9709 w10 ms_12

| Page 4 | Mark Scheme: Teachers' version | Syllabus | Paper |
| :---: | :---: | :---: | :---: |
|  | GCE AS/A LEVEL - October/November 2010 | 9709 | 12 |

\begin{tabular}{|c|c|c|c|c|}
\hline 1 \& \begin{tabular}{l}
(i) \(\begin{aligned} \& 1+8\left(-2 x^{2}\right)+{ }^{8} \mathrm{C}_{2}\left(-2 x^{2}\right)^{2} \\ \& 1-16 x^{2}+112 x^{4}\end{aligned}\) \\
(ii) \(\left(2-x^{2}\right) \times\) their \(\left(1-16 x^{2}+112 x^{4}\right)\) ( \(2 \times\) their 112 ) - their \((-16)\) 240
\end{tabular} \& \begin{tabular}{l}
B2, 1 \\
M1 \\
A1 \(\sqrt{ }\)
\end{tabular} \& \([2]\)
[2] \& \begin{tabular}{l}
Loses 1 for each error \\
Must consider exactly 2 terms
\end{tabular} \\
\hline 2 \& \[
\begin{aligned}
\& \text { LHS }=\sin ^{2} x / \cos ^{2} x-\sin ^{2} x \\
\& \sin ^{2} x\left(1-\cos ^{2} x\right) / \cos ^{2} x \\
\& \frac{\sin ^{2} x \sin ^{2} x}{\cos ^{2} x} \text { oe } \\
\& \tan ^{2} x \sin ^{2} x \\
\& \text { OR RHS }=\frac{\sin ^{2} x}{\cos ^{2} x} \cdot \sin ^{2} x \\
\& \quad \sin ^{2} x\left(1-\cos ^{2} x\right) / \cos ^{2} x \\
\& \left(\sin ^{2} x / \cos ^{2} x\right)-\sin ^{2} x \\
\& \tan ^{2} x-\sin ^{2} x
\end{aligned}
\] \& \begin{tabular}{l}
M1 \\
M1 \\
M1 \\
A1 \\
M1 \\
M1 \\
M1 \\
A1
\end{tabular} \& [4] \& \begin{tabular}{l}
Replace \(\mathrm{t}^{2}\) by s \(\mathrm{s}^{2} / \mathrm{c}^{2}\) or \(\sec ^{2}-1\) \\
Use of \(1-\cos ^{2} x=\sin ^{2} x\) \\
Valid overall method \\
AG \\
Replace \(\mathrm{t}^{2}\) by \(\mathrm{s}^{2} / \mathrm{c}^{2}\) \\
Use of \(1-\cos ^{2} x=\sin ^{2} x\) \\
Valid overall method AG
\end{tabular} \\
\hline 3 \& \begin{tabular}{l}
(i) \(\begin{aligned} \& \left(k(2 t-1)^{-1 / 2}\right. \\ \& \\ \& 0.7(2 t-1)^{-1 / 2}\end{aligned}\) \\
(ii) \(\operatorname{Sub} t=5\) into their deriv 0.23(3)
\end{tabular} \& \begin{tabular}{l}
M1 \\
A1 \\
M1 \\
A1
\end{tabular} \& [2]
[2] \& \begin{tabular}{l}
\[
k \neq 1
\] \\
oe \\
Ignore units
\end{tabular} \\
\hline 4 \& \begin{tabular}{l}
(i) 1.683(18...) \\
(ii) \((2) \times 1 / 2 \times 3^{2} \sin 2.3\) \(1 / 2 \times 3^{2} \times\) their 1.683 \\
Triangle \(A O C+C O B+\) sector 14.3
\end{tabular} \& \[
\begin{aligned}
\& \text { B1 } \\
\& \text { M1 } \\
\& \text { M1 } \\
\& \text { M1 } \\
\& \text { A1 }
\end{aligned}
\] \& [1]

[4] \& Condone omission of factor 2 NB M0 if using angle of 2.3 Two correct triangles + sector co \\
\hline 5 \& (a)

$$
\begin{aligned}
& d=-7 \text { used } \\
& (m / 2)[322+(m-1)(-7)]=0 \\
& 47
\end{aligned}
$$

\[
(b) $$
\begin{gathered}
\frac{a\left(1-r^{n}\right)}{1-r}<\frac{0.9 a}{1-r} \\
1-r^{n}<0.9 \\
r^{n}>0.1
\end{gathered}
$$

\] \& | B1 |
| :--- |
| M1 |
| A1 |
| M1 |
| M1 |
| A1 | \& [3] \& | co |
| :--- |
| Condone omission of $(m / 2)$. Statement co (condone $m=0$ ) |
| Allow for $=,<,>, \leq, \geq$ |
| Needs inequality sign correct co | \\

\hline
\end{tabular}

| Page 5 | Mark Scheme: Teachers' version | Syllabus | Paper |
| :---: | :---: | :---: | :---: |
|  | GCE AS/A LEVEL - October/November 2010 | 9709 | 12 |

\begin{tabular}{|c|c|c|c|c|}
\hline 6 \& \begin{tabular}{l}
\[
\text { (i) } \begin{array}{ll} 
\& k x^{2}-k x+1=0 \\
\& k^{2}-4 k<0 \\
\& 0<k<4
\end{array}
\] \\
(ii)
\[
\begin{aligned}
\& k=4 \text { only } \\
\& (2 x-1)^{2}=0 \\
\& x=1 / 2, y=2 \quad \text { or }(1 / 2,2)
\end{aligned}
\]
\end{tabular} \& \begin{tabular}{l}
M1 \\
M1 \\
A1 \\
B1 \(\sqrt{ }\) \\
M1 \\
A1, A1
\end{tabular} \& [3]
[4] \& \begin{tabular}{l}
\(y\) eliminated \\
Applying \(b^{2}-4 a c<0\) or \(=\) or \(\leq\) or \(\geq\) co \\
ft from their \(k^{2}-4 k=0 .(\operatorname{Not} k=0)\) ft from their \(k\)
\end{tabular} \\
\hline 7 \& \begin{tabular}{l}
(i)
\[
\begin{aligned}
\& (x-2)^{2} \\
\& (x-2)^{2}+3 \\
\& f(x)>3
\end{aligned}
\] \\
(ii)
\[
\begin{aligned}
\& x-2=( \pm) \sqrt{y-3} \\
\& \mathrm{f}^{-1}(x)=2+\sqrt{x-3}
\end{aligned}
\] \\
domain is \(x>3\) \\
(iii) \(\mathrm{h}(x)=x^{2}+3\)
\end{tabular} \& \begin{tabular}{l}
M1 \\
A1 \\
B1 \(\sqrt{ }\) \\
M1 \\
A1 \\
B1 \(\sqrt{ }\) \\
B1
\end{tabular} \& [3]

[3]

[1] \& | Must be " $-2 " \pm k$ |
| :--- |
| co |
| ft on their ' 3 ' |
| $\pm$ not required for M mark |
| $\mathrm{f}(x)+$ removal of minus sign needed ft domain of $\mathrm{f}^{-1}=$ range of f or for $\mathrm{f}^{-1}$ |
| co | \\

\hline 8 \& | (i) $\begin{aligned} & 3 x^{2}+x-2=0 \\ & (x+1)(3 x-2) \rightarrow x=-1 \text { or } 2 / 3 \\ & (-1,1),(2 / 3,6) \end{aligned}$ |
| :--- |
| (ii) $\begin{aligned} & A B^{2}=(5 / 3)^{2}+5^{2} \\ & A B=5.27(0 \ldots) \\ & \text { mid-point }=(-1 / 6,7 / 2) \end{aligned}$ | \& | M1A1 |
| :--- |
| M1 |
| A1 |
| M1 |
| A1 |
| B1 $\sqrt{ }$ | \& [4]

[3] \& | Eliminates $x$ or $y$. Sets quadratic to 0 . Attempt to solve their equation co |
| :--- |
| $\checkmark$ their coordinates from (i) |
| Or $(5 \sqrt{ } 10) / 3$ oe |
| ft from their (i) | \\

\hline 9 \& | (i) $\frac{10-a}{10}=\frac{6}{10}$ oe $a=4$ |
| :--- |
| (ii) $\begin{aligned} \overrightarrow{B G} & =-10 \mathbf{j}-10 \mathbf{i}+4 \mathbf{k}+6 \mathbf{j} \\ & =-10 \mathbf{i}-4 \mathbf{j}+4 \mathbf{k} \end{aligned}$ |
| (iii) $\overrightarrow{B G} \cdot \overrightarrow{B A}=40$ $\begin{aligned} & \cos G B A=\frac{40}{\sqrt{132} \sqrt{100}} \\ & G B A=69.6^{\circ} \end{aligned}$ | \& | M1 |
| :--- |
| A1 |
| B2,1 |
| M1 |
| M1 |
| DM1 |
| A1 | \& [2]

[2]

[4] \& | or $P D E$ is isos hence $P D=6$ (M1) |
| :--- |
| AG |
| Any acceptable notation. Loses 1 for each error. |
| Use of $x_{1} x_{2}+y_{1} y_{2}+z_{1} z_{2}$ |
| Modulus worked correctly for either |
| All ok - must be using $\pm \overrightarrow{B G} . \pm \overrightarrow{A B}$. |
| Must be the acute angle | \\

\hline
\end{tabular}

| Page 6 | Mark Scheme: Teachers' version | Syllabus | Paper |
| :---: | :---: | :---: | :---: |
|  | GCE AS/A LEVEL - October/November 2010 | 9709 | 12 |


| 10 | (i) $\begin{aligned} & h=\frac{8}{x^{2}} \\ & A=\frac{1}{2} x^{2}+2 \times \frac{1}{2} x h+2 x h+\frac{5}{4} x \times \frac{4}{5} x \\ & A=(3 / 2) x^{2}+3 x h \\ & A=\frac{3}{2} x^{2}+3 x \times \frac{8}{x^{2}} \\ & A=\frac{3}{2} x^{2}+\frac{24}{x} \end{aligned}$ <br> (ii) $\begin{aligned} & \frac{d A}{d x}=3 x-\frac{24}{x^{2}}=0 \\ & x=2 \\ & \frac{d^{2} A}{d x^{2}}=3+\frac{48}{x^{3}} \\ & >0 \text { when } x=2 \text { hence minimum } \end{aligned}$ | M1 <br> A1 <br> M1 <br> M1 <br> A1 <br> B1 <br> M1 <br> A1 <br> M1 <br> A1 | [5] | Uses $l b h=4$ <br> co <br> Allow 1 error but needs the lid <br> For substitution of $h$ as $\mathrm{f}(x)$ <br> AG <br> Correct derivative. <br> Sets to 0 and attempts to solve. <br> co <br> Reasonable attempt - allow 1 error <br> co <br> AG (Result consistent with their $\mathrm{f}^{\prime \prime}$ ) |
| :---: | :---: | :---: | :---: | :---: |
| 11 | (i) $\begin{aligned} & A=(0,1) \\ & B=(5,1 / 2) \\ & y-1=-\frac{1}{10}(x-0) \\ & y=-\frac{1}{10} x+1 \end{aligned}$ <br> (ii) $\begin{aligned} & \text { Curve: }(\pi) \int_{0}^{5}(3 x+1)^{-1 / 2} d x \\ & \frac{2 \pi}{3}\left[(3 x+1)^{1 / 2}\right]_{0}^{5} \\ & \frac{2 \pi}{3}[4-1] \\ & {[2 \pi]} \end{aligned}$ <br> Line: $(\pi) \int_{0}^{5}\left(\frac{1}{100} x^{2}-\frac{1}{5} x+1\right) d x$ <br> ( $\pi$ ) $\left[\frac{1}{300} x^{3}-\frac{1}{10} x^{2}+x\right]_{0}^{5}$ <br> ( $\pi$ ) $\left[\frac{125}{300}-\frac{25}{10}+5\right]$ <br> $\left[\frac{35 \pi}{12}\right]$ $\text { Volume }=\frac{35 \pi}{12}-2 \pi=\frac{11 \pi}{12}$ | $\begin{aligned} & \hline \text { B1 } \\ & \text { B1 } \\ & \text { M1 } \\ & \text { A1 } \\ & \text { M1 } \\ & \text { A1A1 } \\ & \text { DM1 } \\ & \\ & \text { M1 } \\ & \text { A2,1 } \\ & \\ & \text { DM1 } \\ & \text { A1 } \end{aligned}$ | [4] | ft their $A, B$ <br> AG <br> Attempt $\int_{0}^{5} y^{2} d x \quad(\pi$ not vital) <br> ( $\pi$ not vital). $2^{\text {nd }} \mathrm{A}$ mark is for $\div 3$. <br> Application of limits to their integral (in either integral). Limits 0 to 5 only. <br> Attempt $\int_{0}^{5} y^{2} d x$ ( $\pi$ not vital) <br> Also directly $-\frac{10}{3}\left(-\frac{1}{10} x+1\right)^{3}$ <br> or $-\frac{10}{3}\left[\left(-\frac{1}{2}+1\right)^{3}-1^{3}\right](\pi$ not vital $)$ <br> - applying limits to their integral <br> Subtraction of their volumes co |

