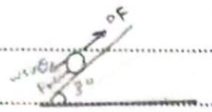
(iii) The cyclist later ascends a straight hill inclined at 3° to the horizontal. His power output and the resistance force are still both unchanged. Find his acceleration when he is travelling at 4 m s^{-1}. [3]



$F = ma$

$R(\nearrow)$ $\frac{2010}{4} - 16 - 800\sin 3° = 80a$

$a = 0.0266$ ms^{-2} (3 s.f.)

6 Particle P travels in a straight line from A to B. The velocity of P at time t s after leaving A is denoted by v m s^{-1}, where

$$v = 0.04t^3 + ct^2 + kt.$$

P takes 5 s to travel from A to B and it reaches B with speed 10 m s^{-1}. The distance AB is 25 m.

(i) Find the values of the constants c and k. [6]

$v = 10$ ms^{-1}

A — v ms^{-1} — B

$t = 5$, when $v = 10$

$v = 0.04t^3 + ct^2 + kt$

$10 = 5 + 25c + 5k$

$(5 = 25c + 5k) \div 5$

$(1 = 5c + k) \times 2$

$10c + 2k = 2$ ... (1)

(1) − (2)

$10c + 2k = 2$

$10c + 3k = 4.5$

$-k = -2.5$

$k = 2.5$

$k = \frac{5}{2}$

$\rightarrow \int_0^5 0.04t^3 + ct^2 + kt \, dt$

$\left[0.01t^4 + \frac{ct^3}{3} + \frac{kt^2}{2}\right]_0^5$

$\left(\frac{25}{4} + \frac{125c}{3} + \frac{25k}{2}\right) - (0 + 0 + 0)$

$\left(\frac{25}{4} + \frac{125c}{3} + \frac{25k}{2}\right) = 25$

$\left(\frac{125}{3}c + \frac{25}{2}k = 18.75\right) \times 6$

$(250c + 75k = 112.5) \div 25$

$10c + 3k = 4.5$ ... (2)

Subs k into (1)

$10c + 2(2.5) = 2$

$c = -0.3$

$c = -\frac{3}{10}$