PEP 2017
Assignment 3

(1) Expand the following functions at $x_0 = 0$ in a series up to the first four terms:

(a) $f(x) = \ln(1+x)^5$

(b) $f(x) = \cosh x$

(c) $f(x) = \sqrt{1-x}$

(2) (a) Given $z = 2e^{i\pi/4}$, calculate z^3

(b) Given $z = \frac{1}{16}e^{i6\pi}$, calculate $z^{1/4}$

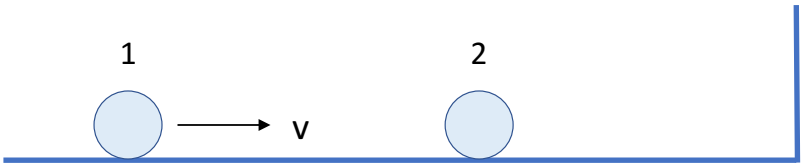
(c) Calculate $\left(\frac{1}{2} - i\frac{\sqrt{3}}{2}\right)^3$

(d) Put the following complex numbers into exponential form:
(i) $5 - 5i$

(ii) $15 - 13i$

(e) Determine the real and imaginary parts of $\frac{(1+i)^2}{\sqrt{2}(1-i)}$

(3) Two balls 1 and 2 on a frictionless horizontal track with a vertical wall on the right. Their masses are m_1 and m_2 respectively. Initially, the ball 2 is at rest while the ball 1 is moving to right with velocity v and collides with ball 2. Find the range of the ratio m_2/m_1 such that the second collisions between two balls become possible. You can assume all the collisions are elastic.



(4) A smooth hemisphere with mass M and radius R is on a horizontal frictionless table. A small ball of mass m is sliding down at rest from the top of the hemisphere and lose contact with the hemisphere at angle θ such that $\cos\theta = 0.7$. Find the ratio M/m.