Question 12 **(5 marks)**

The vertical displacement, $y(t)$ centimetres, of the seat of a toy horse from the mean position after t seconds is measured as the toy horse moves up and down a pole during a ride on a merry-go-round.

The vertical motion of the toy horse obeys the equation $\frac{d^2y}{dt^2} = -\left(\frac{\pi}{2}\right)^2 y$.

The vertical motion of each toy horse spans 50 centimetres, and the seat of the toy horse is at the mean position at the start of the ride.

(a) Determine the vertical displacement function $y(t)$. (3 marks)

(b) Determine the maximum vertical speed of the toy horse, correct to the nearest centimetre per second. (2 marks)