Question Number	Scheme	Marks
	$f(x)=\left(3x^2-4x-5\right)(x-k)-5$	
3 (a)	States -5	B1 **(1)**
(b)	Sets $f(-2)=25\rightarrow\ (3\times4-4\times-2-5)(-2-k)-5=25$	M1
	$15(-2-k)=30\Rightarrow-2-k=2\Rightarrow k=-4$ *	A1* **(2)**
(c)	$\left(3x^2-4x-5\right)(x+4)-5=3x^3+8x^2-21x-25$	B1
	Attempts $3x-1\overline{)3x^3+8x^2-21x-25}$ to achieve quotient of $...x^2+...x+...$ and a remainder that is a constant	M1
	Quotient = x^2+3x-6 OR Remainder = -31	A1ft
	Quotient = x^2+3x-6 AND Remainder = -31	A1 **(4)** **(7 marks)**

(a)

B1: States -5

You may see $f(k)$ or a division sum attempted, which is fine. You are just awarding the sight of -5

Don't be too concerned about what -5 is called. You may see $f(x)$, $f(k)$ or even x

(b)

M1: Sets $f(-2)=25$ to form an equation in k Condone sign slips within the calculations but setting $f(-2)=-25$ or $f(2)=25$ is M0. Some may attempt to substitute -2 into the expanded form of $f(x)=3x^3-(4+3k)x^2+(4k-5)x+5k-5$ which is fine. Condone slips but expect to see linear coefficients for k in each of x^2, x and the constant terms.

Don't be concerned about poor attempts to solve the equation in k for this mark

A1*: Shows sufficient working with no errors to prove that $k=-4$.

The answer must follow a simplified and (easily) solvable equation.

(See scheme for possible route but allow simplified linear equations like $-30-15k=30$)

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M1: Alternatively substitutes $k=-4$ into $f(x)$ to get $\left(3x^2-4x-5\right)(x+4)-5$ and attempt the value of $f(-2)$

A1: Shows that $f(-2)=(12+8-5)(-2+4)-5=15\times2-5=25$ and makes a minimal conclusion e.g. ✓

……

(c)

B1: Multiplies out $\left(3x^2-4x-5\right)\left(x+4\right)-5$ to achieve a simplified $3x^3+8x^2-21x-25$

M1: Scored for a full method of finding **both** the quotient and the remainder.

The two main ways of scoring this mark are;

Either attempting to divide their expanded $\mathrm{f}(x)$ by $\left(3x-1\right)$ to form a quotient of the form $Ax^2+B.x+C$ and a remainder that is a constant.

Alternatively, setting up an identity of the form $\left(Ax^2+B.x+C\right)\left(3x-1\right)+R$ followed by an attempt to find the values of *A*, *B*, *C* and *R*.

Watch for candidates who find $\mathrm{f}\left(\frac{1}{3}\right)=-31$ and then adapt $\mathrm{f}(x)$ to $3x^3+8x^2-21x+6$. The M mark would be scored for dividing their $3x^3+8x^2-21x+6$ by $\left(3x-1\right)$ to form a quotient of the form $Ax^2+B.x+C$ and a remainder that is a constant (which should be 0 in a correct division).

A1ft: For either the quotient = x^2+3x-6. Allow this to be scored within the division sum

Or the remainder = -31 (may be scored within the division sum)

It must follow M1 so attempting $\mathrm{f}\left(\frac{1}{3}\right)$ and reaching -31 will not score this mark without further work

Follow through on finding a correct quotient or remainder for their $3x^3+8x^2-21x-25$ (4 term cubic expression). Note that any $3x^3+8x^2-21x+k$ will have a quotient of x^2+3x-6

A1: States that the Quotient = x^2+3x-6 AND the Remainder = -31. These cannot be scored within a division sum and must be stated separately to this. All previous marks must have been scored in (c) so cannot be awarded following an incorrect $\mathrm{f}(x)$

Question Number	Scheme	Marks
4. (a)	$\log_3(a+1)-\log_3 a=4 \Rightarrow \log_3\left(\frac{a+1}{a}\right)=4$	M1
	$\Rightarrow \left(\frac{a+1}{a}\right)=3^4$	A1
	$\Rightarrow a+1=81a \Rightarrow a=\frac{1}{80}$	dM1, A1
		(4)
(b)	$\text{Area} \approx \frac{1}{2}\left\{\log_3\left(\frac{2}{1}\right)+\log_3\left(\frac{6}{5}\right)+2\left(\log_3\left(\frac{3}{2}\right)+\log_3\left(\frac{4}{3}\right)+\log_3\left(\frac{5}{4}\right)\right)\right\}$	M1, A1
	$=\frac{1}{2}\log_3\left(\frac{2}{1}\times\frac{6}{5}\times\frac{3^2}{2^2}\times\frac{4^2}{3^2}\times\frac{5^2}{4^2}\right)=\frac{1}{2}\log_3 15=\log_3\sqrt{15}$	dM1, A1
		(4)
(c)	States 'increase the number of strips'	B1
		(1)
		(9 marks)

(a) Allow with $a \leftrightarrow x$ as seen in the notes

M1: Sets $\log_3(x+1)-\log_3 x=4$ and then applies the subtraction law. Condone the omission of the 3 in $\log_3$

Alternatively writes the equation $\log_3(x+1)=4+\log_3 x$ as $\log_3(x+1)=\log_3 k+\log_3 x \quad (k\neq 4)$ and then uses the addition law $\log_3(x+1)=\log_3(kx)$

A1: Correct equation not involving logs. For example, $\left(\frac{x+1}{x}\right)=3^4$

dM1: Correct attempt to solve an equation of the form $\frac{x+1}{x}=k$ o.e. where k is an integer $k\neq 3$ or 4.

Look for $\frac{x+1}{x}=k \Rightarrow x=\frac{1}{"k"-1}$ where $k\neq 3$.

A1: a or $x=\frac{1}{80}$ or 0.0125 following the award of M1,A1, dM1.

Working must be seen as required by the question.

Special Case:

You may see attempts that proceed towards the correct answer using incorrect laws.

E.g. $\log_3(x+1)-\log_3 x=4 \Rightarrow \frac{\log_3(x+1)}{\log_3 x}=4 \Rightarrow \left(\frac{x+1}{x}\right)=3^4 \Rightarrow x=\frac{1}{80}$

Candidates who achieve the correct answer using the above incorrect line can score SC 0, 0, 1, 1