[Self] Mini Quiz Lec12 [ALL CORRECT]

Q1 [CORRECT]

Fit these 5 points (3.0, 2.5), (4.5, 1.0), (7.0, 2.5), (9.0, 0.5), (11.0,2.0) with the default cubic splines in Matlab

$s_i(x) = a_i + b_i(x - x_i) + c_i(x - x_i)^2 + d_i(x - x_i)^3$

Determine coefficients of the first spline segment.

Rounding a decimal number to four decimal places.

For $s_1(x)$, $a_1 =$ [ ], $b_1 =$ [ ],

$c_1 =$ [ ], $d_1 =$ [ ]

And also compute the value of the spline when x=10

$s_4(10) =$ [ ]

```
x = [3.0 4.5 7.0 9.0 11.0];
y = [2.5 1.0 2.5 0.5 2.0];
cs = spline(x, y);
cs.coefs
```

```
ans = 4×4
   -0.1835    1.4092   -2.7009    2.5000
   -0.1835    0.5835    0.2881    1.0000
    0.2050   -0.7926   -0.2348    2.5000
    0.2050    0.4375   -0.9451    0.5000
```

```
cstest = spline(x, y, 10)
```

```
cstest =
0.1974
```

Q2 [CORRECT]

```
xtest = 0.22;
```

2.1

Runge's function is written as $f(x) = \frac{1}{1+25x^2}$.

1) Generate five equidistantly spaced values of this function over the interval: [-1, 1].

Fit these data with cubic splines and estimate the value of the function when x = 0.22.

Also compute the absolute value of the percent relative error $|e_t|$.

Rounding a decimal number to four decimal places.

$f_{predict}(0.22) =$ [ ]

$|e_t| =$ [ ]

```
f = @(x) 1 ./ (1 + 25.*x.^2);
xx1 = linspace(-1, 1, 5);
cstest1 = spline(xx1, f(xx1), xtest)
```

```
cstest1 =
0.7657
```

```
cstrue1 = f(xtest);
et5 = abs((cstrue1 - cstest1) / cstrue1) * 100
```

```
et5 =
69.2203
```

2.2

2) Generate six equidistantly spaced values of this function over the interval: [-1, 1].

Fit these data with cubic splines and estimate the value of the function when x = 0.22.

Also compute the absolute value of the percent relative error $|e_t|$.

Rounding a decimal number to four decimal places.

$f_{predict}(0.22)$ =

$|e_t|$ =

```
f = @(x) 1 ./ (1 + 25.*x.^2);
xx2 = linspace(-1, 1, 6);
cstest2 = spline(xx2, f(xx2), xtest)
```

```
cstest2 =
0.4856
```

```
cstrue2 = f(xtest);
et6 = abs((cstrue2 - cstest2) / cstrue2) * 100
```

```
et6 =
7.3268
```

2.3

3) If we generate n equidistantly spaced values of this function over the interval: [-1, 1], and fit these data with cubic splines, then estimate the value of the function when x = 0.22 and compute the absolute value of the percent relative error |e_t |.

What is the minimum value of n such that $|e_t| < 1.0\%$?

n =

```
n = 13
```

```
n =
13
```

```
f = @(x) 1 ./ (1 + 25.*x.^2);
xx2 = linspace(-1, 1, n);
cstest2 = spline(xx2, f(xx2), xtest);
cstrue2 = f(xtest);
et6 = abs((cstrue2 - cstest2) / cstrue2) * 100
```

```
et6 =
0.4240
```