Question	Scheme	Marks
1(a)	$2x^3-4x-15=(Ax+B)(x^2+3x+4)+C(2x+3)\Rightarrow A=...$ or $x^2+3x+4\overline{)2x^3+0x-4x-15}$ $\quad 2x...$ $\quad 2x^3+...$	**M1**
	$A=2$	**A1**
	$B=-6, C=3$	**A1A1**
		(4)
(b)	$\int f(x)\,dx="A"\frac{x^2}{2}+"B"x+"C"\ln\left(x^2+3x+4\right)$	**M1** **A1ft**
	$\int f(x)\,dx=x^2-6x+3\ln\left(x^2+3x+4\right)$	
	$\int_3^5 f(x)\,dx=\left(5^2-6\times5+3\ln\left(5^2+3\times5+4\right)\right)-\left(3^2-6\times3+3\ln\left(3^2+3\times3+4\right)\right)=..$	**dM1**
	$=-5+3\ln 44+9-3\ln 22=4+3\ln\left(\frac{44}{22}\right)$	**M1**
	$=4+\ln 8$	**A1**
		(5)
		(9 marks)

Notes:

(a)

M1: A correct method leading to at least one of the constants. May attempt long division getting the term *A*, or multiply through and compare coefficients or substitute values. Note that achieving *A* = 2 implies this mark.

A1: $A=2$ May be seen in the long division or in the expression.

A1: Either $B=-6$ or $C=3$ Stated or as part of the expression

A1: Both $B=-6$ and $C=3$ Stated or as part of the expression

(b) Note: use of letters *A, B* and *C* can score max 3 marks M1A1ftdM0M1A0.

M1: Attempts to integrate their answer to (a), look for $x^n\rightarrow x^{n+1}$ at least once and

$\frac{2x+3}{x^2+3x+4}\rightarrow k\ln(x^2+3x+4)$ Allow with letters used if values have not been found.

A1ft: Correct integration following through their *A, B* and *C* (or with letters).

dM1: Applies the limits to their integral and subtracts. *Must have numerical values for this mark.*.

M1: Uses correct log laws to combine the log terms into a single log term. (Need not have used the power law at this stage, unless earlier error leads to mismatch of coefficients.) Allow if letters used, so 3*C*ln(44/22) can score this mark.

A1cao: Correct answer in the form specified.

Question	Scheme	Marks
2(a)	Either $\mathrm{f}(x) < 5$ or $\mathrm{f}(x) \ldots 3$	**M1**
	$3 ,, \ \mathrm{f}(x) < 5$	**A1**
		(2)
(b)	(i) $y = 5 - \dfrac{4}{3x+2} \Rightarrow \dfrac{4}{3x+2} = 5 - y \Rightarrow \dfrac{4}{5-y} = 3x + 2 \Rightarrow x = ...$	**M1**
	$\left(\mathrm{f}^{-1}(x)\right) = \dfrac{1}{3}\left(\dfrac{4}{5-x} - 2\right)$ oe such as $\dfrac{4}{15-3x} - \dfrac{2}{3}$ or $\dfrac{2x-6}{15-3x}$	**A1**
	(ii) Domain is $3 ,, \ x < 5$	**B1ft**
		(3)
(c)	$\mathrm{fg}(-\pi) = \mathrm{f}\left(\left\lvert 4\sin\left(-\dfrac{\pi}{3} + \dfrac{\pi}{6}\right)\right\rvert\right) = \mathrm{f}\left(\left\lvert 4\sin\left(-\dfrac{\pi}{6}\right)\right\rvert\right) = \mathrm{f}(2) = ...$	**M1**
	$= 5 - \dfrac{4}{6+2} = \dfrac{9}{2}$	**A1**
		(2)
		(7 marks)

Notes:

(a)

M1: One correct end of range, though allow with „ or < and … or > (in correct direction) at the respective ends, and accept with *y* instead of f(*x*), or even with *x* for the M1.

A1: Correct range, allow with *y* instead of f(*x*) or with other correct set notation (but use of *x* is A0 unless in formal set notation). Accept as two separate inequalities.

(b)(i)

M1: Attempts to make *x* or a swapped *y* the subject of the equation. Allow sign slips, but there should be a correct order of operations.

A1: Correct rule, must be in terms of *x*, accept equivalents and isw after a correct answer is seen. Do not be concerned with the lhs (accept *y* = … and even condone f(*x*) =...)

(b)(ii)

B1ft: Follow through on their answer to (a). Accept intervals or set notation answers. Do not accept e.g. $3 ,, \ \mathrm{f}^{-1}(x) < 5$ or with *y*

(c)

M1: Attempts to evaluate g at $-\pi$ and substitutes into f. (Allow even if a negative value is found.) Evaluation of $\mathrm{g}(-\pi)$ must be attempted, not just substitution into the expression. They may find the expression for fg(*x*) first and substituted, in which case the trigonometric expression must be evaluated before the mark is awarded.

A1: Correct answer. Accept as decimal. Dot not isw if they try to change to degrees.