

1. Solve the following initial value problem

$$\frac{dy}{dx} = e^{x-y}, \quad y(0) = 1.$$

2. Find the general integral of

$$\frac{dy}{dx} = \frac{x^3}{x^2y - y^3}.$$

3. Find the general solution of  $e^y y'' + y' = 0$ .

4. Solve

$$\frac{y^2}{2} + 2ye^x + (y + e^x) \frac{dy}{dx} = 0.$$

5. Solve

$$(4x + 3y^2)dx + 2xydy = 0.$$

6. Find the general solution of

$$x^2 y'' + 2xy' - 2y = x + x^2.$$

7. Show that the origin is a regular singular point of the equation

$$x^2 y'' + xy' + \left(x^2 - \frac{1}{4}\right)y = 0$$

and find at least one of the two linearly independent solutions in terms of Frobenius series.

8. Find the inverse Laplace transform of

$$F(s) = \frac{s^2 + 4s}{(s+1)^2(s^2+4)}.$$

9. Solve the initial value problem

$$y'' + 2y' + 2y = f(t), \quad y(0) = y'(0) = 0$$

where

$$f(t) = \begin{cases} \sin t, & 0 \leq t \leq \pi \\ 0, & t > \pi. \end{cases}$$



McGILL UNIVERSITY  
FACULTY OF ENGINEERING

FINAL EXAMINATION

MATHEMATICS 189-261B

DIFFERENTIAL EQUATIONS

Examiner: Professor B. Lawruk  
Associate Examiner: Professor J. Labute

Date: Tuesday, April 25, 2000  
Time: 2:00 P.M. - 5:00 P.M.

INSTRUCTIONS

**Calculators are not permitted.**

This exam comprises the cover, one page of questions and one page of Laplace transforms.