

SMA 2373

NUMERICAL METHODS CAT TWO

TIME: 1H HOUR

1. Find the value of  $y(1.1)$  and  $y(1.2)$  correct to four decimal places given that  $\frac{dy}{dx} = \sqrt[3]{xy}$  and  $y(1) = 1$  using the first three terms of the Taylor's series expansions. (5 marks)
2. If  $\frac{dy}{dx} = 1 + y^3$  when  $y=0$  and  $x=1$ . Find  $y(1.2)$  and  $y(1.4)$  using Runge-Kutta second order (8 marks)
3. Use Simpson's rule with 3, 5 and 9 ordinates to obtain the initial estimates of the integral  $\int_1^2 \frac{20}{5 + \ln 2x} dx$  then refine your solution by the Romberg integration (10marks)
4. Use LU-decomposition to solve for  $x_1$ ,  $x_2$  and  $x_3$  given

$$2x_1 - 3x_2 + 10x_3 = 3$$

$$-x_1 + 4x_2 + 2x_3 = 20$$

$$5x_1 + 2x_2 + x_3 = -12$$

$-2x_1 - 1$   
 $2x_2^2 y$   
 $4xy + 2x^2$   
(7 marks)