A5 Linear Law
Answers
P3

1	State or imply $\ln y = \ln A + n \ln x$	B1	
	Equate estimate of $\ln y$ -intercept to $\ln A$	M1	
	Obtain value A between 1.97 and 2.03	A1	
	Calculate the gradient of the line of data points	M1	
	Obtain value $n = 0.25$, or equivalent	A1	**[5]**

2	**(i)**	*EITHER:* State or imply $n \ln x + \ln y = \ln C$	B1	
		Substitute x- and y-values and solve for n	M1	
		Obtain $n = 1.50$	A1	
		Solve for C	M1	
		Obtain $C = 6.00$	A1	
		OR: Obtain two correct equations by substituting x- and y-values in $x^n y = C$	B1	
		Solve for n	M1	
		Obtain $n = 1.50$	A1	
		Solve for C	M1	
		Obtain $C = 6.00$	A1	[5]
	(ii)	State that the graph of $\ln y$ against $\ln x$ has equation $n\ln x + \ln y = \ln C$ which is *linear* in $\ln y$ and $\ln x$, or has equation of the form $nX + Y = \ln C$, where $X = \ln x$ and $Y = \ln y$, and is thus a straight line	B1	[1]

3	*EITHER*:	State or imply $\ln y = \ln A - kx^2$	B1	
		Substitute values of $\ln y$ and x^2, and solve for k or $\ln A$	M1	
		Obtain $k = 0.42$ or $A = 2.80$	A1	
		Solve for $\ln A$ or k	M1	
		Obtain $A = 2.80$ or $k = 0.42$	A1	
	OR1:	State or imply $\ln y = \ln A - kx^2$	B1	
		Using values of $\ln y$ and x^2, equate gradient of line to $-k$ and solve for k	M1	
		Obtain $k = 0.42$	A1	
		Solve for $\ln A$	M1	
		Obtain $A = 2.80$	A1	
	OR2:	Obtain two correct equations in k and A and substituting y– and x^2 – values in $y = Ae^{-kx^2}$	B1	
		Solve for k	M1	
		Obtain $k = 0.42$	A1	
		Solve for A	M1	
		Obtain $A = 2.80$	A1	[5]
		[SR: If unsound substitutions are made, e.g. using $x = 0.;64$ and $y = 0.76$, give B1M0A0M1A0 in the *EITHER* and *OR1* schemes, and B0M1A0M1A0 in the *OR2* scheme.]		

4	State a correct un-simplified version of the x or x^2 or x^3 term	**M1**	
	State correct first two terms $1 + x$	**A1**	
	Obtain the next two terms $\frac{3}{2}x^2 + \frac{5}{2}x^3$	**A1 A1**	[4]
	[Symbolic binomial coefficients, e.g. $\binom{-\frac{1}{2}}{3}$ are not sufficient for the M mark.]		

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5	**EITHER:** State a correct unsimplified version of the x or x^2 or x^3 term in the expansion of $(1+6x)^{-\frac{1}{3}}$	**(M1**
	State correct first two terms $1-2x$	**A1**
	Obtain term $8x^2$	**A1**
	Obtain term $-\frac{112}{3}x^3$ $\left(37\frac{1}{3}x^3\right)$ in final answer	**A1)**
	OR: Differentiate expression and evaluate $\mathrm{f}(0)$ and $\mathrm{f}'(0)$, where $\mathrm{f}'(x) = k(1+6x)^{-\frac{4}{3}}$	**(M1**
	Obtain correct first two terms $1-2x$	**A1**
	Obtain term $8x^2$	**A1**
	Obtain term $-\frac{112}{3}x^3$ in final answer	**A1)**
	Total:	**4**

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