MAT 2630 Halleck Fall 2015 Practice Exam 3

REMINDER: your 2 page (front and back) 1 sheet hand-written set of formulas and notes will be 10% of your grade.

Please do as much of the exam as you can by hand. However, you may use a calculator if you need it. The actual exam will consist of questions similar to 5 of the ones that you see below. Each question will be worth 18%.

1. A) Use Lagrange interpolation to find a polynomial that passes through the points (0,−2), (2,1), (4,4).
   B) Use Newton's divided differences to find the interpolating polynomial
   (You can leave each in raw form. You do not need to check that they are equivalent.)

2. Find the one-piece Bézier curve (x(t),y(t)) defined by the given four points (1,2), (1,3), (2,3), (2,2). Determine the points corresponding to t=.25, t=.5 and t=.75. Use them to sketch the curve on graph paper. Use 5 boxes is one unit.

3. Use the three-point centered-difference formula for the second derivative to approximate f ″(0), where f (x) = cos x, for (a) h = 0.1 (b) h = 0.01 (c) h = 0.001. Find a bound on the approximation error. Compare with the actual error.

4. Apply the composite Simpson's Rule with m = 1 and 2 panels to the integrals, and report the errors:
   $\int_0^{\pi} x \cos x \, dx$

5. Apply Euler's Method with step size h = 1/4 to the IVP $y' = 2(t + 1)^2 y$; y(0)=1 on the interval [0,1]. List the w_i, i = 0, . . . , 4, and find the error at t = 1 by comparing with the correct solution. If the step is halved, by how about much will the error decrease?

6. Apply Midpoint Method with step size h = 1/2 to the IVP $y' = 2(t + 1)^2 y$; y(0)=1 on the interval [0,1]. List the w_i, i = 0, . . . , 2, and find the error at t = 1 by comparing with the correct solution. If the step is halved, by how about much will the error decrease?