13	13 a	The population of a herd of wild horses is given by $P(t) = 400 + 50\cos\left(\frac{\pi}{6}t\right)$, where t is time in months. (i) Find all times during the first 12 months when the population equals 375 horses. (ii) Sketch the graph of $P(t)$ for $0 \le t \le 12$.	**2** **2**

(i) $400 + 50\cos\left(\frac{\pi}{6}t\right) = 375$

$50\cos\left(\frac{\pi}{6}t\right) = 375 - 400$

$50\cos\left(\frac{\pi}{6}t\right) = -25$

$\cos\left(\frac{\pi}{6}t\right) = -\frac{1}{2}$

$\frac{\pi}{6}t = \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{8\pi}{3}\ldots$

$t = 4, 8, 16, \ldots$

After 4 months and 8 months

(ii) $P(0) = 400 + 50\cos\left(\frac{\pi}{6}\times 0\right)$

$= 400 + 50\cos 0$

$= 450$

$P(12) = 400 + 50\cos\left(\frac{\pi}{6}\times 12\right)$

$= 400 + 50\cos 2\pi$

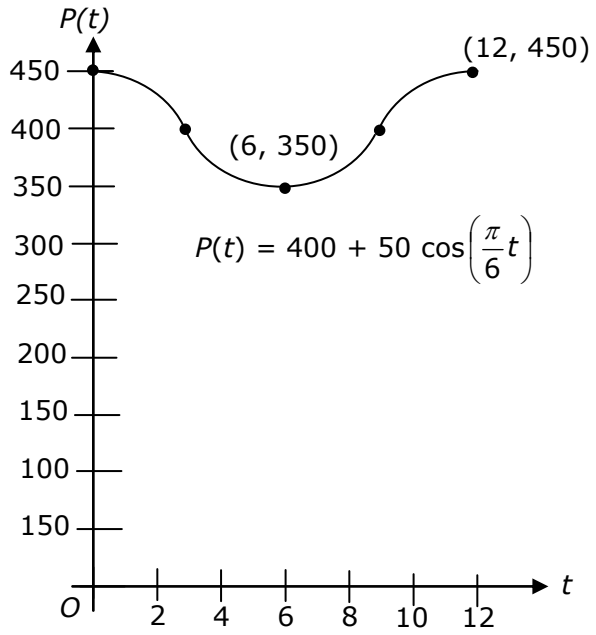
$= 450$

Also, $P(6) = 400 + 50\cos\left(\frac{\pi}{6}\times 6\right)$

$= 400 + 50\cos\pi$

$= 350$

State Mean:
1.20/2
0.77/2



* These solutions have been provided by *projectmaths* and are not supplied or endorsed by the Board of Studies

Board of Studies: Notes from the Marking Centre

(i) Candidates were able to access at least one mark by realising that $P(t) = 375$ and simplifying to get $\cos\left(\frac{\pi}{6}t\right) = -\frac{1}{2}$.

Common problems were:

- substituting $t = 12$ into the equation
- converting to degrees
- separating the $\frac{\pi}{6}$ and the t, hence not being able to proceed to any meaningful conclusion
- not realising that two quadrants should be considered.

(ii) Common problems were:

- sketching the graph incorrectly or inaccurately
- not realising that they were sketching a periodic curve
- not labelling or poorly labelling axes or critical points
- sketching an incorrect shape
- sketching such a small diagram that it was difficult to ascertain if necessary features were correct.

Source: http://www.boardofstudies.nsw.edu.au/hsc_exams/