Question Number	Scheme	Marks
5.	$\frac{d^2y}{dx^2} = -\frac{2}{y}\left(\frac{dy}{dx}\right)^2 + 2$	
(a)	$\left(\frac{dy}{dx}\right)\frac{d^2y}{dx^2}$ seen	B1
	$\frac{d^3y}{dx^3} = -\frac{4}{y}\left(\frac{dy}{dx}\right)\frac{d^2y}{dx^2} + \frac{2}{y^2}\left(\frac{dy}{dx}\right)^3$	M1A1A1
		(4)
ALT:	$\left(\frac{dy}{dx}\right)^2 \to 2\left(\frac{dy}{dx}\right)\frac{d^2y}{dx^2}$ seen	B1
	$\underline{\frac{dy}{dx}\left(\frac{d^2y}{dx^2}\right) + y\frac{d^3y}{dx^3}} + 4\left(\frac{dy}{dx}\right)\left(\frac{d^2y}{dx^2}\right) \underline{-2\frac{dy}{dx}} = 0$	M1<u>A1</u>
	$\frac{d^3y}{dx^3} = \frac{1}{y}\left(-5\frac{d^2y}{dx^2} + 2\right)\frac{dy}{dx}$	A1 (4)
(b)	At $x = 0$ $\quad \frac{d^2y}{dx^2} = \frac{1}{2}\left(-2\times(1)^2 + 4\right) = 1$	B1
	$\frac{d^3y}{dx^3} = \frac{1}{2}(-5\times 1 + 2)\times 1 = \frac{-3}{2}$	M1
	$(y =) 2 + x + (1)\frac{x^2}{2!} + \left(\frac{-3}{2}\right)\frac{x^3}{3!} + \ldots$	M1
	$y = 2 + x + \frac{1}{2}x^2 - \frac{1}{4}x^3 + \ldots$	A1 (4)
		[8]
	Notes	
(a)		
B1	$\left(\frac{dy}{dx}\right)\frac{d^2y}{dx^2}$ seen in the differentiation	
M1	Divide equation by *y* and differentiate wrt *x* chain and product rules needed. LHS correct	
A1	Either RHS term correct. Need not be simplified.	
A1	Both RHS terms correct. Need not be simplified.	
ALT		
B1	$\left(\frac{dy}{dx}\right)^2 \to 2\left(\frac{dy}{dx}\right)\frac{d^2y}{dx^2}$ correct differentiation of middle term.	
M1	Differentiate before dividing. Product rule must be used.	
A1	Correct differentiation of $y\frac{d^2y}{dx^2}$ and $-2y$	
A1	Rearrange to a correct expression for $\frac{d^3y}{dx^3}$ (need not be simplified)	

	Notes
(b)	
B1	Correct value for $\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$. May be implied by the term in their expansion.
M1	Use their expression from (a) to obtain a value for $\frac{\mathrm{d}^3y}{\mathrm{d}x^3}$ (May be implied - you may need to check if their value follows from their expression in (a).)
M1	Taylor's series formed using their values for the derivatives, accept 2! or 2 and 3! or 6 Correct series, must start y =…, or allow f(x) = ... as longs y = f(x) has been defined in the question.
A1	Must come from a correct expression for $\frac{\mathrm{d}^3y}{\mathrm{d}x^3}$