Question	Scheme	Marks
4(a)	$y=\log_{10}(2x+1)\Rightarrow 10^y=2x+1\Rightarrow x=...$	**M1**
	$\Rightarrow x=\dfrac{10^y-1}{2}$	**A1**
		(2)
(b)	$\left(\dfrac{\mathrm{d}x}{\mathrm{d}y}=\right)\dfrac{1}{2}10^y\ln 10$	**M1**
	$\dfrac{\mathrm{d}y}{\mathrm{d}x}=1\Big/\dfrac{\mathrm{d}x}{\mathrm{d}y}=\dfrac{1}{\frac{1}{2}10^y\ln 10}$	**M1**
	$\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{2}{(2x+1)\ln 10}$	**A1**
		(3)
		(5 marks)

Notes:

(a)

M1: Correctly undoes the logarithm and attempts to rearrange to make *x* the subject.

A1: Correct expression for *x*. Apply isw after a correct answer.

(b)

M1: Attempts to differentiate 10^y. Accept $\alpha 10^y\rightarrow\beta 10^y\ln 10$ (ignore any extra terms). Do not be concerned about the lhs for this mark.

M1: Applies reciprocal $\dfrac{\mathrm{d}y}{\mathrm{d}x}=1\Big/\dfrac{\mathrm{d}x}{\mathrm{d}y}$. Variables must be consistent.

A1: Correct answer. Accept equivalents in terms of *x*, e.g. with $10^{\log(2x+1)}$ isw after a correct answer.

Alt for (b): Allow use of change of base formula.

M1: $y=\dfrac{\ln(2x+1)}{\ln 10}$ (effectively a B mark via this method)

M1: $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\left(\dfrac{1}{\ln 10}\times\right)\dfrac{1}{2x+1}\times...$ Attempts to differentiate using the chain rule.

A1: Correct answer.

Note: Candidates who write $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{1}{2x+1}\times...\left(\text{ or }\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{1}{10^y}\times...\right)$ with no ln 10 term can score M0M1A0 under the Alt.

Alt 2: Implicit Differentiation

M1: As main scheme, attempts to differentiate as part of their work, so $\alpha 10^y\rightarrow\beta 10^y\ln 10\dfrac{\mathrm{d}y}{\mathrm{d}x}$

M1: Makes $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ the subject. **A1:** Correct answer.

Question	Scheme	Marks
5(a)	$P(1)=\frac{4-1}{10}+\frac{3}{4}\ln\left(\frac{2}{3^2}\right)$ $(=-0.828...)$	**M1**
	$P(1)=-0.828...$ (which is negative so a loss of £0.828 million,) so approximately £830 000 loss.	**A1***
		(2)
(b)	$P(6)=-0.08799\ldots$ and $P(7)=0.1975\ldots$	**M1**
	There is a sign change and hence as P is continuous on [6,7], so the root for t lies in [6,7].	**A1**
		(2)
(c)	$P=0\Rightarrow\frac{4t-1}{10}=-\frac{3}{4}\ln\left(\frac{t+1}{(2t+1)^2}\right)\Rightarrow t=...$	**M1**
	$\Rightarrow t=\frac{10\left(-\frac{3}{4}\ln\left(\frac{t+1}{(2t+1)^2}\right)\right)+1}{4}=\frac{1}{4}+\frac{30}{16}\ln\left(\frac{t+1}{(2t+1)^2}\right)^{-1}$ $\Rightarrow t=\frac{1}{4}+\frac{15}{8}\ln\left(\frac{(2t+1)^2}{t+1}\right)$ *	**A1***
		(2)
(d)	$t_2=\frac{1}{4}+\frac{15}{8}\ln\left(\frac{13^2}{7}\right)=...(=6.219978...)$	**M1**
	$t_2=$ awrt 6.220	**A1**
	$t_6=6.314$	**A1**
		(3)
(e)	"6.3..."×12 = ... months, or repeated iteration to root 6.31487 gives 75.7785… or allow "0.314..."×12 = "3.768..."	**M1**
	So it will take 76 months. (Accept 75 or awrt 76 months)	**A1**
		(2)
		(11 marks)

Notes:

(a)

M1: Attempts to substitute $t = 1$ into the given formula. Allow if there is a slip but an attempt at substitution is seen, or allow for sight of awrt $-0.828...$

A1*: Correct value for $P(1)$ seen to at least 2.s.f. if substitution has been shown, or at least 3 s.f. if no substitution was shown, followed by suitable conclusion that it is a loss of approximately £830 000, though accept awrt £830 000. Must mention "loss" and include units (£ or pounds). Negative value given is A0.

(b)

M1: Attempts both $P(6)$ and $P(7)$ with at least one correct to 1 s.f. rounded or truncated. A tighter interval could be used but must contain the root (6.31487)