



Subject/Topic: A Maths P2 2018

Date:

$$\begin{aligned}
 5(iii) \quad DE &= 1200 \cos \theta - 800 \sin \theta \\
 &= \sqrt{1200^2 + 800^2} \cos \left(\theta + \tan^{-1} \frac{800}{1200} \right) \\
 &= \sqrt{2080000} \cos \left(\theta + \tan^{-1} \frac{2}{3} \right) \\
 &= 1442.22051 \cos \left(\theta + 33.69006753^\circ \right) \\
 &\approx 1440 \cos \left(\theta + 33.7^\circ \right)
 \end{aligned}$$

$$\begin{aligned}
 (iii) \quad \frac{d}{dx} (x^2 \sin x) &= x^2 \frac{d}{dx} (\sin x) + \sin x \frac{d}{dx} (x^2) \\
 &= x^2 \cos x + 2x \sin x
 \end{aligned}$$

$$\begin{aligned}
 \int x^2 \cos x \, dx &= \int [x^2 \cos x + 2x \sin x - 2x \sin x] \, dx \\
 &= \int (x^2 \cos x + 2x \sin x) \, dx - 2 \int x \sin x \, dx \\
 &= x^2 \sin x - 2(\sin x - x \cos x) + C_1 + C_2 \\
 &= x^2 \sin x - 2 \sin x + 2x \cos x + C_1 + C_2 \\
 &= x^2 \sin x - 2 \sin x + 2x \cos x + C_3
 \end{aligned}$$

Since $DE = 200 \text{ m}$,

$$\begin{aligned}
 \sqrt{2080000} \cos \left(\theta + \tan^{-1} \frac{2}{3} \right) &= 200 \\
 \cos \left(\theta + \tan^{-1} \frac{2}{3} \right) &= \frac{200}{\sqrt{2080000}} \\
 \theta + \tan^{-1} \frac{2}{3} &= \cos^{-1} \frac{200}{\sqrt{2080000}} \quad (\text{reject 4th quad}) \\
 \theta &= \cos^{-1} \frac{200}{\sqrt{2080000}} - \tan^{-1} \frac{2}{3} \\
 &= 48.33874817^\circ \\
 &\approx 48.3^\circ
 \end{aligned}$$

where c_2 and $c_3 = c_1 + c_2$ are arbitrary constants

$$\begin{aligned}
 7(i) \quad \text{Velocity} &= \frac{d}{dt} [840(1 - e^{-t/80}) - 2t] \\
 &= 840 \left[-e^{-t/80} \cdot \frac{d}{dt} \left(-\frac{t}{80} \right) \right] - 2 \\
 &= 840 \left(-e^{-t/80} \right) \left(-\frac{1}{80} \right) - 2 \\
 &= \frac{840}{80} e^{-t/80} - 2 \\
 &= \frac{21}{2} e^{-t/80} - 2 \quad \text{m/s}
 \end{aligned}$$

$$\begin{aligned}
 6(i) \quad \frac{d}{dx} (x \cos x) &= x \frac{d}{dx} \cos x + \cos x \frac{d}{dx} x \\
 &= x(-\sin x) + \cos x (1) \\
 &= \cos x - x \sin x
 \end{aligned}$$

$$\begin{aligned}
 \text{Acceleration} &= \frac{d}{dt} \left(\frac{21}{2} e^{-t/80} - 2 \right) \\
 &= \frac{21}{2} e^{-t/80} \left(-\frac{1}{80} \right) \\
 &= -\frac{21}{160} e^{-t/80} \quad \text{m/s}^2
 \end{aligned}$$

$$\begin{aligned}
 (ii) \quad \int x \sin x \, dx &= - \int -x \sin x \, dx \\
 &= - \left[\int (\cos x - x \sin x - \cos x) \, dx \right] \\
 &= - \left[\int (\cos x - x \sin x) \, dx - \int \cos x \, dx \right] \\
 &= - \int (\cos x - x \sin x) \, dx + \int \cos x \, dx \\
 &= -x \cos x + \sin x + C_1 \\
 &= \sin x - x \cos x + C_1
 \end{aligned}$$

$$\begin{aligned}
 \text{When } t = 10, \quad v &= \frac{21}{2} e^{-10/80} - 2 \\
 &= 7.266217477 \\
 &\approx 7.27 \text{ m/s}
 \end{aligned}$$

$$\begin{aligned}
 \text{When } t = 10, \quad a &= -\frac{21}{160} e^{-10/80} \\
 &= -0.1158271185 \\
 &\approx -0.116 \text{ m/s}^2
 \end{aligned}$$

where c_1 is an arbitrary constant

(ii) The girl is slowing down as she cycles up the hill.

Tuition classes for English, Math (including E Maths & A Maths), Science (including combined science [phy/chem/bio]), Physics, Chemistry, Biology, Social Studies/Geography/History and Principles of Accounts (POA). Secondary 1 to Secondary 4.

