(show all your work and)

1) Use Lagrange interpolating polynomials of degree two to approximate $f(0.43)$
   $f(0.25) = 1.64872,\ f(0.5) = 2.71828,\ f(0.75) = 4.48169$ [6a page 112]

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(show all your work) (CQ10)

1)Use the three-point midpoint formula to estimate $f'(1.15)$ with h=0.1.

x	$f(x)$
1.05	−1.709847
1.10	−1.373823
1.15	−1.119214
1.20	−0.9160143
1.25	−0.7470223
1.30	−0.6015966

2) Use the Second Derivative Midpoint Formula to estimate $''(1.15)$ with h=0.1. The data in the table were taken from the function $f(x) = \tan(x)$. **Find an upper bound for the error**

x	$f(x)$
1.05	−1.709847
1.10	−1.373823
1.15	−1.119214
1.20	−0.9160143
1.25	−0.7470223
1.30	−0.6015966

3) Drive the Second Derivative Midpoint Formula

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$$f'(x) = \frac{1}{2h}\left[f(x_0+h) - f(x_0-h)\right] - \frac{h^2}{6}f^{(3)}(\xi)$$

$$f''(x) = \frac{1}{h^2}\left[f(x_0-h) - 2f(x_0) + f(x_0+h)\right] - \frac{h^2}{12}f^{(4)}(\xi)$$

1) Determine the natural cubic spline S that interpolates the data $f(0)=0, f(1)=1, f(2)=0,$ and $f(3)=-1$.

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & \dots & 0 & 0 & 0 \\ h_0 & 2(h_0+h_1) & h_1 & 0 & 0 & \dots & 0 & 0 & 0 \\ 0 & h_1 & 2(h_1+h_2) & h_2 & 0 & \dots & 0 & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \dots & 0 & \vdots & \vdots \\ 0 & 0 & 0 & 0 & 0 & \dots & h_{n-2} & 2(h_{n-2}+h_{n-1}) & h_{n-1} \\ 0 & 0 & 0 & 0 & 0 & \dots & 0 & 0 & 1 \end{bmatrix},$$

$$\boldsymbol{r} = \begin{bmatrix} \mathbf{0} \\ \frac{3}{h_1}(a_2 - a_1) - \frac{3}{h_0}(a_1 - a_0) \\ \vdots \\ \frac{3}{h_{n-1}}(a_n - a_{n-1}) - \frac{3}{h_{n-2}}(a_{n-1} - a_{n-2}) \\ \mathbf{0} \end{bmatrix}$$

$$\boldsymbol{b_j} = \frac{1}{h_j}(a_{j+1} - a_j) - \frac{h_j}{3}(c_j + c_{j+1}) \qquad \boldsymbol{d_j} = \frac{1}{3h_j}(c_{j+1} - c_j)$$

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MATH-321 **Term-172** **ClassQuiz9**

(show all your work)(cq8)

1) Let $p_4(x)$ be the Taylor polynomial of degree four of the function $f(x) = \sin(x)$ about the center $x_0 = 1$. Use the reminder formula in the Taylor series to find an upper bound for $|f(x) - p_4(x)|,\ 0 \le x \le \pi$.

2) Let $p_1(x)$ be the first Lagrange polynomial for the function $f(x) = xe^{-x}$ on $[\frac{1}{10}, \frac{1}{2}]$ using the nodes $x_0 = \frac{1}{10}$ $and\ x_1 = \frac{1}{2}$. Find an upper bound for

$$|f(x) - p_1(x)|, \qquad \frac{1}{10} \le x \le \frac{1}{2}.$$

3) Let $f(x) = x^4 + 9x - 2$. Use the given table to compute the divided difference $f[0, 1, 2]$.

0			
1			
2			

4) Write MATLAB code for the Fixed Point method to find solution of $f(x) = x^3 - x + 1$ using $x_0 = 1$ and $tol = 10^{-4}$

```
clear;
clc;
```

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MATH-321 **Term-172** **ClassQuiz8**

(show all your work and)

1) Let $f(x) = e^{2x}$

(a) Use the table to compute the divided difference $f[0.25, 0.5, 0.75]$.

0.25			
0.5			
0.75			

(b) use Newton's interpolating polynomial to approximate $f(0.43)$

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MATH-321 **Term-172** **ClassQuiz7**