

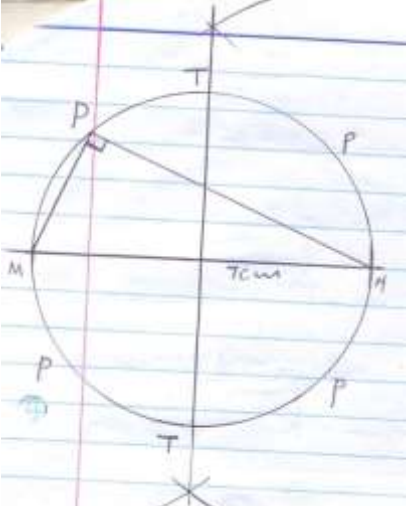
SCHOOL BASED FORM 4 EXAM JULY-AUGUST 2017

KENYA CERTIFICATE OF SECONDARY EDUCATION (K.C.S.E.)

121/2 MATHEMATICS

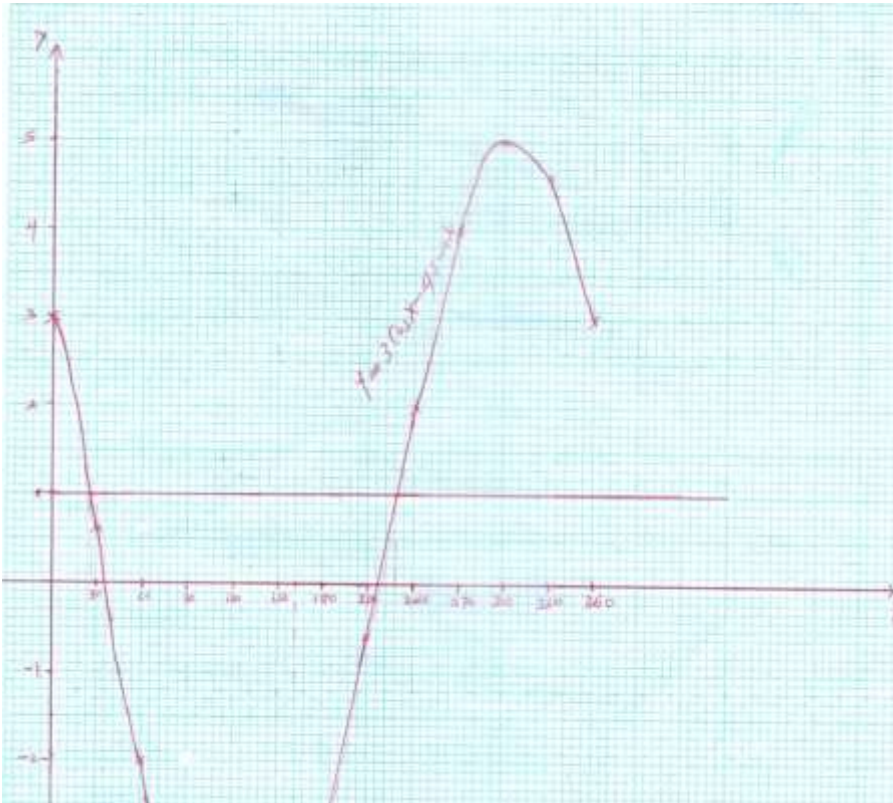
PAPER 2 MARKING SCHEME

| No | | MARKS | |
|----|---|------------------------------|--|
| 1. | $\text{Max } \frac{2.35+8.75}{1.95} = 5.6923$ $\text{Min } \frac{2.25+8.65}{2.05} = 5.3171$ $\text{Actual } \frac{2.3+8.7}{2.0} = 5.0$ $\text{Error } \frac{5.6923-5.3171}{2} = 0.1876$ $\% \text{ Error } \frac{0.1876}{5.0} \times 100 = 3.752\%$ | M1 M1 A1 | |
| | | 03 | |
| 2. | $\frac{2\sqrt{5}}{\sqrt{3}} \times \frac{\sqrt{3}+\sqrt{5}}{\sqrt{3}+\sqrt{5}}$ $= \frac{2\sqrt{15}+2\sqrt{25}}{3+5}$ $= \frac{2\sqrt{15}+10}{-2}$ $= -5 -\sqrt{15}$ | M1 A1 | |
| | | 02 | |
| 3. | <p>(a) $\frac{40}{60} \times 360 = 240$</p> <p>(b) Length = $\frac{240}{360} \times 2 \times \frac{22}{7} \times 6.37$ $= 26.693^0\text{cm}$</p> | M1A1 M1 A1 | |
| | | 03 | |
| 4. | $\angle AOP = \frac{AOB}{2} = \frac{160}{2} = 80$ <p>OA = OP = Radius $\therefore \angle A = \angle P$</p> $\frac{100}{2} = 50$ $\angle OAT = 90^0$ $\angle PAT = 90 - 50 = 40^0$ | M1 M1 A1 | |
| 5. | $\frac{7}{9} \times 90 = 70$ <p>Boys : Girls = 70 : 20</p> <p>New ratio 5 : 4 = 70 : 20 + x</p> $\frac{4}{5} \times 70 = 56$ $x = 56 - 20 = 36$ | B1 M1 A1 | |
| | | 03 | |
| 6. | $3x + 10(6) = 180$ $3x = 120$ $x = 40$ <p>Volume = Cross-section x length</p> $= (\frac{1}{2} \times 10 \times 10 \sin 60) \times 40$ $= 1732.05\text{cm}^3$ | M1 B1 M1 A1 | |
| | | 04 | |
| 7. | $\text{Log}_2 \left(\frac{x-2}{\frac{1}{2}+5} \right) = \text{Log}_2 2$ $\left(\frac{x-2}{\frac{1}{2}+5} \right) = 2$ | M1 M1 | |

| | | | |
|-----|---|----------------|--|
| | $x^2 - x - 12 = 0$ $(x + 3)(x - 4) = 0$ $x = -3$ or 4 | A1 | |
| 8. | $256 - 256x + 112x^2 - 28x^3$ $x = 0.1$ $(1.975)^8 = 256 - 25.6 + 1.12 - 0.028$ $= 231.492$ | A1 M1 A1 | |
| | | 03 | |
| 9. | $x^2 - 6x + 3^2 + y^2 + 4y + 2^2 = 12 + 9 + 4$ $(x - 3)^2 + (y + 2)^2 = 25$ Centre $(3, -2)$ Radius 5 units | M1 M1 A1 | |
| 10. |  | | |
| 11. | $P(R^1 \& G^1) = P(B)$ $\Rightarrow P(B) = \frac{7}{12}$ | M1 A1 | |
| | | 02 | |
| 12. | $20 \leq x \leq 50$ $20 \leq y \leq 50$ $x + y \leq 50$ | B1 B1 A1 | |
| | | 03 | |
| 13. | $\frac{dy}{dx} = 5x + \frac{3}{x^2} = 5x + 3x^{-2}$ $y = \frac{5}{2}x^2 + \frac{3}{-1}x^{-1} + c$ $2 = \frac{5}{2}(1) - \frac{3}{1}(1)^{-1} + c$ $c = 2 - 2.5 + 3 = \frac{5}{2}$ $y = \frac{5}{2}x^2 - \frac{3}{x} + \frac{5}{2}$ | M1 M1 A1 | |
| | | 03 | |
| 14. | $600 = 1440$ $\theta = 24^\circ$ New latitude = 40N | M1 A1 | |
| | | 02 | |
| 15. | $x = \text{Cos}^{-1} \frac{\sqrt{3}}{2} = 30^\circ, -30^\circ$ | | |

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-----|--|--|------|------|------|------|-----|-----|---|---|-----|------|------|------|------|---|-----|-----|-----|-----|-----|-----|-----|---|----|------|-----|---|-----|-----|-----|--|--|
| 16. | $4 \begin{pmatrix} 3 \\ 2 \\ +4 \end{pmatrix} - 2 \begin{pmatrix} -3 \\ +5 \\ -2 \end{pmatrix} + 3 \begin{pmatrix} 6 \\ 3 \\ 5 \end{pmatrix} = \begin{pmatrix} 6i \\ 7j \\ 3k \end{pmatrix}$ $p = 6i + 7j + 3k$ $ p = \sqrt{36 + 49 + 9} = \sqrt{94}$ $= 9.6953597 = 9.695$ | M1 M1 M1 A1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17. | <p>(a) Total amount Sh. x Njoroge got $\frac{3}{8}x$ Mwanzia = $\frac{2}{5} \left(\frac{5}{8}x \right) = \frac{1}{4}x$ Njoroge and Mwanzia $\frac{3}{8}x + \frac{1}{4}x = \frac{5}{8}x$ Three members $\frac{3}{8}x = 1800$ $x = 4,800$</p> <p>(b) Mwanzia = $\frac{1}{4}x$ 4800 = 1200</p> <p>(c) Njoroge $\frac{3}{8}x$ 4800 = 1800 Kiprotich = Sh. 600 $600 + 1800 + 1200 = 3600$ Profit shared $\frac{2}{3}x$ 1200 = 800 Ratio Kip : Mwa : Nj $\frac{1}{1} \quad \frac{2}{2} \quad \frac{3}{3}$ Njoroge $\frac{3}{6}x$ 800 = 400 Mwanzia $\frac{2}{6}x$ 800 = 266.70 Kiprotich $\frac{1}{6}x$ 800 = 133.30</p> | M1 M1 A1 M1 A1 B1 M1 A1 B1 A1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18. | <p>(a) $\frac{9^x}{3^{2x+1}} = \frac{81}{9^x} \Rightarrow \frac{3^{2x}}{3^{2x+1}} = \frac{3^4}{3^{2x}}$ $2x - 2x - 1 = 4 - 2x$ $x = 2.5$</p> <p>(b) $r = \frac{81}{9^{\frac{1}{2}}} = \frac{81}{3^5} = \frac{81}{243}$ $= \frac{1}{3}$</p> <p>(c) $a = 3^6 = 729$ $S_4 = 729 \frac{(1 - (1/3)^4)}{1 - \frac{1}{3}}$ = 1080</p> <p>(d) $5^{\text{th}} = 9 \quad 7^{\text{th}} = 1$ $S_{20} = \frac{20}{2}(18 + 19 \times 8)$ = 1700</p> | M1 M1 A1 A1 M1 M1 A1 M1 A1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | 10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19. | <p>(a)</p> <table border="1"> <tbody> <tr> <td>x</td> <td>0</td> <td>30</td> <td>60</td> <td>90</td> <td>120</td> <td>150</td> </tr> <tr> <td>y</td> <td>3</td> <td>0.6</td> <td>-2.0</td> <td>-4.0</td> <td>-5.0</td> <td>-4.6</td> </tr> </tbody> </table> <table border="1"> <tbody> <tr> <td>x</td> <td>180</td> <td>210</td> <td>240</td> <td>270</td> <td>300</td> <td>330</td> <td>360</td> </tr> <tr> <td>y</td> <td>-3</td> <td>-0.6</td> <td>2.0</td> <td>4</td> <td>5.0</td> <td>4.6</td> <td>3.0</td> </tr> </tbody> </table> | x | 0 | 30 | 60 | 90 | 120 | 150 | y | 3 | 0.6 | -2.0 | -4.0 | -5.0 | -4.6 | x | 180 | 210 | 240 | 270 | 300 | 330 | 360 | y | -3 | -0.6 | 2.0 | 4 | 5.0 | 4.6 | 3.0 | | |
| x | 0 | 30 | 60 | 90 | 120 | 150 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| y | 3 | 0.6 | -2.0 | -4.0 | -5.0 | -4.6 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| x | 180 | 210 | 240 | 270 | 300 | 330 | 360 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| y | -3 | -0.6 | 2.0 | 4 | 5.0 | 4.6 | 3.0 | | | | | | | | | | | | | | | | | | | | | | | | | | |

(b) On the graph



(c) 280 ± 2^0 $226^0 \pm 2$

(d) $90^0 < x < 162^0$

20.

(a) $ME^2 = 5^2 + 10^2$

$ME = \sqrt{125} = 11.18$

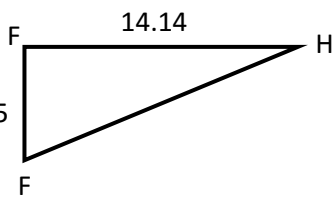
$MH^2 = 11.18^2 + 10^2$

$MH = \sqrt{224.99}$

$14.997 = 15.00\text{cm}$

(b) $FH^2 = FE^2 + FH_2$

$= \sqrt{200}$

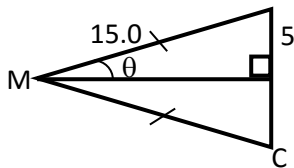


$\text{Tan } \theta = \frac{5}{14.14}$

$\theta = 19.47^0$

$\theta = 14.14^0$

(c)



$\text{Sin } \theta = \frac{5}{14.997}$

$\theta = 19.471$

$\angle \text{HMC} = 19.47 \times 2$

$= 38.942^0$

M1

M1

A1

M1

M1

A1

M1

M1

A1

10

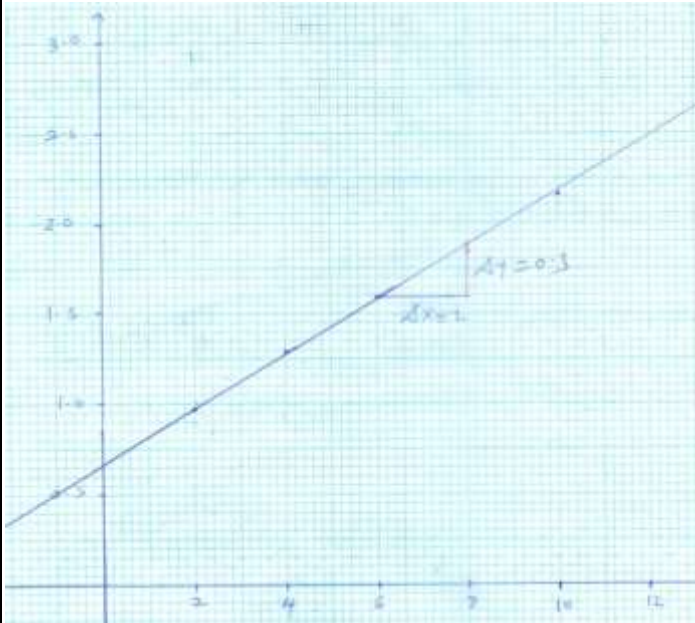
| 21. | <p>(a) (i) $P = \frac{kQ^2}{R}$ $2 = \frac{k16}{5} k = \frac{5}{8}$ $P = \frac{5}{8} \frac{Q^2}{s}$</p> <p>(ii) $4.5 = \frac{5 Q^2}{8 s}$ $Q^2 = 4.5 \times 8 = 36$ $Q = \pm 6$ $Q = 6$</p> <p>(ii) New $P = K \frac{(1.05)^2}{09R} Q$ $= 1.225 k \frac{Q^2}{R}$ % Change in $P = (1.225 - 1)100$ $= 22.5\%$</p> | M1 A1 M1 M1 A1 M1 B1 M1B1 A1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------|---|--|--------------------|-----------------------|-----------------|----------------|-----------------|------|---|------|------|------|-------|------|---|----|----|---|---|------|----|------|-----|------|------|------|----|---|---|---|---|------|----|-----|---|------|------|------|----|---|----|---|----|------|----|-----|----|------|------|------|---|---|---|---|----|--|--|--|--------------------|-----------------------|--|----------------|--|
| 22. | <p>(a) $S = 3(2)^3 - 6(2)^2 + 4(2) + 5$ $= 24 - 24 + 8 + 5 = 13m$</p> <p>(b) $V = \frac{ds}{dt} = 9t^2 - 12t + 4$ $= 9(3)^2 - 12(3) + 4$ $= 49m/s$</p> <p>(c) at rest $V = 0$ $9t^2 - 12t + 4 = 0$ $t = \frac{-12 \pm \sqrt{144 - 144}}{18}$ $= \frac{2}{3} \text{ seconds}$ $\therefore S = 3\left(\frac{2}{3}\right)^3 - 6\left(\frac{2}{3}\right)^2 + 4\left(\frac{2}{3}\right) + 5$ $= \frac{53}{9} = 5.89m$</p> <p>(d) $V = 9t^2 - 12t + 4$ $a = 18t - 12$ $a = 18(1.5) - 12 = 15m/s^2$</p> | A1 M1 M1 A1 M1 M1 A1 M1 A1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23. | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>x</th> <th>f</th> <th>t = x - a</th> <th>ft</th> <th>t²</th> <th>ft²</th> </tr> </thead> <tbody> <tr> <td>28.2</td> <td>5</td> <td>-1.5</td> <td>-7.5</td> <td>2.25</td> <td>11.25</td> </tr> <tr> <td>28.7</td> <td>8</td> <td>-1</td> <td>-8</td> <td>1</td> <td>8</td> </tr> <tr> <td>29.2</td> <td>30</td> <td>-0.5</td> <td>-15</td> <td>0.25</td> <td>7.50</td> </tr> <tr> <td>29.7</td> <td>13</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>30.2</td> <td>10</td> <td>0.5</td> <td>5</td> <td>0.25</td> <td>2.50</td> </tr> <tr> <td>30.7</td> <td>20</td> <td>1</td> <td>20</td> <td>1</td> <td>20</td> </tr> <tr> <td>31.2</td> <td>10</td> <td>1.5</td> <td>15</td> <td>2.25</td> <td>22.5</td> </tr> <tr> <td>31.7</td> <td>4</td> <td>2</td> <td>8</td> <td>4</td> <td>16</td> </tr> <tr> <td></td> <td></td> <td></td> <td>$\Sigma ft = 17.5$</td> <td>$\Sigma ft^2 = 87.75$</td> <td></td> </tr> </tbody> </table> | x | f | t = x - a | ft | t ² | ft ² | 28.2 | 5 | -1.5 | -7.5 | 2.25 | 11.25 | 28.7 | 8 | -1 | -8 | 1 | 8 | 29.2 | 30 | -0.5 | -15 | 0.25 | 7.50 | 29.7 | 13 | 0 | 0 | 0 | 0 | 30.2 | 10 | 0.5 | 5 | 0.25 | 2.50 | 30.7 | 20 | 1 | 20 | 1 | 20 | 31.2 | 10 | 1.5 | 15 | 2.25 | 22.5 | 31.7 | 4 | 2 | 8 | 4 | 16 | | | | $\Sigma ft = 17.5$ | $\Sigma ft^2 = 87.75$ | | B2 B1 B1 | |
| x | f | t = x - a | ft | t ² | ft ² | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28.2 | 5 | -1.5 | -7.5 | 2.25 | 11.25 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28.7 | 8 | -1 | -8 | 1 | 8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29.2 | 30 | -0.5 | -15 | 0.25 | 7.50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29.7 | 13 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30.2 | 10 | 0.5 | 5 | 0.25 | 2.50 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30.7 | 20 | 1 | 20 | 1 | 20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31.2 | 10 | 1.5 | 15 | 2.25 | 22.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31.7 | 4 | 2 | 8 | 4 | 16 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | $\Sigma ft = 17.5$ | $\Sigma ft^2 = 87.75$ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | <p>Max $x^{-1} = \frac{\Sigma ft}{\Sigma f}$ $= \frac{17.5}{100} + 29.7$ $= 29.875$</p> <p>$S = \sqrt{\frac{\Sigma ft}{\Sigma f} - \left(\frac{\Sigma ft}{\Sigma f}\right)^2}$ $= \sqrt{\frac{87.75}{100} - \left(\frac{17.5}{100}\right)^2}$ $= \sqrt{0.846875}$ $= 0.9202$</p> | M1 A1 M1 B1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

24.

(a) $p = Ak^n$
 $\text{Log } p = \text{Log } A + n \text{Log } K$

(b)

| | | | | | |
|-------|------|------|------|------|------|
| m | 2 | 4 | 6 | 8 | 10 |
| Log p | 0.99 | 1.29 | 1.57 | 1.87 | 2.16 |



(c) $\text{Log } p = \text{Log } A + n \text{Log } k$
 $y - \text{axis} = \text{Log } p$
 $y - \text{intercept} = \text{Log } A$
 $\text{Gradient} = \text{Log } k$
 $x - \text{axis} = n$
 $\text{Log } A = 0.7$
 $A = 5.01$
 $\text{Log } k = \frac{0.3}{2}$
 $= 0.15$
 $k = 1.41$

M1
A1

B1
B1

B1

B1 axis

B1 scale

B1 plotting

B1 smooth line