KIRINYAGA CENTRAL SUB-COUNTY JOINT EXAMINATION - 2015

121/1 – MATHEMATICS PAPER 1 MARKING SCHEME

SECTION I:

1. $\sqrt{\left(\frac{153 \times 0.18 \times 104}{0.68 \times 0.32 \times 104}\right)} = \sqrt{\left(\frac{153 \times 18 \times 100}{68 \times 32}\right)}$ M1

$= \sqrt{\left(\frac{9 \times 9 \times 25}{4 \times 4}\right)}$

$= \frac{9 \times 5}{4}$

$11\frac{1}{4}$ *or* 11.25 A1

2

2. $\frac{3(4\chi - 5) - (2\chi - 1)}{6}$ M1

$\frac{12\chi - 15 - 2\chi + 1}{6}$

$\frac{10\chi - 14}{6}$ M1

$\frac{5\chi - 7}{3}$ A1

3

3. $\text{Log}\,(3\chi + 9) = Log\,3^3 + \log 100$

$\text{Log}\,(3\chi + 9) = \log 2700$ M1

$3\chi = 2691$

$\chi = 897$ A1

3

4. $\frac{10}{0.7906} + \frac{4}{12.806}$

$\frac{1}{0.7906} = 0.1265 \times 10 = 1.265$ M1

$\frac{1}{12.806} = 0.7806 \times 10^{-1} = 0.07806$ M1

10 x 1.265 = 12.65

4 x 0.07806 $= \frac{0.31224}{12.96224}$ A1

3

5. (a) $\begin{pmatrix} x \\ y \\ z \end{pmatrix} - \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} = \begin{pmatrix} 5 \\ 1 \\ 2 \end{pmatrix}$ M1

$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 5 \\ 1 \\ 2 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} = \begin{pmatrix} 6 \\ 3 \\ 5 \end{pmatrix}$

$\therefore$ Q at (6, 3, 5) A1

(b) $/PQ/ = \sqrt{5^2 + 1^2 + 2^2}$

$= \sqrt{30}$

= 5.477 B1

3

6. Area of minor sector $POQ = \frac{144}{360} \times \frac{22}{7} \times 3.5 \times 3.5$ M1

= 15.4cm²

Area of $\Delta POQ = \frac{1}{2} \times 3.5 \times 3.5 \times Sin\,144^o$ M1

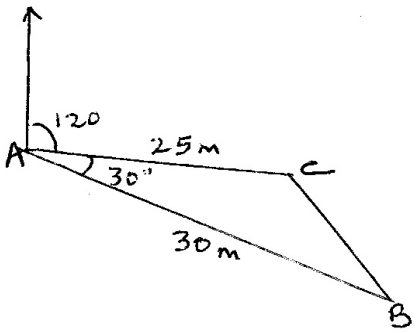
= 3.6cm²

Area shaded = 15.6 – 3.6 M1

= 11.8cm² A1

4

7.



Cosine rule

BC = 30² + 25² - 2(30) (25) Cos 30° M1

= 188.49

$BC = \sqrt{188.49}$ M1

= 13.729m A1

3

8. 5000 x 72.23 = 361,150 M1

361,150 – 214500 = 146,650

$= \frac{146{,}650 \times 1}{135.97}$ M1

= £1078.55 A1

3

9. Gradient = $\frac{-2-6}{4--2} = \frac{-4}{3}$

$\therefore Gradient\ of\ \underline{h} = \frac{3}{4}$

$Mid\ point\ \left(\frac{-2+4}{2}, \frac{6-2}{2}\right) = (1, 2)$ M1

$\frac{y-2}{\chi-1} = \frac{3}{4}$ M1

$y = \frac{3}{4}\chi + \frac{5}{4}$ A1

3

10. $\left(1+\frac{r}{100}\right)^n = \frac{A}{P}$ M1

$n \log\left(1+\frac{r}{100}\right) = \log\left(\frac{A}{P}\right)$ M1

$n = \frac{\log\left(\frac{A}{P}\right)}{\log\left(1+\frac{r}{100}\right)}$ A1

3

11. (i) $\frac{180-40}{2} = 70^0$ (Base angles of isosceles Δ) B1

(ii) ∠BDE = ∠ABE = 60º (angle in alternate segment) B1
60º + 70º = 130º

(iii) ∠BED = ∠CBD = 70º (Angle in alternate segment) B1

(iv) ∠ABD = 60º + 50º = 110º B1

4

12. 1cm → 25000cm
1cm² → (25000)² cm²
2cm² → (25000)² x 2cm² M1
= 125 x 10^7 cm²

$= \frac{125 \times 10^7}{10^4} m^2 = 125000\, m^2$ M1

$= \frac{125000}{10{,}000} ha$

= 12.5ha A1

3

13. (a) $BC = \frac{4}{Tan\ 60^o} = 2.3094$ B1

(b) $CE = \sqrt{2.3094^2 + 2.3094^2}$

= 3.26598

= 3.2660 B1

(c) DC = 3.2660 Cos 15º

= 3.1547 B1

3

14. $V = \frac{ds}{dt} = 9t^2 - 4t + 1$

$\therefore S = \int_2^3 (9t^2 - 4t + 1)dt$

$[3t^3 - 2t^2 + t]_2^3$ M1

= [3(3)³ - 2(3)² + 3] – [3(2)³ - 2(2)² + 2] M1

= (18 – 18 + 3) – (24 – 8 +2)

= 66 – 18

= 48m A1

3

15. (a) $-\chi^2 = (1 - \chi)(\chi + 2)$ M1

$-\chi^2 = \chi + 2 - \chi^2 - 2\chi$

$0 = 2 - \chi$

$\chi = 2$ A1

(b) $\begin{pmatrix} 2 & 4 \\ 3 & -5 \end{pmatrix}\begin{pmatrix} a \\ b \end{pmatrix} = \begin{pmatrix} 6 \\ -2 \end{pmatrix}$ M1

(2a + 4b = 6) x 3

(3a – 5b = -2) x 2

6a + 12b = 18

6a – 10b = -4 –

2b = 22

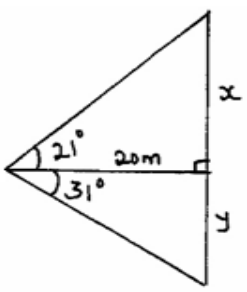
b = 11

∴ a = -19

$Z = \begin{pmatrix} -19 \\ 11 \end{pmatrix}$ A1

4

16.



$Tan\ 21^o = \frac{\chi}{20}$

χ = 20 tan 21

= 7.677 M1

$Tan\ 31 = \frac{y}{20}$

y = 20 tan 31 M1

= 12.017

∴ Height of tree = χ + y

= 7.677 + 12.017

= 19.694 A1

3

SECTION II:

17. (a) (i) $Time = \frac{D}{5}$

$= \frac{324}{60} = 5.4hrs$ M1

= 5hrs 24min

7.00

5.24 A1

12:24pm

(ii) $Time = \frac{324}{80}$ = 4.05hrs = 4hrs 3min M1

9.00

+ 4.03

13.03hrs or 1:03pm A1

(b) (i) Distance = S x T

= 60 x 2 = 120km B1

(ii) Common distance between the two vehicles

324 – 120 = 204km

Relative speed = 60 + 80 = 140kmh M1

Time taken to cover common distance

$\frac{204}{140} = 1.457\,hrs = 1hr\ 27\,\text{min}$ M1

9.00

Time of meeting + 1.27 A1

$10:270m$

(c) Distance from K

120km + 60 x 1.457 M1

120km + 37.42km

207.42km A1

10

18. (a) (i) $New = \frac{\frac{3}{2}P}{\frac{2}{3}q} = \frac{27}{28}$ M1

$\frac{P}{q} = \frac{27}{28} \times \frac{2}{3} \div \frac{3}{2}$ M1

$= \frac{27}{28} \times \frac{2}{3} \times \frac{2}{3} = \frac{3}{7}$ A1

(ii) $\dfrac{\frac{27}{28}-\frac{3}{7}}{\frac{3}{7}}\times 100$ M1

$=\dfrac{15}{28}\times\dfrac{7}{3}\times 100=125\%$ A1

(b) 30 men take 12 days

1 man takes 30 x 12 = 360 days

30 men in 1 day $\dfrac{1}{12}$ of the work

in 4 days $=\dfrac{1}{12}\times 4=\dfrac{1}{3}$ M1

Remaining work = $\dfrac{2}{3}$

1 man takes 360 days

24 men take $\dfrac{360}{24}=15\ days$ M1

15 days – 1 of the work

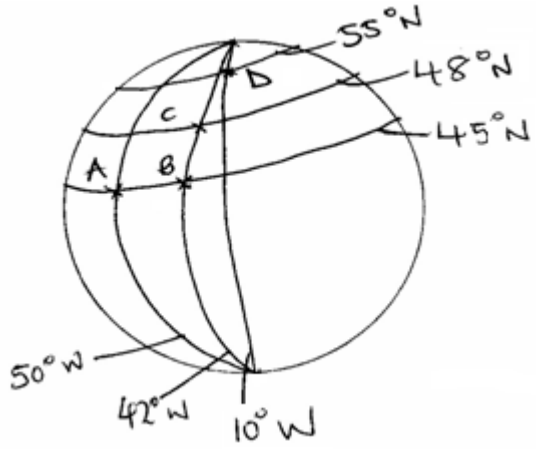
? - $\dfrac{2}{3}$ of the work

$=15\times\dfrac{2}{3}=10\ days$ A1

(c) $\dfrac{3}{5}\times 30+\dfrac{2}{5}\times 50$ M1

= 18 + 20 = Sh.38 A1

19.



(a) d = 8 x 60 Cos 45 = 339.4nm (AB) M1

BC d = 3 x 60 = 180nm M1

Total d = 519.4nm

$t=\dfrac{519.4}{10}=51.94\,hrs$ M1A1

(b) d = 32 x 60 Cos 55 = 1101.3nm M1

d = 7 x 60 = 420nm M1

total d = 1521.3nm

$$t = \frac{1521.3}{10} = 152.13hrs$$ M1A1

(c) d = 1521.3nm
t = 51.94hrs

$$S = \frac{1521.3}{51.94}$$ M1

= 29.29 knots A1

20. (a)

χ	0	1	2	3	4	5	6
χ^2	0	1	4	9	16	25	36
-6χ	0	-6	-12	-18	-24	-30	-36
5	5	5	5	5	5	5	5
y	5	0	-3	-4	-3	0	5

B1B1
B1BO
for at least 8 ✓

(b) SIP1C1

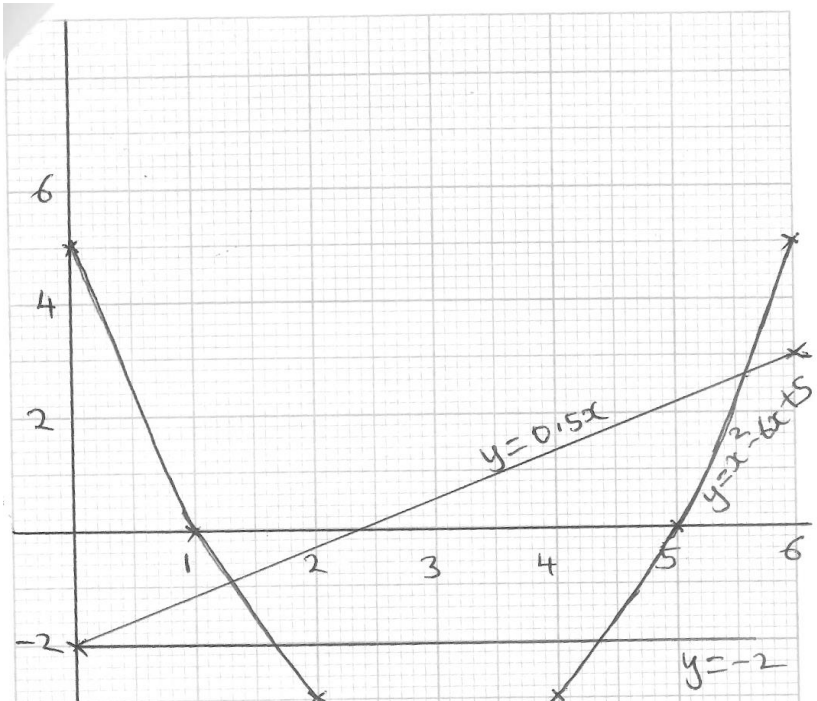
(c) (i) $\chi = 1, 5$ B1

(ii) $y = \chi^2 - 6\chi + 5$
$\underline{0 = \chi^2 - 6\chi + 7}$ -
$y = -2$ L1
$\chi = 1.65, 4.35 \pm 0.1$ B1

(iii) $y = \chi^2 - 6\chi + 5$
$\underline{0 = \chi^2 - 6.5\chi + 5}$ –
$y = 0.5\chi$ L1

χ	Y
0	0
6	3

$\chi = 1.3, 5.6 \pm 0.1$ B1



21.

CLASS	χ	f	$d = A = 5.2$ $\chi - A$	fd	d²	fd^2	cf
3.0 – 3.4	3.2	1	-2.0	-2.0	4	4	1
3.5 – 3.9	3.7	4	-1.5	-6.0	2.25	9	5
4.0 – 4.4	4.2	9	-1.0	-9.0	1	9	14
4.5 – 4.9	4.7	14	-0.5	-7.0	0.25	3.5	28
5.0 – 5.4	5.2	12	0	0	0	0	40
5.5 – 5.9	5.7	10	0.5	5	0.25	2.5	50
6.0 – 6.4	6.2	6	1.0	6	1	6	56
6.5 – 6.9	6.7	3	1.5	4.5	2.25	6.75	59
7.0 – 7.4	7.2	1	2.0	2.0	4	4	60
		$\sum f = 60$		$\sum f$d = 6.5	$\sum f$d² = 44.75		
		B1		B1	B1		

(a) 4.5 – 49. B1

(b) Median

$$\frac{30 + 31}{2} = 30.5^{th}\ value$$

30.5 – 28 = 2.5

$$\therefore \text{Median} = 4.95 + \frac{2.5}{12} \times 0.5$$ M1

= 4.95 + 0.10417

= 5.05417

= 5.0542 A1

(c) (i) $Mean\left(\bar{\chi}\right) = A + \left(\frac{\Sigma fd}{\Sigma f}\right) = 5.2 + \left(\frac{-6.5}{60}\right)$ M1

= 5.2 – 0.1083

= 5.099177 (5dp) A1

(ii) $S.d = \sqrt{\frac{\Sigma fd^2}{\Sigma f} - \left(\frac{\Sigma fd}{\Sigma f}\right)^2}$

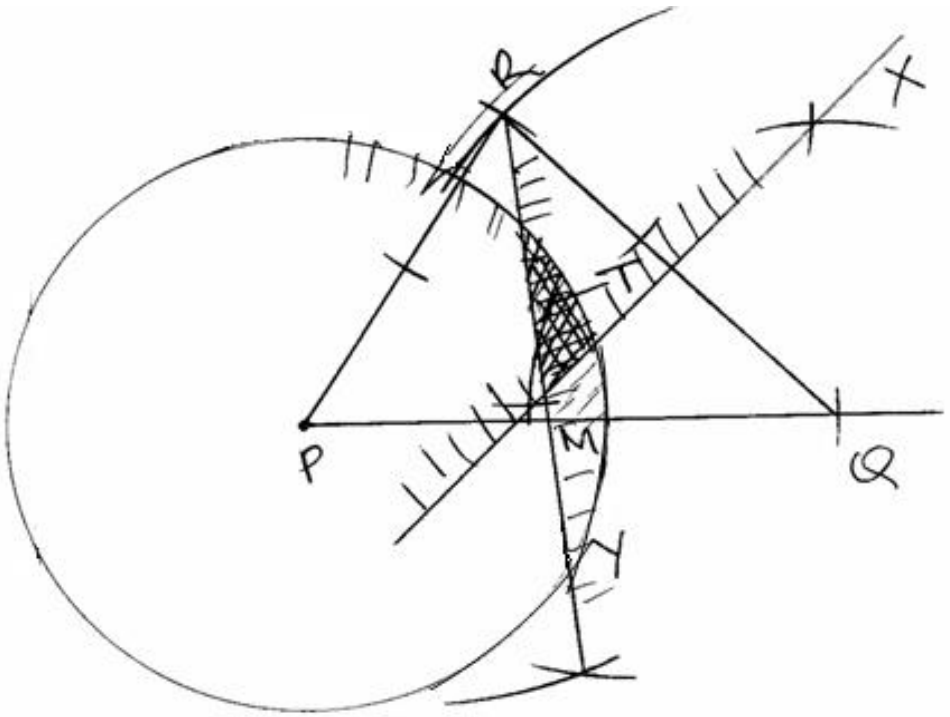
$= \sqrt{\frac{44.75}{60} - \left(\frac{-6.5}{60}\right)^2}$ M1

$= \sqrt{0.74583 - 0.01176}$

$= \sqrt{0.73407}$

= 0.8568 (4dp) A1

22.



B1 - triangle
B1 – bisector of QR
B1B1 – bisector of ∠PRQ
- Locating M
B1 – Circle centre P accept arc in the Δ
B1B1B1 for shading the 3 inequalities.
B1 for marking T

(b) QM = 3.8cm ± 0.1 B1

23. (a) Angle at the centre $\frac{360}{60} = 60^o$ B1

Shaded Area $= 6\left(\frac{1}{2} \times 14^2 \ Sin\ 60^o - \frac{1}{2} \times 12^2 \ Sin\ 60^o\right)$ M1M1

= 6(98 x 0.866 – 720 x 0.866) M1

= 135.096cm² A1

(b) Volume = (135.096 x 20)cm² M1

= 2701.92cm³ A1

(c) Mass = density x volume

= 3.5g/cm³ x 2701.92cm³ M1

= 9456.72g

= 9.45672kg B1

= 9.457kg A1

10

24. (a) $5(1) - 2 = 3$
$5(2) - 2 = 8$
$5(3) - 2 = 13$
} 3, 8 and 13 B1

(b) $ar^2 = 18$ and $ar^5 = 486$

$$\frac{ar^5}{ar^2} = \frac{486}{18}$$ M1

$r^3 = 27$

$r = 3$ A1

$a(3)^2 = 18$

$a = 2$ B1

(c) $-190 = 8 + (34 - 1)\,d$ M1

$33d = -198$

$d = -6$

$$S_{34} = \frac{34}{2}\{2(8) + 33(-6)\}$$ M1

$= 17(16 - 198)$

$= 17 \times (-82)$

$= -3094$ A1

(d) $2^{nd} = a + d$, $4^{th} = a + 3d$, $7^{th} = a + 6d$

$$\therefore \frac{a + 3d}{a + d} = \frac{a + 6d}{a + 3d}$$ M1

$a^2 + 6ad + 9d^2 = a^2 + 7ad + 6d^2$

$3d^2 - ad = 0$

$3d - a = 0$

$a = 3d$

$3d = 2$

$$d = \frac{2}{3}$$ A1

$$r = \frac{2 + 3\left(\frac{2}{3}\right)}{2 + \left(\frac{2}{3}\right)} = \frac{4}{2\frac{2}{3}} = 4 \times \frac{3}{8} = \frac{3}{2} = 1.5$$ B1