**7.** Solve for $\theta$ to the nearest hundredth, where $0 \le \theta \le 2\pi$.

a) $2\cos^2\theta + \cos\theta - 1 = 0$

b) $2\sin^2\theta = 1 - \sin\theta$

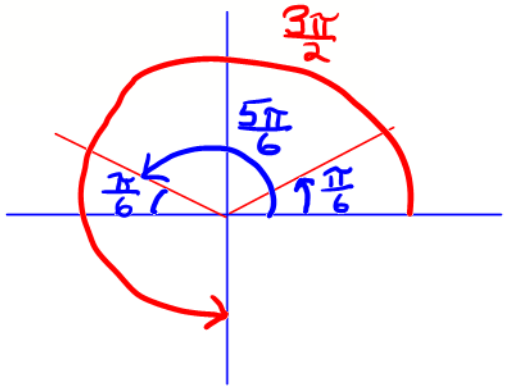
$\therefore 2\sin^2\theta + \sin\theta - 1 = 0$

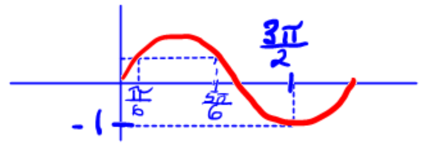
$\therefore (2\sin\theta - 1)(\sin\theta + 1) = 0$

$\therefore 2\sin\theta - 1 = 0$ or $\sin\theta + 1 = 0$

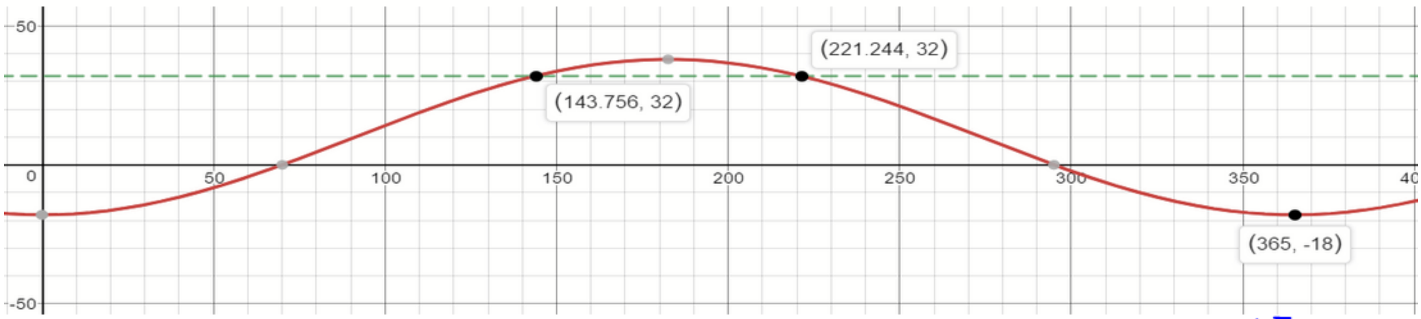
$\therefore \sin\theta = \frac{1}{2}$ or $\sin\theta = -1$

$\therefore \theta = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2}$




**11.** A city's daily high temperature, in degrees Celsius, can be modelled by the function $t(d) = -28\cos\frac{2\pi}{365}d + 10$, where $d$ is the day of the year and $1$ = January 1. On days when the temperature is approximately 32 °C or above, the air conditioners at city hall are turned on. During what days of the year are the air conditioners running at city hall?




$-28\cos\left(\frac{2\pi}{365}d\right) + 10 \ge 32$

$\therefore -28\cos\left(\frac{2\pi}{365}d\right) \ge 22$

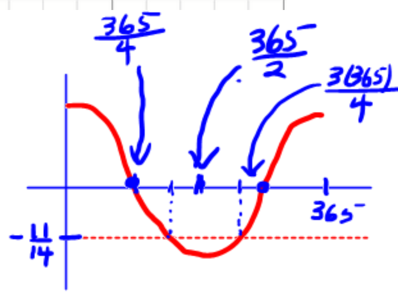
$\therefore \cos\left(\frac{2\pi}{365}d\right) \le \frac{22}{-28} = -\frac{11}{14}$

$\therefore \cos^{-1}\left(-\frac{11}{14}\right) \le \frac{2\pi}{365}d \le 2\pi - \cos^{-1}\left(-\frac{11}{14}\right)$

$\therefore 2.4746 \lessapprox \frac{2\pi}{365}d \lessapprox 2\pi - 2.4746$

$\therefore \frac{365(2.4746)}{2\pi} \lessapprox d \lessapprox \frac{365(2\pi - 2.4746)}{2\pi}$

$143.8 \lessapprox d \lessapprox 221.2$



## Extending

**16.** Prove $\sin C + \sin D = 2\sin\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$.

Let $x = \frac{C+D}{2}$ $\quad y = \frac{C-D}{2}$

Then $x+y = \frac{C}{2}+\frac{D}{2}+\frac{C}{2}-\frac{D}{2} = C$

$x-y = \frac{C}{2}+\frac{D}{2}-\left(\frac{C}{2}-\frac{D}{2}\right) = D$

$\therefore$ L.S. $= \sin C + \sin D$

$= \sin(x+y) + \sin(x-y)$

$= \sin x\cos y + \cos x \sin y + \sin x \cos y - \cos x \sin y$

$= 2\sin x \cos y$

$= 2\sin\left(\frac{C+D}{2}\right)\cos\left(\frac{C-D}{2}\right)$

$=$ R.S.