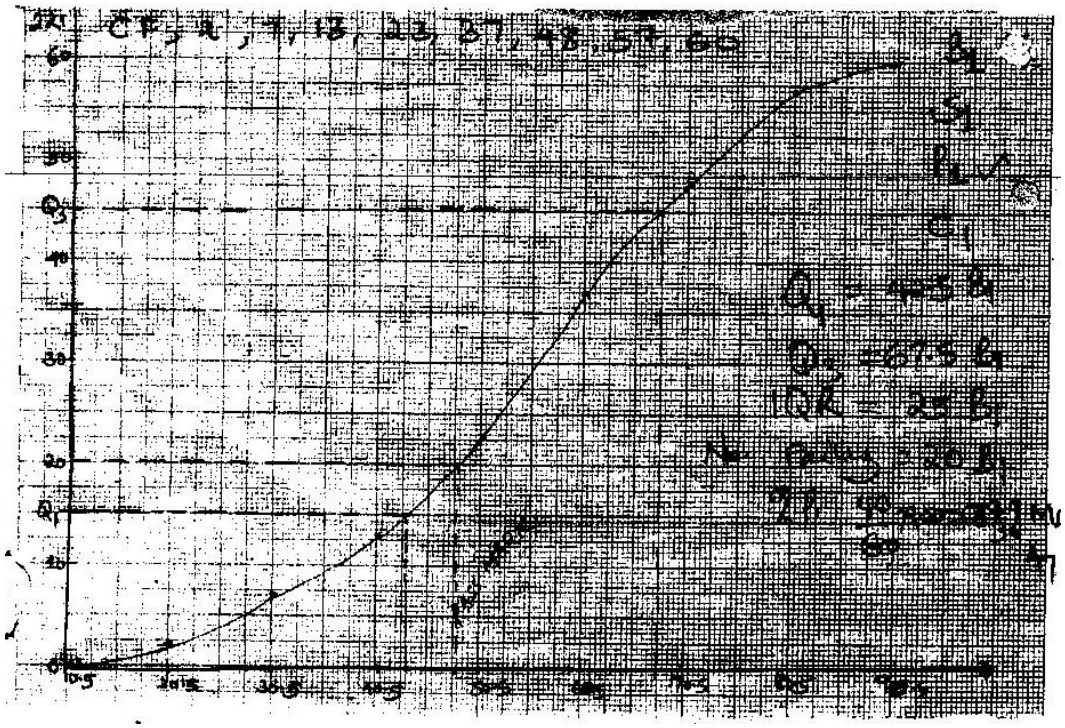
(iii) Time taken $= 2/32$ or $1.5/2.4$ A1

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.