| | | | | |
|---|---|---|---|---|
| (a) | Use $\tan^2\beta = \dfrac{\sin^2\beta}{\cos^2\beta}$ | B1 | E.g. $\tan^2\beta = \dfrac{\sin^2\beta}{\cos^2\beta}$ and then replaces $\sin^2\beta$ with $a^2$ or $\cos^2\beta$ with $1-a^2$. | Nov/9709/11/2024/Q8 |
| | $\cos\beta = -\sqrt{1-a^2}$ | B1 | | |
| | Obtain $\dfrac{a^2}{1-a^2} + 3a\sqrt{1-a^2}$ | B1 | | |
| | | 3 | | |
| (b) | Use correct identity to obtain 3-term quadratic equation in $\sin\theta$ | *M1 | | |
| | Obtain $\sin^2\theta + 4\sin\theta + 1 [=0]$ | A1 | | |
| | Attempt to solve quadratic | DM1 | At least as far as $\dfrac{-4\pm\sqrt{12}}{2}$.<br>$-15.5°$ implies attempt at solving quadratic. | |
| | Obtain 195.5 | A1 | | |
| | Obtain 344.5 | A1FT | Following first answer; and no others for $0° < \theta < 360°$ but must be in $4^{th}$ quadrant.<br>**SC B1** for $3.41^c$ and $6.01^c$. | |
| | | 5 | | |
| 1(a) | $a = 4$ | B1 | Allow $4\sin(2x)+3$ if values of $a$, $b$ and $c$ are not stated. | Nov/9709/12/2024/Q1 |
| | $b = 2$ | B1 | | |
| | $c = 3$ | B1 | | |
| | | 3 | | |
| (b)(i) | 5 | B1 | Ignore attempts at finding solutions. | |
| | | 1 | | |
| (b)(ii) | 1 | B1 | Ignore attempts at finding solutions. | |
| | | 1 | | |
| | $\cos\left(\dfrac{\pi}{6}\right) + \tan 2x + \dfrac{\sqrt{3}}{2} = 0 \Rightarrow \tan 2x = -\sqrt{3}$ | M1 | Making $\tan 2x$ the subject. $\tan 2x = 0$ is M0.<br>Accept decimals and one sign error. | Nov/9709/13/2024/Q2 |
| | $\Rightarrow 2x = -\dfrac{\pi}{3} \Rightarrow x = -\dfrac{\pi}{6}$ | A1 | May come from non-exact working.<br>Ignore answers outside the given range. | |
| | | 2 | | |
| | Let $x = \sin^2\theta$<br>$(2x+7)(2x-1) = 0$ or $(2\sin^2\theta + 7)(2\sin^2\theta - 1)$ | M1 | Or equivalent method. | Nov/9709/13/2024/Q4 |
| | $\Rightarrow \sin^2\theta = \dfrac{1}{2} \Rightarrow \sin\theta = [\pm]\dfrac{1}{\sqrt{2}}$ | M1 | Finding $\sin^2\theta$ and then $\sin\theta$ (may be implied). | |
| | $\theta = 45°, 135°, 225°, 315°$ | A1 A1 | A1 for any two correct values.<br>A1 for all correct and no others within the range.<br>For answers in radians, A1 only for all 4 angles.<br>If no (correct) working, then **SC B1** for all 4 solutions. | |
| | | 4 | | |

| | | | | |
|---|---|---|---|---|
| (a) | {Stretch} {factor 3} { in $y$-direction} | B2,1,0 | 2 out of 3 scores B1. | June/9709/11/2024/Q2 |
| | {Translation} $\begin{pmatrix} \{0\} \\ \{-2\} \end{pmatrix}$ | B2,1,0 | Accept shift. | |
| | **Alternative Method for Question 2(a)** | | | |
| | {Translation} $\begin{pmatrix} \{0\} \\ \left\{-\frac{2}{3}\right\} \end{pmatrix}$ | (B2,1,0) | 2 out of 3 scores B1. Accept shift. | |
| | {Stretch} {factor 3} { in $y$-direction} | (B2,1,0) | | |
| | | 4 | | |
| (b) | $[\mathrm{f}(x)] = \{-3\sin x\}\{-2\}$ | B1 B1 | No marks awarded if extra terms seen. | |
| | | 2 | | |
| (a) | $\frac{\sin^2 x - \cos x - 1}{1+\cos x} = \frac{1-\cos^2 x - \cos x - 1}{1+\cos x}$ or $\frac{-\cos^2 x - \cos x}{1+\cos x}$ | M1 | For use of $\sin^2 x + \cos^2 x = 1$. Allow use of s, c, t or omission of $x$ throughout. | June/9709/11/2024/Q5 |
| | $= \frac{-\cos x(1+\cos x)}{1+\cos x}$ | M1 | For factorising. | |
| | $= -\cos x$ | A1 | | |
| | | 3 | | |
| (b) | $-\frac{1}{2}\cos x = \frac{1}{4} \Rightarrow x = \cos^{-1}\left(-\frac{1}{2}\right)$ | M1 | | |
| | $x = 120°$ or $x = 240°$ | A1 | | |
| | | A1 FT | FT for 360 – *their* answer. **A1 A0** if extra solution(s) in range. **SC B1** if answer in radians for both $\frac{2\pi}{3}, \frac{4\pi}{3}$. | |
| | | 3 | | |
| (a) | $7\frac{\sin\theta}{\cos\theta} + \cos\theta + 12[=0]$ $\left[\text{leading to } 7\frac{\sin\theta}{\cos\theta} + 12\cos\theta = 0\right]$ | M1* | OE<br>Use of $\tan\theta = \frac{\sin\theta}{\cos\theta}$. | June/9709/12/2024/Q3 |
| | $7\sin\theta + 12(1-\sin^2\theta)[=0]$ | DM1 | Use of $s^2 + c^2 = 1$. | |
| | $\Rightarrow 12\sin^2\theta - 7\sin\theta - 12 = 0$ | A1 | AG, WWW<br>Condone use of s, c and t and/or omission of $\theta$ throughout working but the A1 is for cao. | |
| | | 3 | | |
| (b) | $[12\sin^2\theta - 7\sin\theta - 12 = 0 \text{ leading to}](4\sin\theta + 3)(3\sin\theta - 4)$ | M1 | | |
| | $\sin\theta = -\frac{3}{4}$ $\left[\text{or } \frac{4}{3}\right]$ | B1 | OE, WWW<br>Can be implied by a correct value for $\sin^{-1}\left(-\frac{3}{4}\right)$ e.g. $-48.6°$. | |
| | $[\theta =]228.6°, 311.4°$ | B1 | AWRT, WWW<br>No others in the range $0° \le \theta \le 360°$.<br>Ignore any answers outside this range.<br>Condone 229°, 311°. | |
| | | 3 | | |

| | | | | |
|---|---|---|---|---|
| (a) | State $(\frac{5}{3}\pi,\ 0)$ for point $A$ | B1 | Or exact equivalent.<br>Allow $x = \frac{5}{3}\pi$ or exact equivalent. | June/9709/13/2024/Q2 |
| | $x = \frac{19}{6}\pi$ for point $B$ | B1 | Or exact equivalent.<br>May be implied in coordinate or vector form. | |
| | $y = -k$ for point $B$ | B1 | May be implied in coordinate or vector form. | |
| | | 3 | | |
| (b) | Solve at least as far as $\sin^{-1} 3t = k\pi$ with correct value for $\cos^{-1}\left(\frac{1}{2}\sqrt{2}\right)$ | M1 | Allow use of $\pi = 3.14...$.<br>Allow $\sin^{-1} 3t = 30$. | |
| | $\sin^{-1} 3t = \frac{1}{6}\pi$ and hence $t = \frac{1}{6}$ | A1 | Or exact equivalent.<br>Can use degrees if consistent. | |
| | | 2 | | |
| (a) | State $(3\pi,\ -k)$ | B1 | | March/9709/12/2024/Q2 |
| | | 1 | | |
| (b) | Obtain equation of form $[y =]c \pm k\sin\frac{1}{2}x$ | M1 | Any non-zero $c$. | |
| | Obtain correct equation $[y =]2 - k\sin\frac{1}{2}x$ | A1 | OE | |
| | State $(3\pi,\ 2+k)$ | B1 FT | Following part (a), i.e. (*their* $x$, $2 -$ *their* $y$). | |
| | | 3 | | |
| (a) | Expand bracket to obtain 3 terms and use correct identity | M1 | $\theta$ may be missing or another symbol used. | March/9709/12/2024/Q4 |
| | Use identity $\frac{\sin\theta}{\cos\theta} = \tan\theta$ | M1 | Does not require any further explanation.<br>$\theta$ may be missing or another symbol used. | |
| | Conclude with $2\tan\theta$ | A1 | WWW<br>AG | |
| | | 3 | | |
| (b) | Attempt solution of $5\tan^3\theta = 2\tan\theta$ to obtain at least one value of $\tan\theta$ | M1 | SOI<br>Can be awarded if $\tan\theta$ is cancelled and ignored. | |
| | Obtain at least two of $0,\ \pm 32.3$ | A1 | Or greater accuracy.<br>**SC B1** if no method shown. | |
| | Obtain all three values | A1 | Or greater accuracy; and no others in $-90° < \theta < 90°$ range.<br>Other units **SC B1** only for all 3 angles.<br>**SC B1** if no method shown. | |
| | | 3 | | |
| | | | | |
| | | | | |