1.8 Differential Equations: 10-minute Pack

EDEXCEL 9FM0 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A particle P moves on the x axis so that its displacement x metres from the origin at time t seconds satisfies $d^2x/dt^2 = -25x$. When t = 0, x = 2 and dx/dt = -3.

(a) Show that the general solution is $x = A\cos(5t) + B\sin(5t)$, and find the values of A and B. **(4)**

(b) Find the period of the motion and the amplitude, to 3 significant figures. **(3)**

(c) Find the maximum speed of P, to 3 significant figures. **(2)**

(Total for Question 1 is 9 marks)

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Mark scheme · 1.8 Differential Equations: 10-minute Pack

Question 1

(a) auxiliary equation $m^2 + 25 = 0$, so $m = \pm 5i$	**M1**
(a) $x = A\cos(5t) + B\sin(5t)$	**A1**
(a) uses $x(0) = 2$ and $x'(0) = 5B = -3$	**M1**
(a) $A = 2$, $B = -3/5$	**A1**
(a) Answer: $A = 2$, $B = -3/5$	
(b) period $= 2\pi/5 = 1.26$ s	**B1**
(b) amplitude $= \sqrt{A^2 + B^2}$	**M1**
(b) amplitude $= 2.09$ m	**A1**
(b) Answer: period 1.26 s, amplitude 2.09 m	
(c) maximum speed = ω x amplitude	**M1**
(c) 10.4 m/s	**A1**
(c) Answer: 10.4 m/s	

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