King Fahd University of Petroleum and Minerals
Department of Mathematics

Math 371

Exam 1

Semester 243

July 02, 2025

Net Time Allowed: 90 Minutes

MASTER VERSION

1. If $P_3(x)$ is the third Taylor polynomial for the function $f(x) = (x-1)\ln(x)$ about $x_0 = 1$, then the absolute error $|f(0.5) - P_3(0.5)|$ is equal to,

   (a) 0.0341 ____(correct)
   (b) -0.0341
   (c) 0.0231
   (d) 0.0134
   (e) 0.0431

2. Using three-digit rounding arithmetic to calculate $\dfrac{\frac{13}{14} - \frac{6}{7}}{2e - 5.4}$,

   (a) 1.80 ____(correct)
   (b) 1.85
   (c) 1.94
   (d) 1.97
   (e) 0.82

3. Suppose p^* must approximate 900 with relative error at most 10^{-4}, then the largest interval in which p^* must lies is,

   (a) $(899.91, 900.09)$ ________________ (correct)

   (b) $(899.19, 900.09)$

   (c) $(899.90, 900.19)$

   (d) $(899.94, 900.04)$

   (e) $(899.00, 900.00)$

4. The bisection method converge to which of the zero of $f(x) = (x+2)(x+1)x(x-1)^3(x-2)$ in the interval $[-3, 2.5]$,

   (a) 2 ________________ (correct)

   (b) -2

   (c) 0

   (d) 1

   (e) -1

5. Approximate solution of $x^3 - x - 1 = 0$ on $[1, 2]$ accurate to within 10^{-2} with initial guess $p_0 = 1$ and $g(x) = (x + 1)^{\frac{1}{3}}$ is,

   (a) 1.32427 ____(correct)

   (b) 1.73242

   (c) 1.52427

   (d) 4 1.6724

   (e) 1.52837

6. The function $g(x) = \cos(x)$ has a unique fixed point in the interval$[0, 1]$. Using $p_0 = 0$, the minimum number of iterations required to achieve 10^{-5} accuracy by fixed point method is,

   (a) 67 ____(correct)

   (b) 76

   (c) 60

   (d) 55

   (e) 35

7. For which initial guess p_0, the Newton's method fails to approximate a root of $x^3 - 2x^2 - 5 = 0$,

   (a) $p_0 = \frac{4}{3}$ ________________ (correct)
   (b) $p_0 = \frac{2}{3}$
   (c) $p_0 = \frac{4}{5}$
   (d) $p_0 = \frac{5}{3}$
   (e) $p_0 = 4$

8. Let $f(x) = -\cos(x) - x^3$. If secant method is used with $p_0 = -1$ and $p_1 = 0$, then p_3 is equal to,

   (a) -1.25208 ________________ (correct)
   (b) 1.55208
   (c) -1.45208
   (d) 1.35504
   (e) -1.15310

9. Let $x_0 = 0$, $x_1 = \frac{1}{6}$, and $x_2 = \frac{1}{2}$. If second degree Lagrange polynomial $P_2(x)$ is used to approximate $f(x) = \sin(\pi x)$. Then $P_2(0.25)$ is,

(a) 0.6875 ____(correct)

(b) 0.4875

(c) 0.1875

(d) 0.7875

(e) 0.8751

10. If the Natural cubic spline $S(x) = \begin{cases} S_0(x) = a_0 + b_0(x-1) + c_0(x-1)^2 + d_0(x-1)^3, & \text{if} \\ S_1(x) = a_1 + b_1(x-2) + c_1(x-2)^2 + d_1(x-2)^3, & \text{if} \end{cases}$ defined on the interval $[1,3]$ interpolate the data $(1,1),\ (2,1),\ (3,0)$ then $a_0 + a_1 + c_0 + c_1 + b_1 + d_1$ is equal to,

(a) 1.75 ____(correct)

(b) 1.50

(c) 1.55

(d) 2.45

(e) 2.25

11. Let $f(2.1) = 3.4321$, $f(2.3) = 4.3210$ and $f(2.5) = 5.3210$. Using most accurate 3-points formulas, the sum $f'(2.1) + f'(2.3)$ is equal to,

    (a) 8.8889 ____ (correct)
    (b) 8.4587
    (c) 7.9880
    (d) 8.0998
    (e) 8.2682

12. Let $f(1.29) = 13.7818$, $f(1.3) = 14.0428$ and $f(1.31) = 14.3074$. The approximate value of $f''(1.3)$ using $h = 0.01$ is equal to,

    (a) 36.000 ____ (correct)
    (b) 38.0012
    (c) 34.0005
    (d) 37.0102
    (e) 35.4090

13. Approximate value of the integral $\int_0^2 e^{2x}\cos(3x)\,dx$ using the composite Trapezoidal rule with $n = 4$ is,

(a) 7.6775 ______________________________ (correct)
(b) 4.6775
(c) 9.6757
(d) 5.7765
(e) 3.2314

14. The smallest value of n required to approximate the integral $\int_0^\pi \sin(x)\,dx$ by composite Simpson's rule with approximation error less than 0.00002 is,

(a) 18 ______________________________ (correct)
(b) 16
(c) 15
(d) 25
(e) 9