'City Emission Levels'

a) $E'(t) = \frac{1}{20}\left(3\sqrt{t} + \frac{2}{t+1} + 10\sin\frac{t}{2}\right)$
$E'(8.5) = 3.53 \times 10^{-4} (3\text{ s.}f.)$
$E'(8.6) = -7.78 \times 10^{-3}$

Sign switches thus $E'(t) = 0$ when $8.5 < t < 8.6$ Point is a maximum as $E'(t)$ has a negative gradient between 8.5 and 8.6

[5 marks]

b) $E''(t) = \frac{1}{20}\left(\frac{3}{2\sqrt{t}} - \frac{2}{(t+1)^2} + 5\cos\frac{t}{2}\right)$

$$t_{n+1} = t_n - \frac{E'(t_n)}{E''(t_n)}$$

$$t_{n+1} = t_n - \frac{\sqrt[3]{t_n} + \frac{2}{t_n + 1} + 10\sin\frac{t_n}{2}}{\frac{3}{2\sqrt{t_n}} - \frac{2}{(t_n+1)^2} + 5\cos\frac{t_n}{2}}$$

$$t_1 = 9.9 - \frac{3\sqrt{9.9} + \frac{2}{9.9 + 1} + 10\sin\frac{9.9}{2}}{\frac{3}{2\sqrt{9.9}}\frac{2}{(9.9+1)^2} + 5\cos\frac{9.9}{2}}$$

$t_1 = 9.95(8812642)$

Second approximation $= 9.96$

[6 marks]