Calculus of hyperbolic functions

Answers

Further Maths topic practice

This topic online

Q	Answer	Marks
1	**a)** $2x \cosh 3x + 3x^2 \sinh 3x$ **b)** $2x \operatorname{sech}^2(x^2)$ **c)** $2 \tanh 2x$	5
2	**a)** $(3/2) \sinh 2x - 4 \cosh x + c$ **b)** $(1/2) \ln(\cosh 2x) + c$ **c)** $10/9 - (1/2) \ln 3$ shown	8
3	**a)** $dy/dx = 1/\sqrt{(1 + x^2)}$ shown **b)** $3/\sqrt{(1 + 9x^2)}$ **c)** $2x/\sqrt{(x^4 - 1)}$	7
4	**a)** $A = 1/3$, $B = 3/4$ **b)** $(1/3) \ln 2$ **c)** $(1/4) \ln(1 + \sqrt{2})$	7
5	$\ln(3/2)$	6
6	**a)** $2\sinh^2 x - 3 \sinh x + 1 = 0$ shown **b)** $(\ln((1 + \sqrt{5})/2), 5\sqrt{5}/2)$ and $(\ln(1 + \sqrt{2}), 4\sqrt{2})$ **c)** $(\ln((1 + \sqrt{5})/2), 5\sqrt{5}/2)$ is a minimum; $(\ln(1 + \sqrt{2}), 4\sqrt{2})$ is a maximum	9
7	$(3/4) \ln 2 - 1/4$	6
8	$\int$ from 0 to 2 of $\sqrt{(x^2 + 4)}\, dx = 2\sqrt{2} + 2 \ln(1 + \sqrt{2})$ shown	7
9	**a)** $\sqrt{(x^2 + 9)} + 6 \operatorname{arsinh}(x/3) + c$ **b)** $2 + 6 \ln 3$	7
10	**a)** $d/dx \operatorname{arsinh}(\tan x) = \sec x$ shown **b)** $\ln(1 + \sqrt{2})$ **c)** $d/dx \operatorname{artanh}(\sin x) = \sec x$ shown **d)** Both functions have derivative $\sec x$ and both are 0 at $x = 0$, so they are equal	9
11	**a)** 40 m s^{-}1 **b)** $a = 10 - v^2/160$ shown; 4.375 m s^{-}2 **c)** $t = 2 \ln 7 = 3.89$ s **d)** 66.1 m	11
12	**a)** $\int \sqrt{(x^2 - 1)}\, dx = (1/2)x\sqrt{(x^2 - 1)} - (1/2) \operatorname{arcosh} x + c$ shown **b)** area of R = t/2 shown **c)** P(17/8, 15/8)	11

Full worked solutions, written out by hand, are on the solutions sheet for this topic.

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