

Date
20/08/2020

Assignment 1

(MA 31007)

(Mathematical Methods)

Q1) Solve $x \left(\frac{d^2 y}{dx^2} \right) + 2 \left(\frac{dy}{dx} \right) + \frac{(xy)}{2} = 0$, in terms of Bessel's functions, by using the substitution $z = \sqrt{x}$.

Q2) Show that
$$\int_0^1 \frac{u J_0(xu)}{(1-u^2)^{1/2}} du = \frac{\sin x}{x}.$$

Q3) Prove that
$$J_n(x) = \frac{x^n}{2^{n-1} \Gamma(n)} \int_0^{\pi/2} \sin \theta \cos^{2n-1}(\theta) J_0(x \sin \theta) d\theta,$$
 where $n > -\frac{1}{2}$.

Q4) Prove that
$$\int_0^x t \{J_n(t)\}^2 dt = \frac{1}{2} x^2 [J_n^2(x) - J_{n-1}(x) J_{n+1}(x)]$$

Q5) Express $J_4(x)$ in terms of J_0 & J_1 .

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