Question Number	Scheme	Marks
7ai	$f'(4)=\dfrac{4(4)^2+10-7(4)^{\frac{1}{2}}}{4(4)^{\frac{1}{2}}}=\dfrac{15}{2}$	B1
ii	$"\dfrac{15}{2}"\rightarrow-\dfrac{2}{15}$	M1
	$y+1="-\dfrac{2}{15}"(x-4)$	M1
	$2x+15y+7=0$	A1
		(4)
b	$\dfrac{4x^2+10-7x^{\frac{1}{2}}}{4x^{\frac{1}{2}}}=\pm...x^{\frac{3}{2}}\pm...x^{-\frac{1}{2}}\pm...$	M1
	Two of the terms of $x^{\frac{3}{2}}+\dfrac{5}{2}x^{-\frac{1}{2}}-\dfrac{7}{4}$	A1
	$\int\left(x^{\frac{3}{2}}+\dfrac{5}{2}x^{-\frac{1}{2}}-\dfrac{7}{4}\right)dx=\dfrac{2}{5}x^{\frac{5}{2}}+5x^{\frac{1}{2}}-\dfrac{7}{4}x\ \ (+c)$	dM1A1ft
	$\dfrac{2}{5}(4)^{\frac{5}{2}}+5(4)^{\frac{1}{2}}-\dfrac{7}{4}(4)+c=-1\Rightarrow c=...$	ddM1
	$(f(x)=)\ \dfrac{2}{5}x^{\frac{5}{2}}+5x^{\frac{1}{2}}-\dfrac{7}{4}x-\dfrac{84}{5}$	A1
		(6)
		(10 marks)

Question	Answer	Marks	Guidance
7(c)	$gf(x)=2\left(\dfrac{3}{x-2}+1\right)-2$ or $2\left(\dfrac{x+1}{x-2}\right)-2$	**M1**	Substitute f(x) into g(x).
	$\dfrac{6}{x-2}$	**A1**	
		2	

Question	Answer	Marks
5	$\cos POA=\dfrac{5}{13}\rightarrow POA=1.17(6)$ Allow 67.4° **or** $\sin=\dfrac{12}{13}$ or $\tan=\dfrac{12}{5}$	**M1 A1**
	Reflex $AOB=2\pi-2\times$*their* 1.17(6) OE in degrees **or** minor arc AB = 5×2×*their*1.17(6)	**M1**
	Major arc = 5 × *their* 3.93(1) **or** 2π×5 - *their* 11.7(6)	**M1**
	AP (or BP) = $\sqrt{13^2-5^2}$ = 12	**B1**
	Cord length = 43.7	**A1**
		6

Question Number	Scheme	Marks
3. (a)	$\int f(x)\,dx = \int x^{\frac{3}{2}} + 10x^{\frac{1}{2}} + 25x^{-\frac{1}{2}}\,dx = \frac{2}{5}x^{\frac{5}{2}} + \frac{20}{3}x^{\frac{3}{2}} + 50x^{\frac{1}{2}} + c$	M1 A1 A1 A1 **(4)**
(b) (i)	$f'(x) = \frac{3}{2}x^{\frac{1}{2}} + 5x^{-\frac{1}{2}} - \frac{25}{2}x^{-\frac{3}{2}}$	M1 A1
	$f'(x) = 0 \Rightarrow \frac{3}{2}x^{\frac{1}{2}} + 5x^{-\frac{1}{2}} - \frac{25}{2}x^{-\frac{3}{2}} = 0$ AND $\times x^{\frac{3}{2}}$	dM1
	$\frac{3}{2}x^{2} + 5x^{1} - \frac{25}{2} = 0 \Rightarrow 3x^{2} + 10x - 25 = 0$ *	A1*
(ii)	$\left(x = \right)\frac{5}{3}$ only	B1 **(5)** **(9 marks)**

Question	Answer	Marks	Guidance
3(b)	Coefficient of x^4 is $a \times their - 90a^3 + 7 \times their\ 15a^4$ $\left[=15a^4\right]$	**M1**	Must select two appropriate terms only.
	$15a^4 = 240$	**DM1**	Reducing to a simple quartic equation in a.
	$\Rightarrow a^4 = 16 \Rightarrow a = 2$	**A1**	A0 if $a = -2$ is given as a solution.
		3	

Question	Answer	Marks	Guidance
10(a)	$f'(x) = -\left(\frac{1}{2}x + k\right)^{-3}$	**B1**	
	$f'(2) > 0 \Rightarrow -(1+k)^{-3} > 0$	**M1**	Allow for solving *their* $f''(2) > 0$
	$k < -1$	**A1**	WWW
		3	
10(b)	$\left[f(x) = \int\left(\left(\frac{1}{2}x - 3\right)^{-2} - (-2)^{-2}\right)dx = \right]\left\{\frac{\left(\frac{1}{2}x-3\right)^{-1}}{-1\times\frac{1}{2}}\right\}\left\{-\frac{x}{4}\right\}$	**B1 B1**	Allow $-2\left(\frac{1}{2}x + k\right)^{-1}$ OE for 1st B1 and $-(1+k)^{-2}x$ OE for 2nd B1
	$3\frac{1}{2} = 1 - \frac{1}{2} + c$	**M1**	Substitute $x = 2$, $y = 3\frac{1}{2}$ into *their* integral with c present.
	$f(x) = \frac{-2}{\left(\frac{1}{2}x-3\right)} - \frac{x}{4} + 3$	**A1**	OE
		4	
10(c)	$\left(\frac{1}{2}x-3\right)^{-2} - (-2)^{-2} = 0$	**M1**	Substitute $k = -3$ and set to zero.
	leading to $\left(\frac{1}{2}x-3\right)^2 = 4$ $\left[\frac{1}{2}x - 3 = (\pm)2\right]$ leading to $x = 10$	**A1**	
	$(10, -\frac{1}{2})$	**A1**	Or when $x = 10$, $y = -1 - 2\frac{1}{2} + 3 = -\frac{1}{2}$
	$f'(10)\left[=-(5-3)^{-3} \rightarrow\right] < 0 \rightarrow$ MAXIMUM	**A1**	WWW
		4	

Question	Answer	Marks	Guidance
3(a)	$1+10x+40x^2$ May be part of a complete expansion	**B2, 1, 0**	1^5 must be simplified to 1, allow if the '1' is seen in a more complete expansion but not the final answer. Mis-reads not condoned in this question.
		2	
3(b)	$1-12x+54x^2$ May be part of a complete expansion	**B2, 1, 0**	1^4 must be simplified to 1, allow if the '1' is seen in a more complete expansion but not the final answer. Mis-reads not condoned in this question.
		2	
3(c)	$54-120+40$	**M1**	Forming exactly 3 products correctly using their terms.
	-26	**A1**	Allow $-26x^2$ If in a list with other terms it must be clear this is the required term otherwise A0.
		2	

Question	Scheme	Marks
6(a)	E.g. $m=\dfrac{2-11}{8+4}$ or $m=\dfrac{11-2}{-4-8}$	M1
	$m=-\dfrac{3}{4}$	A1
		(2)
(b)	M is $\left(2,\ \dfrac{13}{2}\right)$	B1
	$m_N=-1\div"-\dfrac{3}{4}"$	M1
	$y-"\dfrac{13}{2}"="\dfrac{4}{3}"(x-"2")$	M1
	$8x-6y+23=0$	A1
		(4)
(c)	$AB=\sqrt{(-4-8)^2+(11-2)^2}\ (=15)$ or $AB^2=(-4-8)^2+(11-2)^2\ (=225)$	M1
	$\dfrac{1}{2}\times MC\times AB=37.5\Rightarrow MC=\dfrac{75}{15}\ (=5)$ or $MC^2=25$	M1
	$m_N=\dfrac{4}{3}, MC=5\Rightarrow C$ is $\left("2"-3,\ \dfrac{"13"}{2}-4\right)$ or $\left("2"+3,\ \dfrac{"13"}{2}+4\right)$	dM1
	$(-1,\ 2.5)$ **or** $(5,\ 10.5)$ **or** $x=-1,\ x=5$ **or** $y=2.5,\ y=10.5$	A1
	$(-1,\ 2.5)$ **and** $(5,\ 10.5)$	A1
		(5)
		(11 marks)

Question	Answer	Marks	Guidance
6(c)	$(\text{f}(x)) > \frac{2}{3}$	B1	Allow $(y) > \frac{2}{3}$. Do not allow $x > \frac{2}{3}$
		1	

Question	Answer	Marks	Guidance
6	Use of $\sin^2\alpha + \cos^2\alpha = 1$ eg $\sin\alpha = [\pm]\sqrt{1-\left(\frac{8}{17}\right)^2}$	*M1	Or Pythagoras seen (may quote 8, 15, 17 triple).
	$\sin\alpha = \frac{15}{17}$	A1	
	$\tan\alpha = \frac{15}{8}$	A1	
	$\frac{1}{\sin\alpha} + \frac{1}{\tan\alpha} = \frac{17}{15} + \frac{8}{15}$	DM1	Dealing with reciprocals and addition of fractions correctly.
	$= \frac{5}{3}$ oe	A1	Correct answer with no working shown scores 0. Extra answers from $\sin\alpha = -\frac{15}{17}$ are allowed.
		5	

Question	Answer	Marks	Guidance
1	$[\text{f}(x) =]\ 2x^3 + \frac{8}{x}\ [+c]$	B1	Allow any correct form
	$7 = 16 + 4 + c$	M1	Substitute f(2) = 7 into an integral. c must be present. Expect $c = -13$
	$\text{f}(x) = 2x^3 + \frac{8}{x} - 13$	A1	Allow $y =$, $\text{f}(x)$ or y can appear earlier in answer
		3	

Question	Answer	Marks	Guidance
11(a)	$(5-2p)^2 + (p+2)^2 = (10-2p)^2 + (3-p)^2$	M1 A1	Allow one sign error for M mark only.
	$25 - 20p + 4p^2 + p^2 + 4p + 4 = 100 - 40p + 4p^2 + 9 - 6p + p^2$ $30p = 80 \rightarrow p = \frac{8}{3}$ oe	A1	Allow 2.67 AWRT.
		3	

Question	Answer	Marks	Guidance
11(b)(i)	$m_{AC} = \frac{p+2}{2p-5}$ $m_{BC} = \frac{p-3}{2p-10}$	M1	Allow a sign error.
	$\frac{p+2}{2p-5} \times \frac{p-3}{2p-10} = -1$	M1	Use of $m_1m_2 = -1$ with their m_{AC} and m_{BC}.
	$p^2 - p - 6 = -(4p^2 - 30p + 50) \rightarrow 5p^2 - 31p + 44\ (=0)$	A1	
	$p = 4$ (Ignore $p = \frac{11}{5}$)	A1	Factors $(p-4)(5p-11)$, or formula or completing square must be seen.
		4	
11(b)(ii)	Mid-point of AB = (7½, ½)	B1	SOI
	$r^2 = 2\frac{1}{2}^2 + 2\frac{1}{2}^2\ \left[=\frac{50}{4}\right]$ or $r = \sqrt{(2\frac{1}{2}^2 + 2\frac{1}{2}^2)}\ \left[=\frac{5\sqrt{2}}{2}\right]$	*M1	Or $r^2 = \frac{1}{4}(5^2 + 5^2)\ \left[=\frac{50}{4}\right]$ etc.
	Equation of circle is $(x - their7\frac{1}{2})^2 + (y - their\frac{1}{2})^2 = their\frac{50}{4}$	DM1	Must use r^2 not r or d or d^2
	$x^2 + y^2 - 15x - y + 44 = 0$	A1	CAO
		4	