Question Number	Scheme	Marks
3.(a)	$\left(\frac{dy}{dx}\right) = 3x^2 + \frac{48}{\sqrt{x}}$	M1, A1, A1 **(3)**
(b)	$\left(\frac{d^2y}{dx^2}\right) = 6x - \frac{24}{x^{\frac{3}{2}}}$	M1
	$\Rightarrow x^{\frac{5}{2}} = ...$ $\quad x = 2^{\frac{4}{5}}$	dM1 A1 **(3)** **(6 marks)**

(a)

M1: For reducing a correct power by one any term. So, award for $x^3 \to x^2$, $x^{\frac{1}{2}} \to x^{-\frac{1}{2}}$ or even $5 \to 0$
As in question 1, the indices must be processed

A1: One of the two terms, correct **and** simplified, either $3x^2$ or $+\frac{48}{\sqrt{x}}$ or exact simplified equivalent

A1: CAO $3x^2 + \frac{48}{\sqrt{x}}$ or exact simplified equivalent such as $3x^2 + 48x^{-\frac{1}{2}}$

(b)

M1: For reaching $\left(\frac{d^2y}{dx^2}\right) = Ax \pm \frac{B}{x^{\frac{3}{2}}}$ o.e where A and B are non-zero constants

dM1: Sets their $\frac{d^2y}{dx^2} = Ax \pm \frac{B}{x^{\frac{3}{2}}} = 0$ and proceeds to $x^{\frac{5}{2}} = C$ (or equivalent working) where C is a constant.

Example of equivalent working $x = \frac{4}{x^{\frac{3}{2}}} \Rightarrow x^2 = \frac{16}{x^3} \Rightarrow x^5 = 16$

A1: CAO $x = 2^{\frac{4}{5}}$ following correct $\frac{d^2y}{dx^2}$ with dM1 also being scored. If it is achieved via decimals it is A0

Condone sight of correct work with correct k. E.g. $x^{\frac{5}{2}} = 4 \Rightarrow k = \frac{4}{5}$

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.