1. 

(i) Show that the equation $\frac{\tan \theta}{\cos \theta}=1$ may be rewritten as $\sin \theta=1-\sin ^{2} \theta$
(ii) Hence solve the equation $\frac{\tan \theta}{\cos \theta}=1$ for $0^{\circ} \leqslant \theta \leqslant 360^{\circ}$.
2.

Simplify $\frac{\sqrt{1-\cos ^{2} \theta}}{\tan \theta}$, where $\theta$ is an acute angle.
3.
(i) Show that, when $x$ is an acute angle, $\tan x \sqrt{1-\sin ^{2} x}=\sin x$.
(ii) Solve $4 \sin ^{2} y=\sin y$ for $0^{\circ} \leqslant y \leqslant 360^{\circ}$.

| Question |  | Answer/Indicative content | Marks | Part marks and guidance |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | i | $\left(\frac{\sin \theta}{\frac{\cos \theta}{\cos \theta}}\right)=1 \text { oe }$ <br> $\sin \theta=\cos ^{2} \theta$ and completion to given result | M1 <br> A1 | WWW <br> Examiner's Comments <br> Many candidates answered this question well, although there were a number of attempted fudges using $\tan \theta={ }^{\cos \theta} / \sin \theta$. Some adopted a scattergun approach and it was not always possible to follow their method. |  |
|  | ii | $\sin ^{2} \theta+\sin \theta-1[=0]$ <br> $[\sin \theta=] \frac{-1 \pm \sqrt{5}}{2}$ oe may be implied by correct answer | M1 <br> A1 | allow 1 on RHS if attempt to complete square <br> may be implied by correct answers | condone $y^{2}+y-1=0$ <br> mark to benefit of candidate <br> ignore any work with negative root \& condone omission of negative root with no comment eg M1 for 0.618... |


| Question |  | Answer/Indicative content <br> [ $\theta=$ ] 38.17..., or 38.2 and 141.83..., 141.8 or 142 | Marks <br> A1 | Part marks and guidance |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | ii |  |  | Ignore extra values outside range, A0 if extra values in range or in radians <br> NB 0.6662 and 2.4754 if working in radian mode earns M1A1A0 <br> Examiner's Comments <br> This defeated a significant minority of candidates. However, many obtained the correct quadratic equation. Most then went on to attempt factorisation, going wrong and failing to score. A minority successfully completed the square or used the formula. Many of these went on to score full marks, but some candidates missed the last mark because they presented extra values in the range, or because they didn't realise that further work was needed after obtaining the roots of the quadratic. | If unsupported, B1 for one of these, B2 for both. If both values correct with extra values in range, then B1. <br> NB 0.6662 and 2.4754 to $3 s f$ or more |
|  |  | Total | 5 |  |  |


| Question |  | Answer/Indicative content | Marks | Part marks and guidance |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 2 |  |  |  |  | $\frac{\sqrt{\sin ^{2} \theta}}{\frac{\sin \theta}{\cos \theta}}$ or $\frac{\cos \theta \sqrt{\sin ^{2} \theta}}{\sin \theta}$ | M1 |


|  | Question | Answer/Indicative content | Marks <br> M1 | Part marks and guidance |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 3 | i <br> i <br> i | substitution of $\tan x=\frac{\sin x}{\cos x} \text { or } \sqrt{1-\sin ^{2} x}=\sqrt{\cos ^{2} x} \text { or } \cos x$ <br> in given LHS <br> both substitutions seen and completion to $\sin x$ as final answer | M1 <br> A1 | if no substitution, statements must follow a logical order and the argument must be clear; if one substitution made correctly, condone error in other part of LHS <br> NB AG; answer must be stated <br> allow consistent use of other variable eg $\theta$ for both marks <br> Examiner's Comments <br> A significant minority of candidates chose to work backwards, but few were successful. Many candidates "started at both ends" and tried to meet in the middle sometimes a method mark was achieved. <br> A good number of candidates earned the first method mark with one of the correct substitutions, but either failed to complete the argument or tried to show something else. | condone omission of variable throughout for M1 only, but allow recovery from omission of variable at end <br> M0 if first move is to square one or both sides <br> Simply stating eg $\tan x=\frac{\sin x}{\cos x}$ is insufficient <br> Alternatively SC2 for complete argument eg $\begin{aligned} & \tan x=\frac{\sin x}{\cos x} \\ & {[\tan x \times \cos x=\sin x]} \\ & \sin ^{2} x+\cos ^{2} x=1 \\ & \cos x=\sqrt{1-\sin ^{2} x} \end{aligned}$ $\tan x=\frac{\sin x}{\sqrt{1-\sin ^{2} x}}$ $\tan x \times \sqrt{1-\sin ^{2} x}=\sin x \text { oe }$ |
|  | ii <br> ii <br> ii | $0,180,360$ <br> 14 or 14.47 to 14.5 <br> 166 or awrt 165.5 | B1 <br> B1 <br> B1 | all 3 required <br> radians: mark as scheme but deduct one from total <br> 0, п, 2п; <br> 0.25 or 0.253 or awrt 0.2527; <br> 2.89 or 2.889 or awrt 2.8889 <br> Examiner's Comments <br> Most candidates solved the quadratic successfully and went on to find 14.5 and 166. A surprising number omitted one or more of the three other roots, however. | NB $\sin y=0$ or $1 / 4$ <br> ignore extra values outside range <br> if B3, deduct 1 mark for extra values within range |


| Question |  | Answer/Indicative content | Marks | Part marks and guidance |
| :--- | :--- | :--- | :---: | :---: | :---: |
|  |  | Total | 5 |  |

