Homework 5

Answers should be submitted, as both a tex file and a pdf file, to both me and the teaching assistants. You may use this file as a template.

Q5.1.

$$I(x) = \int_{-\pi}^{\pi} e^{ix \sin t} dt \tag{Q5.1.1}$$

Use the transformation

$$z = e^{it} \tag{Q5.1.2}$$

to express $I(x)$ as a holomorphic integral over a closed curve. Then use

(a) contour integration to determine $I(x)$,

(b) the saddle point approximation to obtain the asymptotic form of $I(x)$ as $x \to \infty$.

Q5.2. In the path integral formulation of quantum mechanics, the amplitude for a particle moving from $x_\mathrm{i}(t_\mathrm{i})$ to $x_\mathrm{f}(t_\mathrm{f})$ is given by

$$\int d[x(t)] \exp\left\{ \frac{i}{\hbar} S[x(t)] \right\} \tag{Q5.2.1}$$

where the integral is over all paths $x(t)$ going from $x_\mathrm{i}(t_\mathrm{i})$ to $x_\mathrm{f}(t_\mathrm{f})$. Derive classical physics.

Q5.3. Calculate

$$\sum_{n=0}^{\infty} \frac{n!}{x^n} \tag{Q5.3.1}$$

for $x = 10$.

Use PGF to draw a diagram illustrating your answer.