Question Number	Scheme	Marks
4.(a)	Sets $kx+2=\frac{2}{x}+3x-4$ and attempts to collect terms or multiply through by x	M1
	$(k-3)x+6-\frac{2}{x}=0\Rightarrow(k-3)x^2+6x-2=0$ *	A1*
		(2)
(b)	Attempts b^2-4ac for $(k-3)x^2+6x-2=0$	M1
	Solves $b^2-4ac=0$ for $(k-3)x^2+6x-2=0\Rightarrow 36+8(k-3)=0\Rightarrow k=...$	dM1
	$k=-\frac{3}{2}$	A1
		(3)
		(5 marks)

Ignore labels here. Mark (a) and (b) as one complete question.

(a)

M1: Sets $kx+2=\frac{2}{x}+3x-4$ condoning slips and either attempts to collect terms or else multiply through by x

Allow for either of

- $kx+2=\frac{2}{x}+3x-4\Rightarrow(k\pm3)x+6=\frac{2}{x}$ o.e condoning slips on the 6. E.g. condone $6\leftrightarrow -2$
- $kx+2=\frac{2}{x}+3x-4\Rightarrow kx^2+2x=2+3x^2-4x$ with correct multiplication seen on at least 3 terms

A1*: Proceeds to given answer showing at least the required/ necessary steps with no incorrect lines.

Examples of correct work gaining M1 A1 showing a minimum number of necessary steps (three)

- By initially collecting terms: $kx+2=\frac{2}{x}+3x-4\Rightarrow(k-3)x+6-\frac{2}{x}=0\Rightarrow(k-3)x^2+6x-2=0$
- By multiplying initially: $kx+2=\frac{2}{x}+3x-4\Rightarrow kx^2+2x=2+3x^2-4x\Rightarrow(k-3)x^2+6x-2=0$
- Bracketing must be correct. There may be extra lines, which is fine, as long as they are correct.

(b)

M1: Attempts b^2-4ac for $(k-3)x^2+6x-2=0$ with **correct** values for a and b with c condoned as ±2

This is implied by setting $b^2=4ac$ but also $b^2-4ac>0$ and $b^2-4ac<0$ as well as non-strict versions. Note that stating and attempting b^2+4ac is M0 followed by dM0, A0

This cannot be scored if b^2-4ac can only be seen embedded within a quadratic formula.

dM1: Solves $b^2-4ac=0$ o.e. for $(k-3)x^2+6x-2=0\Rightarrow 6^2-4(k-3)(-2)=0\Rightarrow k=....$

Also $(k-3)x^2+6x-2=0\Rightarrow 36+8(k-3)=0\Rightarrow k=...$

It is dependent upon the previous M1 being an **equality** AND **correct** a, b and c leading to a value for k

Don't be too concerned by the processing of the equation leading to the value for k

A1: $k=-\frac{3}{2}$ o.e.

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Alt (b) via gradients.

M1: Sets $\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{-2}{x^2}+3=k$. Look for a $\frac{\mathrm{d}y}{\mathrm{d}x}$ in the form $\frac{\alpha}{x^2}+\beta$

dM1: Attempts to find $x^2=\left(\frac{2}{3-k}\right)$, substitutes into $(k-3)x^2+6x-2=0$ and solves to find $k=...$

Alternatively substitutes $k=\frac{-2}{x^2}+3$ into $(k-3)x^2+6x-2=0$ and solves to find x and then k.

A1: $k=-\frac{3}{2}$ o.e such as $-\frac{12}{8}$ or -1.5

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Question Number	Scheme	Marks
5 (a)	$9x^3-10x^2+x=x\left(9x^2-10x+1\right)=x(ax\pm1)(bx\pm1)$ with $ab=9$	M1
	$=x(9x-1)(x-1)$	A1
		(2)
(b)	States or implies that $x=3^y$ AND sets = to their 1 or $\frac{1}{9}$	M1
	Solves their $3^y=$"1" or $3^y=$"$\frac{1}{9}$"	dM1
	$y=0,-2$	A1
		(3)
		(5 marks)

THIS IS A NON- CALCULATOR QUESTION.

(a)

M1: Takes out (or divides by) a common factor of x and attempts to factorise the quadratic factor.
In most cases this will be

- either $9x^3-10x^2+x=x\left(9x^2-10x+1\right)=x(ax\pm1)(bx\pm1)$ with $ab=9$
- or $9x^2-10x+1=(ax\pm1)(bx\pm1)$ with $ab=9$

Other methods exist such as $9x^3-10x^2+x=(x-1)\left(9x^2-x\right)$ but the method is only scored when the factor of x is taken from the second bracket

It would be very difficult to score following an attempt to find the roots of $9x^2-10x+1=0$

A1: $x(9x-1)(x-1)$ o.e such as $(9x-1)(x-1)(x-0)$, $x(-9x+1)(-x+1)$ or $9x\left(x-\frac{1}{9}\right)(x-1)$ following the award of the M1 mark. **This must be done in part (a) but use review if unsure**

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Watch out for these.

Example 1: If you see $9x^3-10x^2+x=0\Rightarrow x=0,1,\frac{1}{9}$ followed by $x(9x-1)(x-1)$ it is M0 A0
(calculator use)

Example 2: If you see $9x^3-10x^2+x=x\left(x-\frac{1}{9}\right)(x-1)$ it is M0 A0
(Incorrect and probable calculator use)

Special case:

If you see $9x^3-10x^2+x=x(9x-1)(x-1)$ or $9x\left(x-\frac{1}{9}\right)(x-1)$ without any other working it is SC M1 A0

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