Question		Answer	Marks	AO	Guidance
11	(a)	Vertical asymptote when $x^2 + 2x + 4 = 0$	M1	2.2a	Seen or may be implied by an attempt to find the discriminant Allow for $(x^2 + 2x + 4)^2 = 0$ Or no vertical asymptotes if $(x^2 + 2x + 4)^2 \neq 0$ seen Also allow for using $\frac{dy}{dx}$ infinite instead leading to vertical asymptote when $x^2 + 2x + 4 = 0$ oe
		Discriminant $2^2 - 4 \times 1 \times 4 [= -12][< 0]$	M1	3.1a	Or equivalent using the quadratic formula or completing the square. Do not allow just for "will not factorise" or "no real roots" or similar
		So the denominator is never zero	A1	2.1	Clear conclusion with discriminant < 0, -12 or $(x + 1)^2 = -3$ seen. Must include reference to vertical asymptote if not mentioned earlier in the solution
			[3]		
	(b)	$\frac{dy}{dx} = -2(x^2 + 2x + 4)^{-3}(2x + 2)$	M1	1.1	Use of chain rule with negative powers. Also allow for quotient rule used provided $u'(x) = 0$ seen Also allow for implicit differentiation on rearranged equation
			A1	2.1	Fully correct derivative – ISW if wrongly simplified $\frac{dy}{dx} = \frac{-(4x^3+12x^2+24x+16)}{(x^2+2x+4)^4}$ may be seen
		At stationary point $\frac{dy}{dx} = 0$ giving $x = -1$	A1	1.1	Cao from correct derivative
		When $x = -1, y = \frac{1}{9}$ so $(-1, \frac{1}{9})$	A1	1.1	FT their x-coordinate Allow 0.11 or better
			[4]		