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. $-1\text{,,}\ \ x<6$, $[-1,6)$

(c)

M1: For an attempt to "undo" g once in an attempt to find the value of $g(x)$, x^2 or x^2+5.

This may be scored for any of the following methods (condoning slips)

- $\left(x^2+5\right)^2+5=126 \Rightarrow x^2+5=\sqrt{121}$

  $\left(x^2+5\right)^2+5=126 \Rightarrow x^4+10x^2-96=0 \Rightarrow \left(x^2-6\right)\left(x^2+16\right)=0 \Rightarrow x^2=...$
- Condone $\left(x^2+5\right)^2+5=126 \Rightarrow x^4+10x^2-96=0 \Rightarrow x=$ awrt 2.45 OR $x^2=6$
- $g(x)=\sqrt{126-5}$

Do not award this mark if the candidate believes that to find x you only need to undo g once.
So, answers like $x=11$ or $x=6$ will score 0,0,0 unless further work is seen

dM1: For a complete attempt to find the exact solution to the equation. Examples of this would include

- $\left(x^2+5\right)^2+5=126 \Rightarrow x^2+5=\sqrt{121} \Rightarrow x=\sqrt{\sqrt{121}\pm 5}$
- $\left(x^2+5\right)^2+5=126 \Rightarrow x^4+10x^2-96=0 \Rightarrow \left(x^2-6\right)\left(x^2+16\right)=0 \Rightarrow x^2=6 \Rightarrow x=\sqrt{6}$
- $\left(x^2+5\right)^2+5=126 \Rightarrow x=\sqrt{6}$ or $\left(x^2+5\right)^2+5=126 \Rightarrow x=-\sqrt{6}$
- $\left(x^2+5\right)^2+5=126 \Rightarrow x^4+10x^2-96=0 \Rightarrow x=\sqrt{6}$
- $x=\sqrt{'11'-5}$

A1: $x=\pm\sqrt{6}$ only. Ignore any reference to $\pm 4i$ if included.

Sight of $\pm\sqrt{6}$ without incorrect working scores all 3 marks

Question Number	Scheme	Marks
7 (a)	$\mathrm{f}(x)=x^3\sqrt{4x+7} \Rightarrow \mathrm{f}'(x)=3x^2\sqrt{4x+7}+2x^3\left(4x+7\right)^{-\frac{1}{2}}$	M1, A1
	$\Rightarrow \mathrm{f}'(x)=3x^2\sqrt{4x+7}+\dfrac{2x^3}{\sqrt{4x+7}}=\dfrac{3x^2\left(4x+7\right)+2x^3}{\sqrt{4x+7}}$	dM1
	$\Rightarrow \mathrm{f}'(x)=\dfrac{7x^2\left(2x+3\right)}{\sqrt{4x+7}}$	A1
		(4)
(b)	Substitutes $x=-\dfrac{3}{2}$ into $x^3\sqrt{4x+7} \Rightarrow y=...$	M1
	$\left(-\dfrac{3}{2},-\dfrac{27}{8}\right)$	A1
		(2)
(c)	Attempts $-4\times"-\dfrac{27}{8}"$	M1
	y „ $\dfrac{27}{2}$	A1
		(2)
(d)	$\left(2,7\right)$	M1, A1
		(2)
		Total 10

(a)

M1: Attempts the product rule to achieve $\mathrm{f}'(x)=Px^2\sqrt{4x+7}+Qx^3\left(4x+7\right)^{-\frac{1}{2}}$ where P and Q are positive constants.

Other methods are possible so look at each one carefully.

For example: $\mathrm{f}(x)=x^3\sqrt{4x+7} \Rightarrow \mathrm{f}(x)=\sqrt{4x^7+7x^6} \Rightarrow \mathrm{f}'(x)=\dfrac{1}{2}\left(4x^7+7x^6\right)^{-\frac{1}{2}}\times\left(28x^6+42x^5\right)$

The same principles for the main mark scheme can be applied

A1: $\mathrm{f}'(x)=3x^2\sqrt{4x+7}+2x^3\left(4x+7\right)^{-\frac{1}{2}}$ o.e. which may be left unsimplified

dM1: Dependent upon previous M1. It is for "correctly" producing a single fraction with a denominator of $\sqrt{4x+7}$.

Look for $\mathrm{f}'(x)=Px^2\sqrt{4x+7}+Qx^3\left(4x+7\right)^{-\frac{1}{2}} \Rightarrow \dfrac{Px^2(4x+7)+Qx^3}{\sqrt{4x+7}}$ o.e

A1: $\mathrm{f}'(x)=\dfrac{7x^2\left(2x+3\right)}{\sqrt{4x+7}}$

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It is possible to attempt this by WMA14 methods using $\left[\mathrm{f}(x)\right]^2=x^6\left(4x+7\right)=4x^7+7x^6$

Score

M1, A1: $2\mathrm{f}(x)\mathrm{f}'(x)=28x^6+42x^5$

dM1, A1: $\mathrm{f}'(x)=\dfrac{14x^5(2x+5)}{2\mathrm{f}(x)}=\dfrac{14x^5(2x+5)}{2x^3\sqrt{4x+7}}=\dfrac{7x^2(2x+5)}{\sqrt{4x+7}}$