## Answer on Question \#52583, Physics, Mechanics | Kinematics | Dynamics

A particle of mass $m$ is initially situated at the point $p$ inside a hemispherical surface of radius $r$. A horizontal acceleration of magnitude $a_{0}$ is suddenly produced on the particle in the horizontal direction. If gravitational acceleration is neglected, the time taken by particle to touch the sphere again is:

## Solution:



From figure $\mathrm{OP}=\mathrm{r}$.

The kinematics equation is

$$
x=x_{0}+v_{o} t+\frac{1}{2} a_{0} t^{2}
$$

where
$x_{0}=P$ is initial position
$v_{0}=0 \mathrm{~m} / \mathrm{s}$ is initial speed
$a_{0}$ is acceleration
$x=B$ is final position.
Thus,

$$
t=\sqrt{\frac{2\left(x-x_{0}\right)}{a_{0}}}
$$

From figure

$$
\begin{gathered}
x-x_{0}=P B=2 P A \\
P A=O P \cos \alpha=r \cos \alpha
\end{gathered}
$$

Hence,

$$
t=\sqrt{\frac{2 * 2 * r \cos \alpha}{a_{0}}}=\sqrt{\frac{4 r \cos \alpha}{a_{0}}}
$$

Answer: $\sqrt{\frac{4 r \cos \alpha}{a_{0}}}$

