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### DEPARTMENT OF MATHEMATICS UNIT - IV INTERPOLATION, NUMERICAL DIFFERENTIATION & INTEGRATION

DERIVATIVES FROM DIFFERENCE TABLES - DIVIDED DIFFERENCE AND FINITE DIFFERENCES : The following data gives the velocity of a particle for 20 seconds at an interval of 5 seconds. Find the initial acceleration using the entire date Time (sec): 0 5 10 15 20 Velocity (m/sec): 0 3 14 69 228. Soln: velocity -> 2 Acceleration -> dv Initial acceleration = du at t=0 2º 22º 220 132 142 7 0 0 15 159 228 20



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Initial accideration du at t=0 is = = = [ [ A20 + 1 A30 - 1 A40 + ...] -h=5 = = = [3-=== x8+=== x36-=== x24]  $= \frac{1}{5} [3 - 4 + 12 - 6] = 007 218 6$ 2= (5) (5) P=(2)) (2) (2) (2) (2) = lolol - de lo Find dy and dry at n= 51 from the following data: x: 50 60 70 80 90 y: 19-96 36.65 58.81 77.21 94.61 Boln: Here h=10, 2=50, x=51  $\frac{1}{5} = \frac{1}{5} = \frac{51 - 50}{10} = 0.1$ 



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$ \frac{dy}{dx} = \left(\frac{dy}{dx}\right) = \frac{1}{7} \left[\Delta y_0 + \frac{(2u-1)}{2!} \Delta^2 y_0 + \frac{(3u^2 - 6u + 2)}{3!} \Delta^3 y_0 + \frac{(3u^2 - 6u + 2)}{3!} \Delta^3 y_0 + \frac{(4u^3 - 18u^2 + 22u - 6)}{4!} \Delta^4 y_0 + \frac{4u^3 - 18u^2 + 22u - 6}{4!} \right) \Delta^4 y_0 + \frac{4u^3 - 18u^2 + 22u - 6}{4!} $
$\chi = \chi - \chi_0^2 \qquad y \qquad \Delta y \qquad \Delta^2 y \qquad \Delta^3 y \qquad \Delta^4 y$
50   0   19.56   16.69   16.69   5.47   22.16   -9.23   170   2   58.81   -3.76   -9.23   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   11.99   12.16   12.16   11.99   12.16   11.99   12.16   12.16   11.99   12.16   12.16   12.16   12.16   12.16   12.16   12.16   12.16   12.16   12.16   12.16   12.16   12.16   12.16   12.16   12.16   12.16   12.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13.16   13
60 1 36.65 22.16 -9.23
70 2 58.81 -3.76 18.4 2.76 80 3 77.21 -1.00
80 3, 00000 77.21000 - 1.00 Michael (10)
80 90 yra (4-1)(1-10)1094.61 -(1-10)10 + of a 11 + of -(10) f 10 - yra (4-10)(1-10)1094.61 -(1-10)10 + of a 11 + of -(10) f
$ \frac{(dy)}{(dn)_{u=0.1}} = \frac{1}{10} \left[ \frac{16.69}{10} + \frac{2 \times 0.1 - 1}{2} \times 5.47 + \frac{3 \times 0.1^2 - 6 \times 0.1 + 2}{6} \right] $
$(dn/u=0.1)$ 10 [ $(-9.23)+4\times0.1^{3}-18\times0.1^{2}+22\times0.1-6\times11.99$ ] $(-9.23)+4\times0.1^{3}-18\times0.1^{2}+22\times0.1-6\times11.99$ ]



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 $= \frac{1}{10} \left[ 16.69 - 2.188 - 2.1998 - 1.9863 \right]$ = 1.03159 (2) Find the first, second & third derivatives of f(x) at x = 1.5 g x : 1.5 2.0 2.5 3.0 3.5 4.0 f(x) : 3.375 7.00 13.625 24.0 38.875 59.0 f(x) : 3.375 7.00 13.625 24.0 38.875 59.0  $\frac{1}{1}(x) : -\frac{1}{1}(1.5) = \frac{1}{1}(1.5) = \frac{1}{1}(1.5) = 6$