Second order homogeneous differential equations

Answers

Further Maths topic practice

This topic online

Q	Answer	Marks
1	$y = Ae^{2x} + Be^{3x}$	3
2	$y = (A + Bx)e^{-3x}$	3
3	**a)** $y = A\cos 4x + B\sin 4x$ **b)** $y = e^{-2x}(A\cos 3x + B\sin 3x)$	4
4	**a)** $y = 2e^{3x/2} + e^{-2x}$ **b)** 257/16	6
5	**a)** $f(x) = (2 - x)e^{x/2}$ **b)** (2, 0) **c)** shown: $dy/dx = -(x/2)e^{x/2}$, zero only at $x = 0$, and $d^2y/dx^2 = -1/2 < 0$ there	7
6	**a)** $y = e^{-x}(\cos 2x + 2\sin 2x)$ **b)** 1.34	7
7	**a)** $y = 2\cos 3x + 5\sin 3x$ **b)** $R = \sqrt{29}$, $\alpha = 1.19$ **c)** maximum $\sqrt{29}$ when $x = 0.397$	7
8	**a)** $k = 3$; $y = (A + Bx)e^{-3x}$ **b)** $y = Ae^{-x} + Be^{-9x}$ **c)** $y = e^{-2x}(A\cos\sqrt{5}x + B\sin\sqrt{5}x)$ **d)** $0 < k < 3$	8
9	**a)** $a = 2$, $b = -5$, $c = -3$ **b)** $d^2y/dx^2 + 2\,dy/dx + 10y = 0$ **c)** shown	7
10	**a)** $\theta = Ae^{x/2} + Be^{-x/2}$ **b)** shown **c)** 2.20 °C **d)** 3.61 cm	10
11	**a)** shown **b)** shown **c)** $2\sqrt{2}\,e^{-\pi/4}$ **d)** shown	10
12	**a)** shown **b)** 1.24 s **c)** $\sqrt{35}$ m s^{-}1 **d)** $r = 0.5e^{-2t}$ **e)** r decreases towards 0 but is never 0: the bead approaches O but never reaches it	11

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

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