	Scheme	Marks	AOs
13.	The overall method of finding the x coordinate of A .	M1	3.1a
	$y = 2x^3 - 17x^2 + 40x \Longrightarrow \frac{dy}{dx} = 6x^2 - 34x + 40$	B1	1.1b
	$\frac{\mathrm{d}y}{\mathrm{d}x} = 0 \Longrightarrow 6x^2 - 34x + 40 = 0 \Longrightarrow 2(3x - 5)(x - 4) = 0 \Longrightarrow x = \dots$	M1	1.1b
	Chooses $x = 4$ $x \neq \frac{5}{3}$	A1	3.2a
	$\int 2x^3 - 17x^2 + 40x dx = \left[\frac{1}{2}x^4 - \frac{17}{3}x^3 + 20x^2\right]$	B1	1.1b
	Area $=\frac{1}{2}(4)^4 - \frac{17}{3}(4)^3 + 20(4)^2$	M1	1.1b
	$=\frac{256}{3}$ *	A1*	2.1
		(7)	
(7 marks)			

Notes

M1: An overall problem -solving method mark to find the minimum point. To score this you need to see

- an attempt to differentiate with at least two correct terms
- an attempt to set their $\frac{dy}{dx} = 0$ and then solve to find x. Don't be overly concerned by the mechanics of this solution
- **B1:** $\left(\frac{dy}{dx}\right) = 6x^2 34x + 40$ which may be unsimplified

M1: Sets their $\frac{dy}{dx} = 0$, which must be a 3TQ in *x*, and attempts to solve via factorisation, formula or calculator. If a calculator is used to find the roots, they must be correct for their quadratic. If $\frac{dy}{dx}$ is correct allow them to just choose the root 4 for M1 A1. Condone $(x-4)\left(x-\frac{5}{3}\right)$ A1: Chooses x=4 This may be awarded from the upper limit in their integral

B1:
$$\int 2x^3 - 17x^2 + 40x \, dx = \left[\frac{1}{2}x^4 - \frac{17}{3}x^3 + 20x^2\right]$$
 which may be unsimplified

M1: Correct attempt at area. There may be slips on the integration but expect two correct terms The upper limit used must be their larger solution of $\frac{dy}{dx} = 0$ and the lower limit used must be 0. So if their roots are 6 and 10, then they must use 10 and 0. If only one value is found then the limits must be 0 to that value.

Expect to see embedded or calculated values.

Don't accept $\int_0^4 2x^3 - 17x^2 + 40x \, dx = \frac{256}{3}$ without seeing the integration and the embedded or calculated values

A1*: Area = $\frac{256}{3}$ with correct notation and no errors. Note that this is a given answer.

Notes on Question 13 continue

For correct notation expect to see

• $\frac{dy}{dx}$ or $\frac{d}{dx}$ used correctly at least once. If f(x) is used accept f'(x). Condone y'

 $2x^3 - 17x^2 + 40x dx$ used correctly at least once with or without the limits.