Question Number	Scheme	Marks
6 (i)	Can write p and/or q in an appropriate form. E.g $p=2n+1, q=2n+3$ $n\in\mathbb{N}$	B1
	$p^2-q^2=(2n+1)^2-(2n-1)^2$	M1
	$=4n^2+4n+1-(4n^2-4n+1)$	A1
	$=8n$ which is a multiple of 8, hence proven *	A1* **(4)**
(ii)	$y=x^3+12x^2+49x+2\Rightarrow\dfrac{\mathrm{d}y}{\mathrm{d}x}=3x^2+24x+49$	M1,
	$\Rightarrow\dfrac{\mathrm{d}y}{\mathrm{d}x}=3(x+4)^2+1$	dM1, A1
	Gradient is always $\geqslant 1$ so cannot ever be 0, so no stationary points on C *	A1* **(4)**
		(8 marks)

(i)

B1: Can write p and/or q in an appropriate form. Condone omission of $n\in\mathbb{N}$
Allow any letter to be used in place of n
Allow $(p=)\,2n+3, (q=)\,2n+1$ p and q to be implied

M1: Starts the proof by writing $\left[p^2-q^2=\right]\,(2n+1)^2-(2n-1)^2$ o.e

OR, such as $p^2-q^2=(2n+3)^2-(2n+1)^2$

NB Must be in one variable only and *p* and *q* must be consecutive.

A1: Correct multiplication to an intermediate or fully simplified answer,
Allow $4n^2+4n+1-(4n^2-4n+1)$

A1*: Reaches a correct answer, E.g. $8n$, gives a valid statement 'which is a multiple of 8' or a minimal conclusion. E.g., 'QED', 'Shown', □, #, etc.,

Note with $p^2-q^2=(2n+3)^2-(2n+1)^2$ you will get $8n+8$

SC Uses *p* < *q* Award marks as above, but score B1 M1 A1 A0 for an otherwise fully correct proof.

(ii)

M1: Attempts to differentiate and achieves a 3TQ

An attempt to differentiate is defined in General Guidance.

dM1: And then uses a valid method of showing that $\frac{\mathrm{d}y}{\mathrm{d}x} \neq 0$

Valid methods could be

1. Attempting to complete the square
2. Attempting the discriminant $\left(\text{Disc} = -12\right)$
3. Attempting to solve, with working, $'3x^2 + 24x + 49' = 0$
   Accept 'not real roots' following some working but not 'Math Error'
   $\left(\text{Roots are } \frac{-12 \pm \sqrt{3}\mathrm{i}}{3}\right)$

A1: Correct calculations [As above]

A1*: Valid conclusion. E.g.

1. $\frac{\mathrm{d}y}{\mathrm{d}x} \geqslant 1$ hence is never 0 **so no stationary points**
2. The Discriminant is negative **so no (real) roots** and **hence no stationary points**
3. The roots are complex so there are **no (real) solutions** and **hence no stationary points.**

   Accept reference to turning points.

Question Number	Scheme	Marks
7 (i)	$8^{2x-5} = 20$	
	Take $\log_2$ of <u>both</u> sides and uses power rule $(2x-5)\log_2 8 = \log_2 20$	M1
	Uses $\log_2 8 = 3$ or $\log_2 20 = \log_2 4 + \log_2 5$	dM1
	$3(2x-5) = 2 + \log_2 5$	A1
	$x = \frac{17}{6} + \frac{1}{6}\log_2 5$	A1
		(4)
(ii)	$\log_3(13+2y) + 3 = 2\log_3(4-y)$	
	One correct log law $2\log_3(4-y) \to \log_3(4-y)^2$ or $3 \to \log_3 27$	B1
	Correct attempt to combine two terms	M1
	Correct equation (not involving logs) E.g. $(4-y)^2 = 27(13+2y)$	A1
	$y^2 - 62y - 335 = 0$	
	$(y+5)(y-67) = 0$	dM1
	$y = -5$ only	A1
		(5)
		(9 marks)

(i)

M1: Take $\log_2$ of <u>both</u> sides and uses power rule $(2x-5)\log_2 8 = \log_2 20$

Allow this mark for log work with any or no base: E.g. $(2x-5)\log 8 = \log 20$

dM1: Uses $\log_2 8 = 3$ or $\log_2 20 = \log_2 4 + \log_2 5$ **correctly** to obtain an equation in x involving just $\log_2 5$

A1: A **correct** intermediate equation in x involving just $\log_2 5$

A1: $x = \frac{17}{6} + \frac{1}{6}\log_2 5$

There are several ways of solving part (i). These are the General Principles for marking this. Allow numerical slips only, index and log work must be correct.

M1: Deal with the index and take logs of both sides

dM1: Simplify logs/use the addition law **correctly** to obtain an equation involving x, $\log_2 5$ and constant(s) only. If candidates change from base 8 to base 2 it must be correct throughout.

A1: For a **correct** equation involving x and $\log_2 5$ (no other logs) and constant(s)

A1: For $x = \frac{17}{6} + \frac{1}{6}\log_2 5$