

Name _____ ID # _____ Section # _____

The examination consists of ?? problems. The first 5 are multiple choice; the last 5 are partial credit. For the partial credit problems you *must* present your work clearly and understandably; no credit will be given for unsupported answers. **Please indicate clearly your answers.** In the multiple choice problems, just **circle the correct answer**. There are 100 total points.

CALCULATORS ARE NOT ALLOWED ON THIS EXAM

<p><i>Check the exam booklet before you start. There should be ?? problems on ?? pages.</i></p>

Do not write below this line. _____

1. _____ (6)
 2. _____ (6)
 3. _____ (6)
 4. _____ (6)
 5. _____ (6)
 6. _____ (12)
 7. _____ (12)
 8. _____ (12)
 9. _____ (22)
 10. _____ (12)
- Total** _____

6 pts 1. If $f(x) = x^{101} + x + 100$, find the second Newton approximation to the equation $f(x) = 0$, starting with the first Newton approximation $x_1 = -1$.

a) $x_2 = 0$

b) $x_2 = 1$

c) $x_2 = -\frac{100}{51}$

d) $x_2 = -2$

e) $x_2 = -\frac{2}{51}$

6 pts 2. If $f(x)$ has a **derivative** given by $f'(x) = (x-1)^2(x-2)^3(x-4)$, which one of the following statements is true for the function $f(x)$?

a) The function f has local extrema at 1, 2, and 4.

b) The function f has local extrema at 2 and 4.

c) The function f has only a local minimum at 2.

d) The function f has only a local minimum at 4.

e) The function f doesn't have any local extrema.

6 pts

3. Compute the limit $\lim_{x \rightarrow \infty} \left(\sqrt{x^2 + 4x + 2} - x \right)$.

- a) 0
- b) 1
- c) 2
- d) ∞
- e) the limit doesn't exist.

6 pts

4. Find all horizontal asymptotes for the function $f(x) = \frac{x(3x + 1)(2x - 1)}{5(x - 2)^2(x - 1)}$.

- a) $y = 0$
- b) $y = \frac{5}{6}$
- c) $y = 1$
- d) $y = \frac{6}{5}$
- e) the graph of this function doesn't have any horizontal asymptotes.

6 pts 5. An antiderivative of the function $h(x) = \sin x + 2 \cos x + 2\sqrt{x} + x^3 - 1$ is

a) $-\cos x - 2 \sin x + \frac{4}{3}\sqrt{x^3} + \frac{1}{4}x^4$

b) $-\cos x - 2 \sin x + \frac{4}{3}\sqrt{x^3} + \frac{1}{4}x^4 - x$

c) $-\cos x + 2 \sin x + \frac{4}{3}\sqrt{x^3} + \frac{1}{4}x^4 - x$

d) $\cos x + 2 \sin x + \sqrt{x^3} + 3x^2$

e) $-\cos x + 2 \sin x + \sqrt{x^3} + x^4 - x$

THIS ENDS THE MULTIPLE CHOICE QUESTIONS. THE NEXT FIVE QUESTIONS ARE PARTIAL CREDIT AND WILL BE HANDGRADED. PLEASE SHOW ALL YOUR WORK, OTHERWISE YOU MAY NOT RECEIVE FULL CREDIT, EVEN IF THE FINAL ANSWER IS CORRECT.

12 pts 6. Approximate $\sqrt[3]{64.2}$ using differentials.

12 pts 7. For $f(x) = 3x^5 - 5x^3 - 1$ find

(a) all critical points of function f ;

(b) all points of local maxima;

(c) all points of local minima;

(d) the absolute maximum and minimum values of f on the interval $[-2, 2]$.

- 12 pts 8. A homeowner wishes to fence in a rectangular patio behind his house using the back of the house as one side of the fence. The area of the patio is to be 100 square feet. The two sides of the fence perpendicular to the house each cost \$10 per foot, while the one side parallel to the house costs \$20 per foot. What is the minimum cost of fencing for the patio? Your work must justify your answer. (See accompanying figure.)

9. For the function $f(x) = \frac{x^2}{x-1}$ find all the information asked for in the following parts (a)-(h).

3 pts (a) the first and the second derivatives f' and f'' ; (For each part of this problem do your work in the space given.)

1 pt (b) all critical points;

3 pts (c) all intervals on which $f(x)$ is increasing, and those on which it is decreasing.

3 pts (d) all local maximum and local minimum values;

The previous problem continues on this page.

- 3 pts (e) all intervals of concavity indicating type of concavity;
- 3 pts (f) all points of inflection;
- 3 pts (g) all vertical, slant or horizontal asymptotes, as they exist;
- 3 pts (h) draw the graph of the function, indicating the coordinates of the intercepts and all local extrema on the graph.

12 pts

10. Find the dimensions of the rectangle of the largest area that can be inscribed in a circle of radius $r = \sqrt{2}$.