a) $3x^2 + 2x + k = 0$

$\Delta = b^2 - 4ac$

$= 2^2 - 4(3)k$

$= 4 - 12k$

∴ equation has no real roots when $\Delta < 0$

$\therefore \quad 4 - 12k < 0$

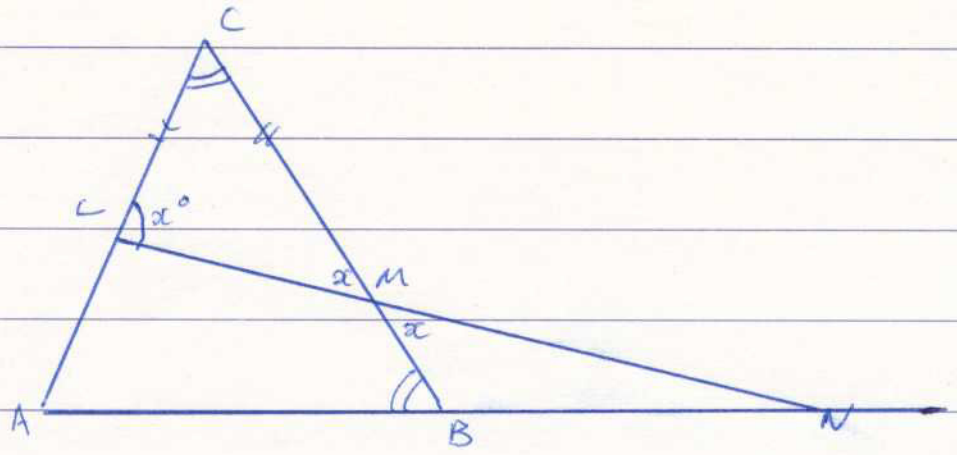
$-12k < -4$

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

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

the values of k for which equation $3x^2 + 2x + k = 0$ has no real roots are $k > \frac{1}{3}$

PTO →



i) $\angle ABC = 180 - 2x^\circ$

$\triangle CLM$ is isosceles

$\therefore \angle CML = x^\circ$ (Same base $\angle$'s in an isos $\triangle$)

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

$\therefore \angle CBA = 180 - 2x$ (given in diagram that $\angle ACB = \angle CBA$)

ii) $\angle MBN = 180^\circ - (180 - 2x)$ (180° in a straight line)

$= 180^\circ - 180^\circ + 2x$

$= 2x^\circ$

$\angle BMN = x^\circ$ (vert. opp. $\angle$'s are equal)

$\therefore \angle TNL = \angle MBN + \angle BMN$

$= 2x^\circ + x^\circ$ (exterior angle is sum of opposite interior angles)

$= 3x^\circ$

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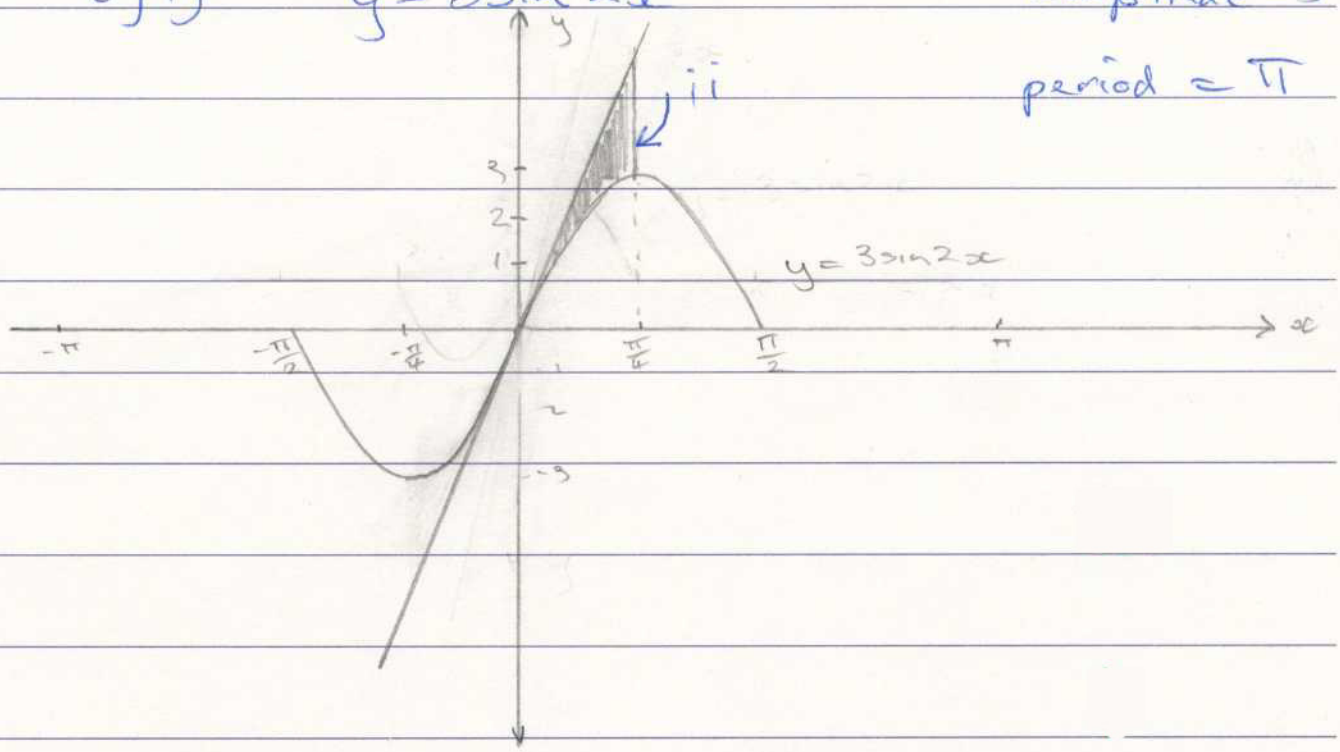
c) i) $y = 3\sin 2x$

amplitude = 3

period = π



ii) on diagram.

iii) $\int_0^{\frac{\pi}{4}} (3\sin 2x - \frac{1}{4}x)\,dx = \left[-\frac{3}{2}\cos 2x - \frac{1}{8}x^2\right]_0^{\frac{\pi}{4}}$

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

$= -\frac{3}{2} - \frac{\pi^2}{128}$

$= \left(\frac{3}{2} - \frac{\pi^2}{128}\right) - \left(-\frac{3}{2}\right)$

$= -\frac{\pi^2}{128}$