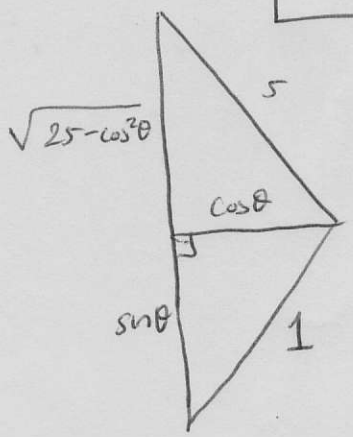
IW #2

1) h & height, t = time (speed), θ = angle for picture



2) $h = \sin\theta + \sqrt{25-\cos^2\theta}$

3) $\frac{d\theta}{dt} = \theta'(t) = 30 \times 2\pi = 60\pi \frac{\text{rad}}{\text{sec}}$

$\Rightarrow \theta(t) = 60\pi t + k$ $\quad k$: constant

$\theta(0) = k$ and $\theta(0) = 0 \Rightarrow k = 0$

$\Rightarrow \theta(t) = 60\pi t$

4) $h(t) = \sin(60\pi t) + \sqrt{25-\cos^2(60\pi t)}$

5) $h'(t) = \cos(60\pi t) \cdot 60\pi + \frac{1}{2}\left(25-\cos^2(60\pi t)\right)^{-1/2} \cdot (-2\cos(60\pi t)) \cdot (-\sin(60\pi t)) \cdot 60\pi$

6) $\theta = \theta(t)$

7) $h(t) = \sin(\theta(t)) + \sqrt{25-\cos^2(\theta(t))}$

8) $h'(t) = \cos(\theta(t)) \cdot \theta'(t) + \frac{1}{2}\left(25-\cos^2(\theta(t))\right)^{-1/2} (-2\cos(\theta(t)))(-\sin(\theta(t)))\,\theta'(t)$

9) $h'(t_0) = h'(t_0) = \cos\left(\frac{\pi}{3}\right) 23 + \frac{1}{2}\left(25-\cos^2(\pi/3)\right)^{-1/2} (-2\cos(\pi/3)(-\sin(\frac{\pi}{3}) \cdot 23$

$= \frac{23}{2} + \sqrt{\frac{4}{99}}\left(4 \cdot \frac{1}{2} \cdot \frac{\sqrt{3}}{2}\right) \cdot 23 = \frac{23}{2} + 23\sqrt{\frac{4}{33}}$ ///

10) We did not need to know to since it was enough to know at a certain time $\theta = \frac{\pi}{3}$ and $\theta' = 23$ holds and the problem is asked at that time.

i.e. problem can be asked as

... "when $\theta = \frac{\pi}{3}$ and $\theta' = 23$ "