Date
08/10/2021

Assignment 1 (MA31007)

(Mathematical Methods)

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

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 $n > -1/2$.

Q4) Prove that

$$\int_0^x t\left\{J_n(t)\right\}^2 dt = \frac{1}{2}x^2\left\{J_n^2(x) - J_{n-1}(x)\, J_{n+1}(x)\right\}.$$

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

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