Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
1	Makes an attempt to expand $\left(5-3\sqrt{x}\right)\left(5-3\sqrt{x}\right)$. Must be 4 terms (or 3 if $\sqrt{x}$ terms collected).	M1	3.1	5th Integrate more complicated functions such as those requiring simplification or rearrangement.
	Fully correct expansion $25-30\sqrt{x}+9x$ or $25-30x^{\frac{1}{2}}+9x$	A1	1.1b	
	Writes $\sqrt{x}$ as $x^{\frac{1}{2}}$ (or subsequently correctly integrates this term)	B1	1.1b	
	Makes an attempt to find $\int(25-30x^{\frac{1}{2}}+9x)\mathrm{d}x$. Raising x power by 1 at least once would constitute an attempt.	M1	1.1b	
	Fully correct integration. $25x-20x^{\frac{3}{2}}+\frac{9}{2}x^2+C$ o.e.	A1	1.1b	
				(5 marks)

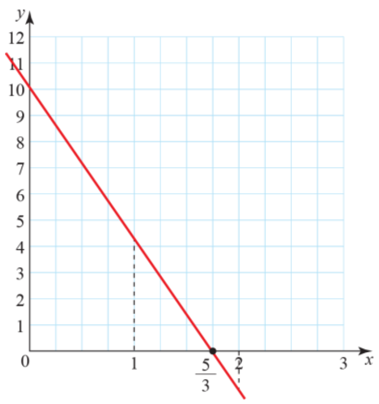
Notes

Award all 5 marks for a fully correct final answer, even if some working is missing.

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
2	Uses laws of indices correcty at least once anywhere in solution (e.g. $\frac{1}{\sqrt{x}}=x^{-\frac{1}{2}}$ or $\sqrt{x}=x^{\frac{1}{2}}$ or $x\sqrt{x}=x^{\frac{3}{2}}$ seen or implied).	**B1**	2.2a	5th Find the equation of a curve given the gradient function and a point on the curve.
	Makes an attempt at integrating $\text{h}'(x)=15x^{\frac{3}{2}}-40x^{-\frac{1}{2}}$ Raising at least one *x* power by 1 would constitute an attempt.	**M1**	1.1b	
	Fully correct integration. $6x^{\frac{5}{2}}-80x^{\frac{1}{2}}$ (no need for +*C* here).	**A1**	1.1b	
	Makes an attenpt to substitute (4, 19) into the integrated expression. For example, $19=6\times 4^{\frac{5}{2}}-80\times 4^{\frac{1}{2}}+C$ is seen.	**M1**	1.1b	
	Finds the correct value of *C*. $C=-13$	**A1**	1.1b	
	States fully correct final answer $\text{h}(x)=6x^{\frac{5}{2}}-80\sqrt{x}-13$ or any equivalent form.	**A1**	2.2a	
				(6 marks)

Notes

Award all 6 marks for a fully correct final answer, even if some working is missing.

Q	Scheme		Marks	AOs	Pearson Progression Step and Progress descriptor
3a	Makes an attempt to find $\int(10-6x)\mathrm{d}x$ Raising x powers by 1 would constitute an attempt.		M1	1.1b	5th Find definite integrals analytically.
	Shows a fully correct integral with limits. $\left[10x-3x^2\right]_a^{2a}=1$		A1	2.2a	
	Makes an attempt to substitute the limits into their expression. For example, $\left(10(2a)-3(2a)^2\right)-\left(10(a)-3(a)^2\right)$ or $\left(20a-12a^2\right)-\left(10a-3a^2\right)$ is seen.		M1ft	1.1b	
	Rearranges to a 3-term quadratic equation (with = 0). $9a^2-10a+1=0$		M1ft	1.1b	
	Correctly factorises the LHS: $(9a-1)(a-1)=0$ or uses a valid method for solving a quadratic equation (can be implied by correct answers).		M1ft	1.1b	
	States the two fully correct answers $a=\frac{1}{9}$ or $a=1$ For the first solution accept awrt 0.111		A1	1.1b	
			(6)		
3b	**Figure 1** 	Straight line sloping downwards with positive x and y intercepts. Ignore portions of graph outside $0\leqslant x\leqslant 2$	M1	3.1	1st Assumed Knowledge
		Fully correct sketch with points (0, 10), and $(\frac{5}{3}, 0)$ labelled. Ignore portions of graph outside $0\leqslant x\leqslant 2$	A1	2.2a	
			(2)		

3c		Statements to the effect that the (definite) integral will only equal the area (1) if the function is above the x-axis (between the limits) AND when $a = 1$, $2a = 2$, so part of the area will be above the x-axis and part will be below the x-axis.	**B1**	2.1	5th Find an area below the x-axis using integration (including an appreciation of the meaning of a negative definite integral).
		Greater than 1.	**B1**	2.2a	
			(2)		
(10 marks)					

Notes

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
4	Writes $\sqrt{t}$ as $t^{\frac{1}{2}}$ or $50\sqrt{t}$ as $50t^{\frac{1}{2}}$ (can be implied by correct integral).	B1	2.2a	5th Integrate more complicated functions such as those requiring simplification or rearrangement.
	Makes an attempt to find $\frac{1}{20}\int(50t^{\frac{1}{2}}+20t^2-t^3)\mathrm{d}t$. Raising at least one t power by 1 would constitute an attempt.	M1	1.1b	
	Makes a fully correct integration (ignore limits at this stage). $s=\frac{1}{20}\left[\frac{100}{3}t^{\frac{3}{2}}+\frac{20}{3}t^3-\frac{t^4}{4}\right]_0^{20}$	M1	1.1b	
	Makes an attempt to substitute the limits into their integrated function. For example, $\frac{1}{20}\left[\left(\frac{100}{3}\times 20^{\frac{3}{2}}+\frac{20\times 20^3}{3}-\frac{20^4}{4}\right)-\left(\frac{100}{3}\times 0^{\frac{3}{2}}+\frac{20\times 0^3}{3}-\frac{0^4}{4}\right)\right]$ is seen. Award mark even if the 0 limit is not shown.	M1ft	1.1b	
	States fully correct answer. s = 816 cao.	A1	1.1b	
				(5 marks)

Notes

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
5a	Attempts to take out x or $-x$. $y=x\left(-x^2+2x+8\right)$ or $y=-x\left(x^2-2x-8\right)$	**M1**	3.1	4th Factorise cubic expressions with monomial factors.
	Fully and correctly factorised cubic. $y=x(4-x)(2+x)$ or $y=-x(x-4)(x+2)$	**M1**	1.1b	
	Correct coordinates written. $A(-2,0)$ and $B(4, 0)$.	**A1**	1.1b	
		(3)		
5b	Makes an attempt to find $\int(-x^3+2x^2+8x)\mathrm{d}x$ Raising at least one x power by 1 would constitute an attempt.	**M1**	3.1a	5th Find an area below the x-axis using integration (including an appreciation of the meaning of a negative definite integral).
	Fully correct integration seen. $\left[-\frac{x^4}{4}+\frac{2}{3}x^3+4x^2\right]_{-2}^{0}$ (ignore limits at this stage)	**A1**	1.1b	
	Makes an attempt to substitute limits into integrated function to find the area between $x = -2$ and $x = 0$ $(0)-\left(-4-\frac{16}{3}+16\right)$	**M1**	1.1b	
	Finds the correct answer. $-\frac{20}{3}$	**A1**	1.1b	
	$+\frac{20}{3}$ stated or used as area here or later in solution (could be implied by correct final answer).	**B1**	3.2	
	Makes an attempt to substitute limits into integrated function to find the area between $x = 0$ and $x = 4$ $\left(-64+\frac{128}{3}+64\right)-(0)$	**M1**	1.1b	
	Finds the correct answer. $\frac{128}{3}$	**A1**	1.1b	

	Correctly adds the two areas. $\frac{148}{3}$ o.e.	**A1**	2.2a	
		(8)		
				(11 marks)

Notes

5a Award method marks for substituting limits even if evaluation at $x = 0$ is not seen.

5b For the first integral, candidates may integrate $-f(x)$ between -2 and 0 to obtain a positive answer directly.

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
6a	Equates the curve and the line. $x^2 - 8x + 20 = x + 6$	**M1**	3.1	4th Interpret solutions to simultaneous equations graphically.
	Simplifies and factorises. $(x - 7)(x - 2) = 0$ (or uses other valid method for solving a quadratic equation).	**M1**	1.1b	
	Finds the correct coordinates of *A*. $A(2, 8)$.	**A1**	1.1b	
	Finds the correct coordinates of *B*. $B(7, 13)$.	**A1**	1.1b	
		(4)		
6b	Makes an attempt to find the area of the trapezium bounded by $x = 2$, $x = 7$, the *x*-axis and the line. For example, $\frac{5}{2}(8+13)$ or $\int_2^7 (x+6)\mathrm{d}x$ seen.	**M1**	3.1	1st Assumed Knowledge
	Correct answer. Area = 52.5 o.e.	**A1**	1.1b	
		(2)		
6c	$\int_2^7 (x^2 - 8x + 20)\mathrm{d}x$.	**B1**	3.1	5th Find the area under a curve using integration.
	Makes an attempt to find the integral. Raising at least one *x* power by 1 would constitute an attempt.	**M1**	1.1b	
	Correctly finds $\left[\frac{1}{3}x^3 - 4x^2 + 20x\right]_2^7$	**A1**	1.1b	
	Makes an attempt to substitute limits into the definite integral. $\left[\left(\frac{343}{3} - 196 + 140\right) - \left(\frac{8}{3} - 16 + 40\right)\right]$	**M1**	1.1b	
	Correct answer seen. $\frac{95}{3}$ or $31.\dot{6}$ oe seen.	**A1**	1.1b	
		(5)		

6d	Understands the need to subtract the two areas. $\pm(52.5-31.\dot{6})$	**M1**	2.2a	5th Find the area under a curve using integration.
	20.8 units^2 seen (must be positive).	**A1**	2.2a	
		(2)		
				(13 marks)

Notes

6a If A0A0, award A1 for full solution of quadratic equation (i.e. $x = 2$, $x = 7$).