Exercises in Physics
Assignment # 3

Date Given: April 21, 2022
Date Due: April 28, 2022

P1. (**2 points**) A particle which moves with curvilinear motion has coordinates in millimeters which vary with the time t in seconds according to $x = 3t^2 - 4t$ and $y = 4t^2 - t^3/3$. Determine the magnitudes of the velocity $\boldsymbol{v}$ and acceleration $\boldsymbol{a}$ and the angles which these two vectors make with x-axis when $t = 2$s.

P2. (**2 points**) The position of a point that moves in the xy plane is given by $\boldsymbol{r} = \left(\frac{2}{3}t^3 - \frac{3}{2}t^2\right)\boldsymbol{i} + \frac{t^4}{12}\boldsymbol{j}$, where $\boldsymbol{r}$ is in meters and t is in seconds. Determine the angle between the velocity $\boldsymbol{v}$ and the acceleration $\boldsymbol{a}$ when (a) $t = 2$s and (b) $t = 3$s.

P3. (**2 points**) The basketball player likes to release his foul shots at an angle $\theta = 50°$ to the horizontal as shown. What initial speed[1] v_0 will cause the ball to pass through the center of the rim?
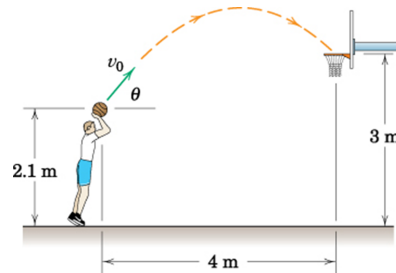

Figure 1: Illustration to Problem 3.

P4. (**4 points**) A projectile is launched from point A with an initial speed[2] $v_0 = 30$m/s. Determine the value of the launch angle α for which the projectile will land at point B.
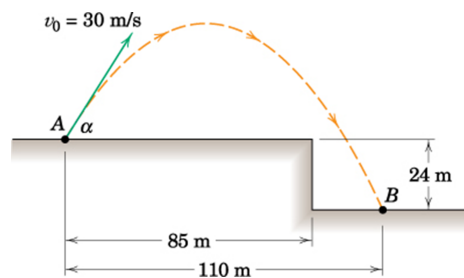

Figure 2: Illustration to Problem 4.

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[1]By the speed v_0 we understand the magnitude of the vector $\boldsymbol{v}_0$ shown in Figure 1.
[2]By the speed v_0 we understand the magnitude of the vector $\boldsymbol{v}_0$ shown in Figure 2.