

Take Home - No collaboration- Show all your work

Demonstrate (or attempt to demonstrate) that each solution satisfies the equation!!!

1) Solve the differential equation with initial conditions: (10 pts each)

a) $x^2y'' - 2xy' - 4y = 0, \quad y(1) = 2, \quad y'(1) = 3.$

b) $x^2y'' + xy' + y = 0, \quad y(1) = 1, \quad y'(1) = 2.$

2) (15pts) Solve Bessel's differential equation for one of the independent solutions using power series techniques.

$$x^2y'' + xy' + (x^2 - 9)y = 0.$$

3) (15pts) Solve the Legendre equation for one of the independent solutions using power series techniques:

$$(1 - 2x^2)y'' - 2xy' + 4y = 0.$$

4) (25 pts) Solve the partial differential equation with boundary conditions:

$$u_{tt} = u_{xx}; \quad u(0, t) = 0; \quad u(L, t) = 0; \quad \lim_{t \rightarrow 0} u_t(x, t) = f(x);$$

5) (25 pts) Solve the partial differential equation with boundary conditions:

$$u_t = u_{xx}; \quad u(0, t) = 20; \quad u(L, t) = 40; \quad u(x, 0) - 20 - 20x = f(x);$$