a) $3x^2 + 2x + k = 0$ no real roots $\Delta < 0$

$\Delta = b^2 - 4ac$

$= 4 - 4.3.k$

$= 4 - 12k$

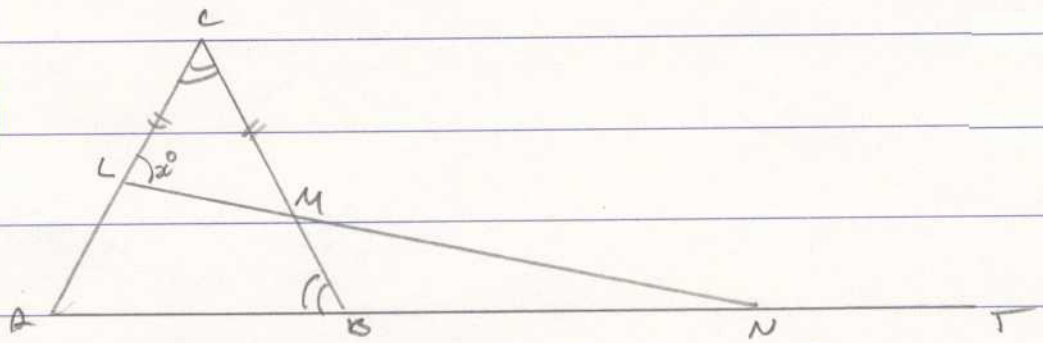
$4 - 12k < 0$

$-12k < -4$

$12k > +4$

$k > 1$

b)



i) ΔCLM is isosceles ($CL = CM$)

$\angle CML = x°$ (base $\angle$'s in isosceles triangle)

$\therefore \angle LCM = 180 - 2x°$ (angle sum of triangle CLM)

$\therefore \angle ABC = 180 - 2x°$ ($\angle ABC = \angle LCM$ given)

as reqd

ii) $\therefore \angle BMN = x°$ (vert opposite angles)

$\therefore \angle MBN = 2x°$ (supplementary with $\angle ABC$)

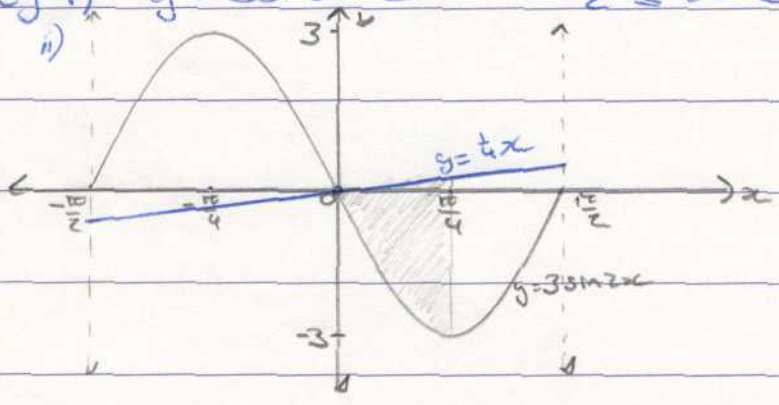
$\therefore \angle BNM = 180 - (x^\circ) - (2x^\circ)$ ($\angle$ sum $\triangle BMN$)

$= 180 - 3x^\circ$

$\therefore \angle TNL = 3x^\circ$ (supplementary with $\angle BNM$)

c) i) $y = 3\sin 2x \quad -\frac{\pi}{2} \le x \le \frac{\pi}{2}$

ii)



iii) $\int_0^{\frac{\pi}{4}} \left(3\sin 2x - \frac{1}{4}x\right) dx$

$= \int_0^{\frac{\pi}{4}} 3\sin 2x \, dx - \int_0^{\frac{\pi}{4}} \frac{x}{4} \, dx$

$= \left[-\frac{3}{2}\cos 2x\right]_0^{\frac{\pi}{4}} - \left[\frac{x^2}{8}\right]_0^{\frac{\pi}{4}}$

$= \left[-\frac{3}{2}\cos\frac{2\pi}{4} - \left(-\frac{3}{2}\cos 0\right)\right] - \left[\frac{\left(\frac{\pi}{4}\right)^2}{8} - 0\right]$

$= \left[0 + 1\frac{1}{2}\right] - \left[\frac{\frac{\pi^2}{16}}{8}\right]$

$= 1\frac{1}{2} - \frac{\pi^2}{2} \ u^2$