

1. Read Marion through the end of Chapter 2.
True/False: I read this material.
2. Marion Ch 2, Problem 21
Appx A, Problem 2 (first four terms)
3. Compute Taylor series for $(1+x)^n$ and $1/(1+x)^n$ around $x=0$. Compute each to third order (*ie* to x^3); you may assume n is an integer greater than 4. Check your answers by multiplying the two series and keeping terms to the same order.
4. You're coasting on a bicycle in a straight line and into the wind. The wind comes in periodic gusts, and you may model the resistive force which results by $-cv(t)(1+\cos\omega t)$.
 - (a) Set up a simple scheme to solve for $v(t)$ numerically as discussed in lecture.
 - (b) Use it to approximate $v(t)$ for t from 0 to 10s if the initial velocity $v_0 = 10\text{m/s}$, your mass combined with the bicycle $m = 80\text{kg}$, the coefficient $c = 6.0\text{kg/s}$, and the gusts peak with a period of 8.0s. Use 10 time steps. (This is simple enough to work out on a hand calculator, but if you do code it, feel free to solve it more accurately with additional, smaller time steps.)
 - (c) Plot your result. (Any form is ok: by hand on graph paper, or by computer plotting routine.)
5. For a projectile shot straight up from ground level and assuming a resistive force proportional to the velocity v , the relation between the initial velocity v_0 and final velocity v_f when it hits the ground again is

$$v_0 - v_f = \frac{g}{k} \log \left(\frac{1 + kv_0/g}{1 + kv_f/g} \right). \quad (1)$$

Solve for v_f perturbatively, assuming a weak resistive force, up to order k . To do so, you'll need to keep terms to order k^2 in intermediate steps. (As a check, what should you find for the leading term? Be careful to get the sign right. What happens if you choose the wrong sign?)