4. (a)

$$\Delta = b^2 - 4ac$$

$$= 2^2 - 4 \times 3 \times k$$

$$= 4 - 12k$$

No real roots $\longrightarrow \Delta > 0$
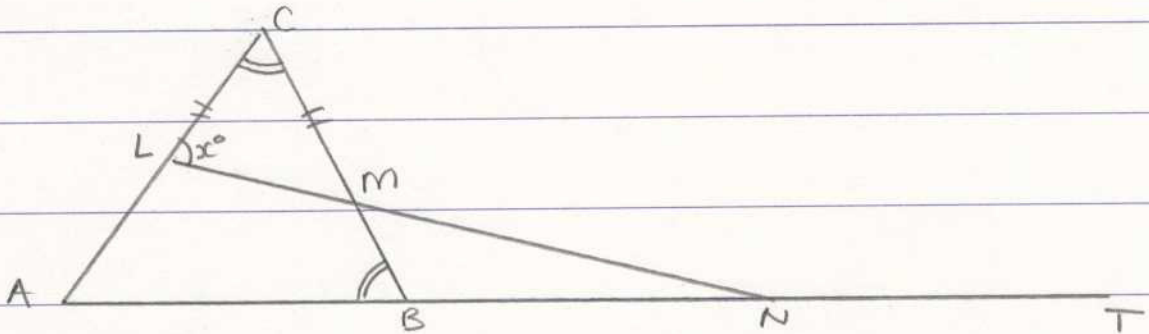
$$\therefore \quad 4 - 12k > 0$$

$$-12k > -4$$

$$-k > \frac{-4}{12}$$

$$k > \frac{1}{3}$$

(b)

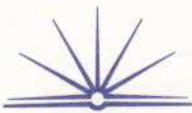**(i)**

$$\angle CLM = \angle CML = x^\circ \,(\text{base } \angle\text{'s isosceles } \Delta)$$

$$\angle LCM = 180^\circ - 2x^\circ$$

$$\angle LCM = \angle ABC$$

$$\therefore \quad \angle ABC = 180^\circ - 2x^\circ$$

(ii)

$\angle BMN = x°$ (vert. opp. $\angle$'s)

$\angle MBN = 2x°$ (supplementary $\angle$'s)

$\angle BNM = 180° - 3x°$ ($\angle$ sum of $\triangle$)

$\angle TNM = 3x°$ (supplementary $\angle$'s)

(c)(i)

$y = 3\sin 2x$

x	$-\frac{\pi}{2}$	$-\frac{\pi}{3}$	$-\frac{\pi}{4}$	0	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$
y	-0.16	-0.11	-0.08	0	0.16	0.11	0.08

$y = \frac{1}{4}x$

$y = 3\sin 2x$

shaded region
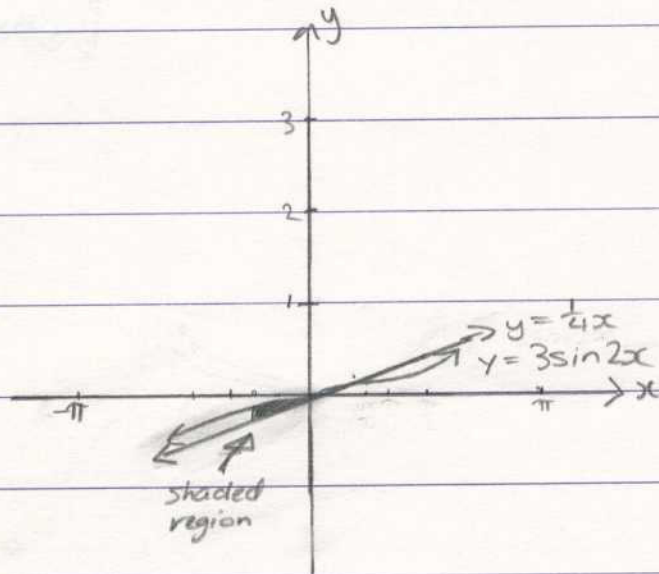
(ii)

$y = \frac{1}{4}x$

x	$-\frac{\pi}{2}$	$-\frac{\pi}{3}$	$\frac{\pi}{4}$	0	$\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{\pi}{2}$
y	$-\frac{\pi}{8}$	$-\frac{\pi}{12}$	$-\frac{\pi}{16}$	0	$\frac{\pi}{16}$	$\frac{\pi}{12}$	$\frac{\pi}{8}$
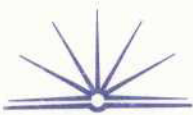
(iii)

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

$$=$$