Question Number	Scheme	Marks
2(a)	$\dfrac{2x^2-x+11}{(x+2)(2x-3)}=1+\dfrac{-2x+17}{(x+2)(2x-3)}$	M1A1
	$\dfrac{-2x+17}{(x+2)(2x-3)}=\dfrac{B}{x+2}+\dfrac{C}{2x-3}\Rightarrow B=...,\ C=...$	M1
	$\dfrac{2x^2-x+11}{(x+2)(2x-3)}=1-\dfrac{3}{x+2}+\dfrac{4}{2x-3}$	A1
	ALT 1	
	$2x^2-x+11=A(x+2)(2x-3)+B(2x-3)+C(x+2)$ Let e.g., $x=-2$ or $x=\dfrac{3}{2}$ $\Rightarrow$ eliminates either B or $C\Rightarrow B=-3$ or $C=4$	M1A1
	$2x^2-x+11=A(x+2)(2x-3)+B(2x-3)+C(x+2)$ Let e.g., $x=-2$ and $x=\dfrac{3}{2}\Rightarrow$ finds B,C and A	M1
	$\dfrac{2x^2-x+11}{(x+2)(2x-3)}=1-\dfrac{3}{x+2}+\dfrac{4}{2x-3}$	A1
	ALT 2	
	$2x^2-x+11=2Ax^2+x(A+2B+C)+(-6A-3B+2C)$ $\Rightarrow$ equates coefficients to find $A\Rightarrow 2=2A\Rightarrow A=1$	M1A1
	$A+2B+C=-1\Rightarrow 1+2B+C=-1$ $-6A-3B+2C=11\Rightarrow -6-3B+2C=11$ $\Rightarrow B=.....,\quad C=.....$	M1
	$\dfrac{2x^2-x+11}{(x+2)(2x-3)}=1-\dfrac{3}{x+2}+\dfrac{4}{2x-3}$	A1
		(4)
(b)	$\displaystyle\int\left(1-\frac{3}{x+2}+\frac{4}{2x-3}\right)\mathrm{d}x=x-3\ln\lvert x+2\rvert+2\ln\lvert 2x-3\rvert(+c)$	M1A1ftA1ft
		(3)
		Total 7

Notes

(a)

M1: Uses e.g. long division or inspection to express $f(x)$ as a constant with a linear remainder of the form $1+\dfrac{\pm\alpha x\pm\beta}{(x+2)(2x-3)}$ where α,β are non zero constants.

A1: Correct expression. i.e., $1+\dfrac{-2x+17}{(x+2)(2x-3)}\Rightarrow A=1$

M1: Uses an appropriate method to both B and C from an expression of the form $\frac{\alpha x+\beta}{(x+2)(2x-3)}$. E.g. substituting values or comparing coefficients to result in a three term expression.

A1: Fully correct expression. .Accept either embedded or listed values. E.g., $A = 1$, $B = -3$, $C = 4$

ALT 1

M1: Multiplies through by the denominator to obtain the shown equation, substitutes an appropriate value of x to find a value for B or C Allow sign errors for this mark.
Some candidates are deducing that $A = 1$ in this method. Award this mark for the equation and for B or C.

A1: Either B or C correct. **following fully correct processing**

M1: For **complete** processing to find both A and either B or C to result in a three term expression.

A1: Fully correct expression. .Accept either embedded or listed values. E.g., $A = 1$, $B = -3$, $C = 4$ o.e

ALT 2

M1: Multiplies through by the denominator to obtain the shown equation [can be deduced], multiplies out the RHS,
equates coefficients and finds a value for A. Allow sign errors for this mark.

A1: A correct **following fully correct processing**.

M1: For **complete** processing to find both B and C to result in a three term expression.

A1: Fully correct expression. .Accept either embedded or listed values. E.g., $A = 1$, $B = -3$, $C = 4$ o.e

isw further simplification

(b)

M1: $\int \frac{\ldots}{x+2}\,dx = \ldots\ln(x+2)$ **or** $\int \frac{\ldots}{2x-3}\,dx = \ldots\ln(2x-3)$ Allow modulus or round brackets.
Do not allow errors on $(x+2)$ or $(2x-3)$

A1ft: For any 2 terms correctly integrated. Follow through their stated A, B and C.
The brackets must be present but allow e.g. $-3\ln(x+2)$ or e.g. $2\ln(2x-3)$

A1ft: All **3** of their terms fully simplified. Follow through their stated A, B and C. The "+ c" is not required. If their $A = 0$ this mark is not awarded.
Allow $x-3\ln(x+2)+2\ln(2x-3)(+c)$
isw further simplification

Question Number	Scheme	Marks
3	$V = x^3 \Rightarrow \left(\frac{\mathrm{d}V}{\mathrm{d}x}\right) = 3x^2$	B1
	$V = 100 \Rightarrow x^3 = 100 \Rightarrow x = \sqrt[3]{100}$	B1
	$k = \frac{\mathrm{d}x}{\mathrm{d}t} = \frac{\mathrm{d}x}{\mathrm{d}V} \times \frac{\mathrm{d}V}{\mathrm{d}t} = \frac{1}{3 \times 100^{\frac{2}{3}}} \times 0.085$	M1
	$= 0.00132$	A1
		(4)
		Total 4

Notes

$\left[\text{Note: } 0.085 = \frac{17}{200}\right]$

Allow other variables in place of x but not t.

B1: $\left(\frac{\mathrm{d}V}{\mathrm{d}x}\right) = 3x^2$ seen anywhere in the working

B1: M1 in Epen Finds x when $V = 100 \Rightarrow x = \sqrt[3]{100}$ or awrt 4.64

M1: Applies $\frac{\mathrm{d}x}{\mathrm{d}t} = \frac{\mathrm{d}x}{\mathrm{d}V} \times \frac{\mathrm{d}V}{\mathrm{d}t}$ with their $\frac{\mathrm{d}V}{\mathrm{d}x} = 3x^2$ provided it is of the form $\frac{\mathrm{d}V}{\mathrm{d}x} = \mu x^2$ and their numerical value for x substituted correctly

This must lead to $\frac{\mathrm{d}x}{\mathrm{d}t} = ...$

Do not award this mark for $x = 100$ substituted here.

A1: Awrt 0.00132 (oe e.g. awrt 1.32×10^{-3}) Ignore units given.