Question Number	Scheme	Marks
5(a)	$\sin 3x = \sin(2x+x) = \sin 2x\cos x + \cos 2x \sin x$	M1
	$= (2\sin x\cos x)\cos x + (1-2\sin^2 x)\sin x$	dM1
	$= 2\sin x\cos^2 x + \sin x - 2\sin^3 x$	A1
	$= 2\sin x(1-\sin^2 x) + \sin x - 2\sin^3 x = 3\sin x - 4\sin^3 x$	A1
		(4)
(b)	$2\sin 3\theta = 5\sin 2\theta \Rightarrow 2(3\sin\theta - 4\sin^3\theta) = 10\sin\theta\cos\theta$	M1
	Divides or takes out $\sin\theta$ as a factor and uses $\sin^2\theta = 1-\cos^2\theta$ to set up and solve a 3TQ in $\cos\theta$ E.g. $\Rightarrow 6\sin\theta - 8\sin^3\theta = 10\sin\theta\cos\theta \Rightarrow 6-8(1-\cos^2\theta) = 10\cos\theta$ $\Rightarrow 4\cos^2\theta - 5\cos\theta - 1 = 0$ $\Rightarrow \cos\theta = \dfrac{5-\sqrt{41}}{8} = (-0.175...)$	dM1
	Any two of the following four answers $\sin\theta = 0 \Rightarrow \theta = 180°, 360°$ $\cos\theta = \dfrac{5-\sqrt{41}}{8} \Rightarrow \theta =$ awrt 100° or awrt 260°	A1
	All of 180°, 360°, awrt 100.1°, awrt 259.9°	A1
		(4)
		Total 8

(a)

M1: Attempts $\sin 3x = \sin(2x+x)$ and achieves $\pm\sin 2x\cos x \pm \cos 2x\sin x$. The $= \sin(2x+x)$ may be implied

dM1: Dependent upon the previous mark. It is for using $\sin 2x = 2\sin x\cos x$ and $\cos 2x = \pm 1 \pm 2\sin^2 x$, $\pm 1 \pm 2\cos^2 x$ or $\pm(\cos^2 x - \sin^2 x)$ to form an expression in just sin$x$ and cos$x$.

A1: Fully correct AND expanded expression in just sin$x$ and cos$x$

Examples of correct expanded expressions are;

$2\sin x\cos^2 x + \sin x - 2\sin^3 x$

$2\sin x\cos^2 x + 2\sin x\cos^2 x - \sin x$

$2\sin x\cos^2 x + \sin x\cos^2 x - \sin^3 x$

or $4\sin x\cos^2 x - \sin x$

Condone a missing x on a sin x, for example. Condone a slip in notation, e.g. writing $\sin x^3$ instead of $\sin^3 x$ as long as it is subsequently corrected.

A1: Proceeds correctly to $3\sin x - 4\sin^3 x$ using $\cos^2 x = 1-\sin^2 x$

Penalise notational and bracketing errors on this mark only

E.g. Writing $\cos x^2$ for $\cos^2 x$, mixing variables, missing x on a sin x etc

(b) Allow if solved in terms of another variable, say x

The question states hence or otherwise solve $2\sin 3\theta = 5\sin 2\theta$

In almost all cases they will use their part (a) and proceed by the 'hence' route.

'Otherwise' routes could start with earlier versions of $2\sin 3\theta$ such as $2\left(2\sin x\cos^2 x + \sin x - 2\sin^3 x\right)$

In almost all cases the main mark scheme provides a framework of how the marks are awarded

M1: Uses their part (a) and a double angle for $\sin 2\theta$ of the form $G\sin\theta\cos\theta$ to form an equation in $\sin\theta$ and $\cos\theta$. Look for $R\sin\theta + S\sin^3\theta = T\sin\theta\cos\theta$ o.e. Condone slips such as forgetting to $\times 2$

dM1: The mark is scored for dividing or taking out a factor of $\sin\theta$ and using $\sin^2\theta = \pm 1 \pm \cos^2\theta$ to set up and solve a 3TQ in $\cos\theta$. To solve you should expect to see a valid method used, leading to at least one value for $\cos\theta = k, -1 < k < 1, k \neq 0$

If a calculator is used to solve the 3TQ in $\cos\theta$ the value(s) must be correct for their equation.

Candidates cannot go straight from an equation e.g. $4\cos^2\theta - 5\cos\theta - 1 = 0$ to a solution e.g. 100.1° without sight of the value for $\cos\theta$ in between.

A1: Finds two angles of 180°, 360°, awrt 100°, awrt 260° following at least one previous M1

The 180° and/or 360° must be found via a correct method with $\sin\theta = 0$ being seen or implied and also produced from a factorised $P\sin\theta + Q\sin^3\theta = R\sin\theta\cos\theta$

Likewise, the 100° and 260° must have been achieved via solving a correct equation.

Allow this mark if the answers are given in radians. So, for two angles of π, 2π, awrt 1.75, awrt 4.54

A1: All of 180°, 360°, awrt 100.1°, awrt 259.9° with no extra values within the range following M1, dM1

There are no marks for answers appearing without valid method and working

There are other (usually more complicated) ways of attempting part (b) so you must look carefully through each response. If you think a response deserves credit and you are unsure of how to mark, please send to review.

Question Number	Scheme	Marks
6 (a)	$\text{gf}(2)=\text{g}(3)=3^2+5$	M1
	$=14$	A1
		(2)
(b)	Correct attempt at inverse $y=6-\dfrac{21}{2x+3}\Rightarrow 2x+3=\dfrac{21}{6-y}\Rightarrow x=\left(\dfrac{21}{6-y}-3\right)\div 2$	M1
	$\text{f}^{-1}(x)=\dfrac{3x+3}{2(6-x)}$ or $\text{f}^{-1}(x)=\dfrac{21}{2(6-x)}-\dfrac{3}{2}$	A1
	$-1\text{,,}\ \ x<6$	B1
		(3)
(c)	$\text{gg}(x)=126\Rightarrow\left(x^2+5\right)^2+5=126\Rightarrow x^2+5=\sqrt{121}$	M1
	$\Rightarrow x^2=\text{"6"}\Rightarrow x=(\pm)\sqrt{6}$	dM1
	$\Rightarrow x=\pm\sqrt{6}$	A1
		(3)
		Total 8

(a)

M1: Full attempt at $\text{gf}(2)$ applying the rules in the correct order

Look for one of

- An attempt at $6-\dfrac{21}{2\times 2+3}\rightarrow k$ followed by an attempt at k^2+5
- An attempt at substituting $x = 2$ into $\left(6-\dfrac{21}{2x+3}\right)^2+5$

A1: 14

Allow just 14 with no incorrect working for both marks

(b)

M1: For an attempt at the method of finding the inverse. It is the process you are scoring here.

Look for a process that starts with *y* as a function of *x* and proceeds to *x* as a function of just *y*.

Starting with $y=6-\dfrac{21}{2x+3}$, or possibly a changed function of the form $y=\dfrac{ax+b}{2x+3}$, which proceeds to a form x = function of **just** y. Some candidates may swap x and y first. E.g $x=6-\dfrac{21}{2y+3}$ and proceed to function y = function of just x which is fine.

A1: Correct inverse $\text{f}^{-1}(x)=\dfrac{3x+3}{2(6-x)}$ or $\text{f}^{-1}(x)=\dfrac{21}{2(6-x)}-\dfrac{3}{2}$ o.e. but condone y or f^{-1} for $\text{f}^{-1}(x)$

Allow other equivalents such as $y=\dfrac{-3x-3}{2(x-6)}$, $y=\dfrac{10.5}{(6-x)}-1.5$ and $y=\left(\dfrac{21}{6-x}-3\right)\div 2$

ISW following a correct answer

B1: Correct domain written in correct form. E.g. $-1\text{,,}\ \ x<6$, $[-1,6)$