(1) (a) Show that:
$$\cos^2 x = 3\sin^2 x$$
can be written as $\tan^2 x = \frac{1}{3}$.
(b) Hence or otherwise, solve the equation $\cos^2 2\theta = 3\sin^2 2\theta$ in the interval $0 \le \theta \le 180^o$.

(2) Show that the equation
$$\cos^2 x - 2\sin x - 6 = 0$$
has no real solutions.

(3) $f(x) = k + \sin(3x)$
where k is a positive constant.
Given that $f(x) = 0$ only has one solution in the interval
$0 \le x \le 120^o$:
(a) State the value of k.
(b) Find the value of x for which $f(x) = 0$