

Find the complex number $I_0(\omega)$
 using $Z_R = R$ $Z_C = \frac{1}{i\omega C}$ $Z_L = i\omega L$
 and Ohm's Law for Impedance.

② Find roots of $z^4 = 1$

③ Use Taylor expansion to prove Euler's formula.

④ How many roots will $z^5 + 2z^3 - 1 = 0$ have?
 i.e. 5th order polynomial.

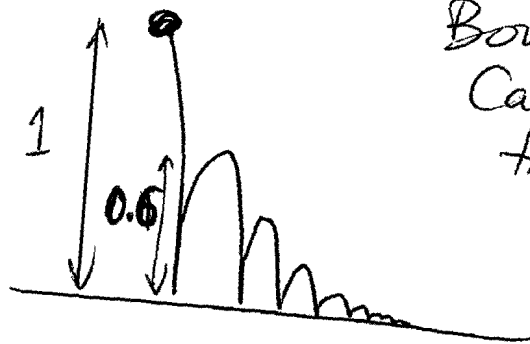
⑤ Use Euler's formula to express $\cos 2\theta$
 as a function of $\cos \theta$ & $\sin \theta$.

⑥ Find the real & Imaginary parts of $\ln(1-i)$

⑦ What values of x will satisfy
 $\cosh x - 5 \sinh x - 5 = 0$

8 Calculate $\sum_{n=100}^{200} 2n$

9

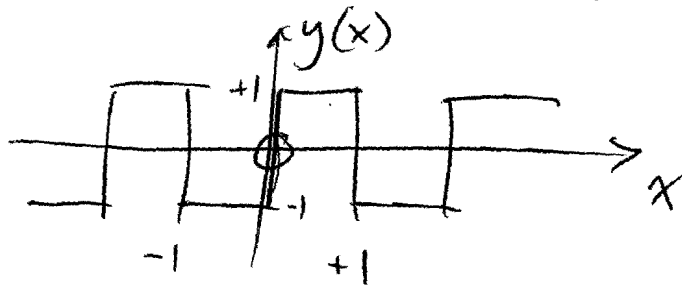


Bouncing ball:
Calculate total distance
traveled in vertical direction
(use infinite sum).

10 Review the convergence tests.

11 Expand $(1+x)^{1/2}$ into a Taylor series.

12 Find the Fourier series for



13 Solve the simultaneous eqns

$$3x_1 + 2x_2 = 3 \quad \text{--- ①}$$

$$4x_1 + 3x_2 = 6 \quad \text{--- ②}$$

(Easiest to ~~the~~ rearrange ①
& sub into ②).

(14) $\vec{v} = \begin{bmatrix} 1 \\ 7 \\ 2 \end{bmatrix}$ calculate $|\vec{v}|$

(15) Find the Rank of ~~A~~ $A = \begin{bmatrix} 1 & 0 & 1 \\ 3 & 0 & 3 \\ 1 & -1 & 0 \end{bmatrix}$

using $\det A$ & a determinant of a submatrix of A .

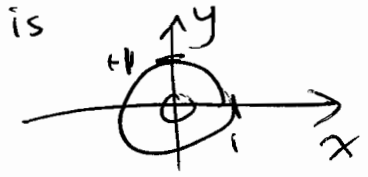
(16) Find eigenvalues and 3 orthonormal eigenvectors of $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 1 & -3 \\ 3 & -3 & -3 \end{bmatrix}$

(17) Find the inverse of $A = \begin{bmatrix} 2 & 4 & 3 \\ 1 & -2 & -2 \\ -3 & 3 & 2 \end{bmatrix}$

(18) Form an orthonormal basis that includes $\begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$ and linear combinations of $\begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}$ & $\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$.

(19) $\phi(x, y, z) = r \sin \theta$
Calculate $\nabla \phi$ ~~in~~ ⁱⁿ spherical coords.

(20) Calculate $\oint_C x \, dy$ where the contour



is
Circle centered
at origin radius
= 1.

(21) Find the most general soln of

a) $\frac{dy}{dx} - xy - x = 0$ [separable ODE]

b) $x \frac{dy}{dx} + 3x + y = 0$ [Exact ODE]

c) $\frac{dy}{dx} = \frac{-2}{y} - \frac{3y}{2x}$ [Inexact]

d) $\frac{dy}{dx} + \frac{y}{x} = 2x^3y^4$ [Bernoulli's]

(22) How many linear indep fns $z(x)$ do you expect to find that satisfy

$$\frac{d^4 z}{dx^4} = kz \quad ?$$

(23) Use the Wronskian method to show that $\sin x$ & $\cos x$ are linearly indep.

(24) Find the most general soln $f(t)$ that satisfies:

$$a) \quad \frac{d^2 f}{dt^2} + 8 \frac{df}{dt} + 12f = 12e^{-4t}$$

(for homogeneous case try $e^{\lambda t}$)

$$b) \quad \frac{d^2 f}{dt^2} - 4 \frac{df}{dt} + 6f = 0$$

(25) Use Variation of parameters to find the most general soln for

$$y'' + y = \frac{1}{\sin x}$$

(26) Use series soln $\sum_{n=0}^{\infty} a_n z^n$ to solve

$$y'' + y = 0$$

(27) Legendre Eqn is

$$y'' - \frac{2x}{1-x^2} y' + \frac{l(l+1)}{1-x^2} y = 0$$

Find the recursion relation for a_n when $l=1$.

Write an explicit soln $y(x)$ when $l=1$, and test this soln in the ODE.

(28) Find the most general soln to

(i)
$$\frac{\partial^2 u}{\partial t^2} = \frac{1}{c^2} \frac{\partial^2 u}{\partial x^2}$$

(ii)
$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 6(x+y)$$

(iii)
$$x \frac{\partial u}{\partial x} - 2y \frac{\partial u}{\partial y} = 0 \quad \text{where } u = 2y+1 \text{ on the line } x=1.$$