Question Number	Scheme	Marks
3.(a)	$y=\dfrac{5x^3-8}{2x^2}=\dfrac{5}{2}x-4x^{-2}$	M1
	$\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{5}{2}+8x^{-3}$	dM1 A1 A1 **(4)**
(b)	Substitutes $x=2$ into their $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\text{"}\dfrac{5}{2}+\dfrac{8}{2^3}\text{"}\Rightarrow\dfrac{\mathrm{d}y}{\mathrm{d}x}=\text{"}\dfrac{7}{2}\text{"}$	M1
	Uses their $\dfrac{7}{2}$ and (2, 4) $\Rightarrow y-4=\text{"}\dfrac{7}{2}\text{"}\left(x-2\right)$	M1
	$\Rightarrow 7x-2y-6=0$	A1 **(3)**
		(7 marks)

(a)

M1: Attempts to write *y* as **a sum of two terms** and achieves at least one term with the correct index.

Award for $Px+Qx^k$ or Px^k+Qx^{-2}. Condone $Qx^{-2}\leftrightarrow\dfrac{Q}{x^2}$

dM1: Requires both

- the given expression to be written as a sum of two terms with both indices correct
- correct differentiation applied to the indices $Px+Qx^{-2}\rightarrow A+Bx^{-3}$ o.e

A1: One correct term which need not be simplified. Condone $\dfrac{5}{2}x^0$

Note that 1010 is possible where candidates only form one of the two correct terms and differentiate that correctly

A1: $\left(\dfrac{\mathrm{d}y}{\mathrm{d}x}\right)=\dfrac{5}{2}+8x^{-3}$ or simplified equivalent such as $\dfrac{1}{2}\left(5+\dfrac{16}{x^3}\right)$. There is no need to have the $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

(b)

M1: Substitutes $x=2$ into their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ and attempts its value. Their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ cannot be the same as their "*y*"

Score for sight of embedded 2's in their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ followed by a value or it may be implied for a correct value for their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

M1: Correct method for finding the equation of a tangent.

Look for a correct use of their $\left.\dfrac{\mathrm{d}y}{\mathrm{d}x}\right|_{x=2}$ and the point (2, 4) to form equation $y-4=\text{"}\dfrac{7}{2}\text{"}\left(x-2\right)$.

If the form $y=mx+c$ is used it must proceed as far as *c* = ...

Award this mark if they achieve $\dfrac{\mathrm{d}y}{\mathrm{d}x}=\dfrac{5}{2}$ in part (a) and correctly form the equation using $m=\dfrac{5}{2}$ and (2, 4). They cannot score the previous mark.

A1: $7x-2y-6=0$ or any multiple thereof

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Alt (a)

Some may have done WMA13 and may attempt the quotient rule

M1, dM1 for an attempt at the quotient rule to obtain $\dfrac{2x^2\times ax^2-\left(5x^3-8\right)\times bx}{\left(2x^2\right)^2}$ where $a > 0$, $b > 0$

condoning lack of brackets

So allow, for example, if you see $2x^4$ on the denominator.

These two marks are scored together so 1000 is not possible via this route

Then A1 for $\dfrac{2x^2\times 15x^2-\left(5x^3-8\right)\times 4x}{\left(2x^2\right)^2}$ and finally A1 for $\dfrac{5x^3+16}{2x^3}$ or other simplified equivalent

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Alt (b)

Some may use the $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ function of their calculator to find the gradient of the tangent at $x = 2$

So if the gradient of $\dfrac{7}{2}$ appears without any working **AND** following an incorrect or missing part (a) score as follows

M0: No sight of using $x=2$ in their $\dfrac{\mathrm{d}y}{\mathrm{d}x}$

M1: For sight of $y-4=\dfrac{7}{2}\left(x-2\right)$ or equivalent

A1: For $7x-2y-6=0$ or integer multiple

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Question Number	Scheme	Marks
4 (a)	$2\times 4^{x}-2^{x+3}=17\times 2^{x-1}-4$ Uses an index law and states or implies any of $4^{x}=p^{2},\quad 2^{x+3}=8p \quad \text{or} \quad 2^{x-1}=\frac{p}{2}$	B1
	Writes the given equation in terms of p $2\times 4^{x}-2^{x+3}=17\times 2^{x-1}-4\Rightarrow 2p^{2}-2^{3}\times p=\frac{17p}{2^{1}}-4$	M1
	Proceeds to $4p^{2}-33p+8=0$ via $2p^{2}-8p=\frac{17p}{2}-4$ * CSO	A1*
		(3)
(b)	$4p^{2}-33p+8=0\Rightarrow (4p-1)(p-8)=0\Rightarrow p=...,...$	M1
	Sets $2^{x}=\frac{1}{4},8\Rightarrow x=...$	M1
	$x=-2,3$	A1
		(3)
		(6 marks)

(a) Watch out here as this is a given answer. All stages of working are required to score the 3 marks

B1: Uses an index law and states or implies any of $4^{x}=p^{2},\ 2^{x+3}=8p$ or $2^{x-1}=\frac{p}{2}$

Allow equivalents such as $4^{x}=p\times p,\ 2^{x+3}=8\times p, p\times 8$ or $2^{x-1}=\frac{1}{2}p, p\div 2, 0.5p$

M1: Attempts to write the given equation in x to a quadratic equation in terms of p

$2\times 4^{x}-2^{x+3}=17\times 2^{x-1}-4\Rightarrow 2p^{2}-2^{3}\times p=\frac{17p}{2^{1}}-4$ or $2p^{2}-2^{3}\times p=17p\times 2^{-1}-4$

All three index laws must be seen but condone slips on signs or on the 2^{3} if there was an incorrect attempt to process.

$2\times 4^{x}-2^{x+3}=17\times 2^{x-1}-4\Rightarrow 2p^{2}-6\times p=\frac{17p}{2^{1}}-4$ would be fine for the M1

Allow a recovery for this M1, e.g. $2^{x+3}=2^{x}+2^{3}=8p$ but not the A1*

Watch for candidates who manipulate the given equation first. This is acceptable.

$$2\times 4^{x}-2^{x+3}=17\times 2^{x-1}-4\Rightarrow 4^{x}-2^{x+2}=17\times 2^{x-2}-2$$

So $$\Rightarrow p^{2}-2^{2}\times p=\frac{17p}{2^{2}}-2$$

A1*: CSO Proceeds to the given answer of $4p^{2}-33p+8=0$ with no errors or omissions.

Condone working such as $4^{x}=2^{x^{2}}$ leading to p^{2}. It is often hard to decipher the relative heights of the indices.

An intermediate line of $2p^{2}-8p=\frac{17p}{2}-4$ o.e. must be seen.