Test 3, 5.04.2017

1. The truncation error in calculating $f'(2)$ for $f(x)=x^2$ by

$$f'(x)\approx\frac{f(x+h)-f(x)}{h}$$

with $h=0.2$ is

(A) -0.2
(B) 0.2
(C) 4.0
(D) 4.2

2. The formula for normal strain in a longitudinal bar is given by $\in=\frac{F}{AE}$ where

F = normal force applied
A = cross-sectional area of the bar
E = Young's modulus

If $F=50\pm0.5\,\text{N}$, $A=0.2\pm0.002\ \text{m}^2$, and $E=210\times10^9\pm1\times10^9\ \text{Pa}$, the maximum error in the measurement of strain is

(A) 10^{-12}
(B) 2.95×10^{-11}
(C) 1.22×10^{-9}
(D) 1.19×10^{-9}

3. Given the two points $[a,f(a)]$, $[b,f(b)]$, the linear Lagrange polynomial $f_1(x)$ that passes through these two points is given by

(A) $f_1(x)=\frac{x-b}{a-b}f(a)+\frac{x-a}{a-b}f(b)$
(B) $f_1(x)=\frac{x}{b-a}f(a)+\frac{x}{b-a}f(b)$
(C) $f_1(x)=f(a)+\frac{f(b)-f(a)}{b-a}(b-a)$
(D) $f_1(x)=\frac{x-b}{a-b}f(a)+\frac{x-a}{b-a}f(b)$

4. The following incomplete y vs. x data is given.

x	1	2	4	6	7
y	5	11	????	????	32

The data is fit by quadratic spline interpolants given by

$f(x)=ax-1,\ \ 1\le x\le 2$
$f(x)=-2x^2+14x-9,\ \ 2\le x\le 4$
$f(x)=bx^2+cx+d,\ \ 4\le x\le 6$

$$f(x) = 25x^2 - 303x + 928, \quad 6 \le x \le 7$$

where $a, b, c,$ and d are constants. The value of c is most nearly

(A) -303.00
(B) -144.50
(C) 0.0000
(D) 14.000

5. The following data

x	1	20	30	40
y	1	400	800	1300

is regressed with least squares regression to $y = a_1 x$. The value of a_1 most nearly is

A) 27.480
B) 28.956
C) 32.625
D) 40.000