CHAPTER 5
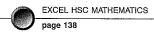## Applications of calculus to the physical world

Derivatives with respect to time (1)

QUESTION 1   Find $\dfrac{dy}{dt}$ if:

a $y = 3t^2 - 8t + 4$

b $y = 9 - 5t^7$

c $y = (4t - 7)^5$

QUESTION 2   Find $f'(t)$ if:

a $f(t) = 6t^5 - 7t^3 + 2t$

b $f(t) = t^4 + t^3 - t^2 - t + 1$

c $f(t) = \sin(2t + 5)$

QUESTION 3   Find $\dfrac{dx}{dt}$ if:

a $x = 3t^6 + t^3 - 7t - 1$

b $x = 4e^{2t-1}$

c $x = (3t + 1)^2$

QUESTION 4   Find $\dot{x}$ if:

a $x = 7$

b $x = 3 - 2t - 5t^2$

c $x = \ln t$

QUESTION 5   Find $\ddot{x}$ if:

a $x = t^3 - 10t^2$

b $x = 8t$

c $x = 3 \cos \pi t$

Applications of calculus to the physical world

Derivatives with respect to time (2)

QUESTION **1**   Find x if:

a $\dot{x} = 4t + 3$ and when $t = 1$, $x = 5$

b $\dot{x} = 8t^2 - 12t + 7$ and when $t = -1$, $x = 3$

QUESTION **2**   Find x if:

a $\ddot{x} = 8 - t$ and when $t = 0$, $\dot{x} = 4$ and $x = 2$

b $\ddot{x} = 7$ and when $t = 2$, $\dot{x} = 2$ and $x = 58$

Applications of calculus to the physical world

Derivatives with respect to time (3)

QUESTION **1**   If $Q = 20 + 8t - t^2$ ($t \geq 0$) find:

a Q when $t = 5$

b t when $Q = 0$

c $\dfrac{dQ}{dt}$ when $t = 7$

d t when $\dfrac{dQ}{dt} = 0$

QUESTION **2** $\dfrac{dV}{dt} = 10t^2 - t^3$

a   Find $\dfrac{dV}{dt}$ when $t = 4$

b   If $V = 300$ when $t = 0$ find V when $t = 4$

Page 120 1 a $6t - 8$ b $-35t^6$ c $20(4t - 7)^4$ 2 a $30t^4 - 21t^2 + 2$ b $4t^3 + 3t^2 - 2t - 1$ c $2\cos(2t + 5)$ 3 a $18t^5 + 3t^2 - 7$

b $8e^{2t-1}$ c $6(3t + 1)$ 4 a 0 b $-2-10t$ c $\dfrac{1}{t}$ 5 a $6t - 20$ b 0 c $-3\pi^2\cos\pi t$

Page 121 1 a $2t^2 + 3t$ b $\dfrac{8t^3}{3} - 6t^2 + 7t + 18\dfrac{2}{3}$ 2 a $4t^2 - \dfrac{t^3}{6} + 4t + 2$ b $\dfrac{7t^2}{2} - 12t + 68$

Page 122 1 a 35 b 10 c -6 d 4 2 a 96 b $449\dfrac{1}{3}$