20-R-KM-DK-5

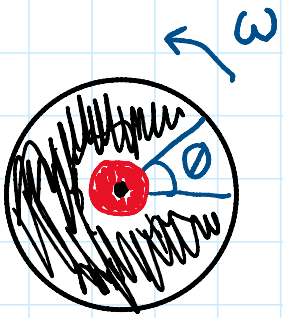
July 31, 2020 11:24 AM

20-R-KM-DK-5 Beginner

Inspiration: 16-5 Hibbeler

Constant Acceleration

Stuck in quarantine, a retired engineer decides to jam out to his record player, only to find out that it's broken. He notices a pattern in which the record rotates, and hypothesizes that the angular distance the record travels can be described by the equation ***theta = 16 + 4t^2 + 3t^3***, there t is time in seconds. Determine the number of revolutions, the angular velocity, and the angular acceleration at the instant when ***t = 30s***.



$\theta = 16 + 4t^2 + 3t^3 \qquad t = 30s$

$\theta = 16 + 4(30)^2 + 3(30)^3 = 84616 \text{ rad}$

$84616 \text{ rad} \times \frac{1 \text{ rev}}{2\pi \text{ rad}} = \boxed{13467.05466 \text{ revs}}$

$\omega = \frac{d\theta}{dt} = 0 + 8t + 9t^2 \qquad 8(30) + 9(30)^2 = \boxed{8340 \text{ rad/s}}$

$\alpha = \frac{d\omega}{dt} = 8 + 18t \qquad 8 + 18(30) = \boxed{548 \text{ rad/s}^2}$