

# Math 128A: Worksheet #6

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**Problem 1.** 1. Construct the natural cubic spline for the following data (by hand and using Matlab):

$x$	$f(x)$
0	3
1	0
2	3

2. This data was taken from the function  $f(x) = 3(x - 1)^2$ . Use the cubic splines to approximate  $f(0.5)$  and  $f'(0.5)$ , and calculate the actual error.
3. This data also matches the function  $g(x) = 3x^4 - 5x^3 - 3x^2 + 2x + 3$ . Use the cubic splines to approximate  $g(0.5)$  and  $g'(0.5)$ , and calculate the actual error.

**Problem 2** (3.6, #1a). Let  $(x_0, y_0) = (0, 0)$  and  $(x_1, y_1) = (5, 2)$  be the endpoints of a curve. Use the guidepoints  $(1, 1)$  and  $(6, 1)$ , respectively, to construct parametric cubic Hermite approximations  $(x(t), y(t))$  to the curve and graph the approximations.

**Problem 3.** Derive a method for approximating  $f''(x_0)$  whose error term is of order  $h^4$  by expanding the function  $f$  in a sixth Taylor polynomial about  $x_0$  and evaluating at  $x_0 \pm h$  and  $x_0 \pm 2h$ .