Subject: Mathematics Paper II Mathematical Method

1) Find the radius of convergent for the following power series:
   a)$\sum_{n=0}^{\infty} n!\, x$n
2) For the differential equation y'+y =1, find a power series solution of the form ∑ an xn and try to recognize the resulting series as the expansion of a familiar function. Also ,verify your conclusion by solving the equation directly.
3) Theorem- Let x_0 be an ordinary point of the differential equation: y" +P(x)y' +Q (x)y=0
4) Find the general solution of y"+y=0 in terms of power series in x.can you express this solution by means of elementary function?
5) Verify that the solution y"+ y'-xy =0 has a three term recursion formula,and find its series solution y1(x) &y2(x) such that (a) y1(0) =1 (b)y1'(0)=0
6) Find the indicial equation and its roots for the differential equation x^3 y''+(cos 2x -1)y' +2xy
7) For the following differential equation , locate and classify its singular points on the x-axis:
8) Bessel's equation of order zero x^2y''+xy'+x2y=0.Show that its indicial equation has only one root,and corresponding Frobenius series solution is y =$\sum_{n=0}^{\infty}(-1)$n/2n(n!) x2n.
9) Legendre's function of the first kind(or Legendre's polynomial of degree n).
10) Show that all the roots of Pn(x)=0 are distinct.
11) Show that all the roots of Pn(x)=0 are not distinct must be wrong.
12) Show that Pn(1)=1 and Pn(-x)=(-1)nPn(x).Hence or otherwise deduce that Pn(-1)=(-1)n.
13) Determine the polynomials Pn(x)for n=0,1,2,3,4,5
14) Find series of Legendre's polynomials for x^2
15) Recurrence formula for the Legendre's polynomial Pn(x) (2n+1)xpn=(n=1)Pn+1+ nPn-1.
16) nPn= xP'n-P'n-1

17) Orthogonality of Legendre's polynpmial.
18) Recurrence Formula for the Bessel's function jn(x)
19) For the differential equation y'+y =1, find a power series solution of the form ∑ an xn and try to recognize the resulting series as the expansion of a familiar function. Also ,verify your conclusion by solving the equation directly.
20) Prove that Jn(x)=0 has no repeated roots except at x=0
21) Sectional or piecewise continuity.
22) Existence of Laplace Transform of f(t).
23) Laplace Transform of Some Elementry Function. L{1}=1/s ,s>0
24) Properties of Laplace Transforms. A)Linearity Properties B)First Shifting .
25) Laplace Transform of Derivative of f(t).
26) Laplace Transform of Integral of f(t).
27) Laplace Transform of f(t)/t (Division by t)
28) Evaluate L{t2 cos2t}
29) Find the Laplace transform of the following functions t sin at.
30) Evaluation of Integrals.
31) Unit step function.
32) Laplace Transform of Unit step function
33) Find the Laplace transform t2 u (t-3)
34) Define : Periodic Function.
35) Laplace transform of Bessel Function j0(t) and j1(t).
36) Inverse Laplace Transforms.
37) Properties of Inverse Laplace Transforms.
38) Linearity Properties.
39) Explain Second shifting Property.
40) Find the Inverse Laplace transform of the following function.a)s/s^2