

1. Let $p_2(x)$ be a second Taylor polynomial about $x_0 = 0$ for $f(x) = e^x \cos x$, then $|f(0.5) - p_2(0.5)| =$

- (a) 0.0531 _____(correct)
(b) 0.0431
(c) 0.0581
(d) 0.4242
(e) 0.0408

2. Using two digit chopping arithmetic, compute $120 \cos \pi + \frac{e^2}{0.0325}$

- (a) 110 _____(correct)
(b) 115
(c) 114
(d) 120
(e) 113

3. When bisection method using to approximate $\sqrt{2 + \sqrt{3}}$ with smallest interval $[a, b]$ where a and b are integers and $f(x)$ is a polynomial with lowest degree then the second iteration (p_2) is,

- (a) 1.75 _____(correct)
(b) 1.5
(c) 2
(d) 1.25
(e) 2.5

4. The function $g(x) = \frac{\pi}{2} - \sin \frac{x}{2}$ has a unique fixed point on the interval $[0, 3]$.
Use $p_0 = 0.5$ to estimate the minimum number of iteration required to achieve 10^{-3} accuracy by fixed point iteration.

- (a) 12 _____(correct)
(b) 11
(c) 13
(d) 14
(e) 10

5. Use fixed point iteration with $g(x) = \frac{1}{\pi} \arcsin\left(-\frac{x}{2}\right)$ with $p_0 = 1$, then the second iteration (p_2) is

(a) 0.0266 _____(correct)

(b) 0.0216

(c) 0.0166

(d) 0.0553

(e) 0.0583

6. The equation $4x^2 - e^x = e^{-x}$. Use the Newton's method to approximate the solution, with $p_0 = 2$, then (p_2) is equal

(a) 0.8429 _____(correct)

(b) 0.8719

(c) 0.8629

(d) 0.8479

(e) 0.8529

7. The equation $\sin x = e^{-x}$ has a root in the interval $[0, 2]$. Using the Secant method with $p_0 = 0$, and $p_1 = 1$, compute the third iterate (p_3).

- (a) 0.5691 _____(correct)
- (b) 0.6691
- (c) 0.5191
- (d) 0.5291
- (e) 0.5891

8. Consider $f(x) = \ln(x + 2)$, $0 \leq x \leq 1$. Construct the second Lagrange interpolating polynomial $p_2(x)$, using $x_0 = 0$, $x_1 = 0.5$, $x_2 = 1$, then the value of $|f(0.25) - p_2(0.25)| =$

- (a) 0.0011 _____(correct)
- (b) 0.0211
- (c) 0.0111
- (d) 0.0071
- (e) 0.0041

9. A Clamped Cubic Spline on $[0, 2]$ defined by

$$S(x) = \begin{cases} S_0(x) = ax + x^2 - x^3 & 0 \leq x \leq 1 \\ S_1(x) = b - 2(x-1)^2 + C(x-1)^3 & 1 \leq x \leq 2 \end{cases}$$

$S'(0) = 1, S'(2) = -1$, then $a + b + c =$

- (a) 3 _____(correct)
- (b) 2
- (c) 1
- (d) 2.5
- (e) 1.5

10. Determine the natural cubic spline S that interpolates the data

$$f(0) = 0, f(1) = 1, f(2) = 0, \text{ then } S(1.5) =$$

- (a) 0.6875 _____(correct)
- (b) 0.6275
- (c) 0.6375
- (d) 0.6805
- (e) 0.6372

11. Consider the following data

$$f(0.5) = 0.4794, f(0.6) = 0.5646, \text{ and } f(0.7) = 0.6442$$

Let $A = f'(0.6)$, and $B = f'(0.7)$ be approximated using the most accurate applicable three points formula, then $A + B =$

- (a) 1.5920 _____(correct)
- (b) 1.2920
- (c) 1.5120
- (d) 0.7610
- (e) 0.7510

12. The minimum value of n required to approximate the integral $\int_0^1 e^x \cos x \, dx$ to within 10^{-3} , by using Trapezoidal rule is

- (a) 20 _____(correct)
- (b) 19
- (c) 21
- (d) 12
- (e) 23

13. Use the composite Simpson's rule to approximate $\int_0^6 x^2 \cos x \, dx$, with $n = 6$

- (a) 1.7360 _____(correct)
- (b) 1.5360
- (c) 1.9360
- (d) 1.4360
- (e) 1.5366

14. Let $f(x) = (x + 1) \ln(x + 1)$. Then the upper bound for the error in approximating $f'(1.1)$ by using the three-point end point formula with $h = 0.1$ is

- (a) 0.0008 _____(correct)
- (b) 0.0001
- (c) 0.0801
- (d) 0.0550
- (e) 0.0025