
INSTRUCTIONS: **Simplify** and **box** all your answers. Write neatly and **show all work**. A correct answer with incorrect or no supporting work may receive no credit. Books, notes, electronic devices (such as calculator or other unauthorized electronic resources) are not permitted. **Give all answers in exact form.**

NOTE: YOU MAY TEAR OFF THIS FIRST PAGE AND USE (FRONT AND BACK) AS SCRATCH PAPER.

- i. DO NOT START UNTIL INSTRUCTED BY ME.
- ii. THE EXAM IS ON BOTH SIDES OF EACH FOLLOWING EXAM PAGE
- iii. WRITE YOUR NAME ON THE NEXT PAGE.
- iv. WHEN YOU FINISH (IF BEFORE THE EXAM END TIME) PLEASE QUIETLY SCAN AND UPLOAD IT ON GRADESCOPE.

Name: _____

1. The following are unrelated

(a) (4 pts) Write the following sum in sigma notation

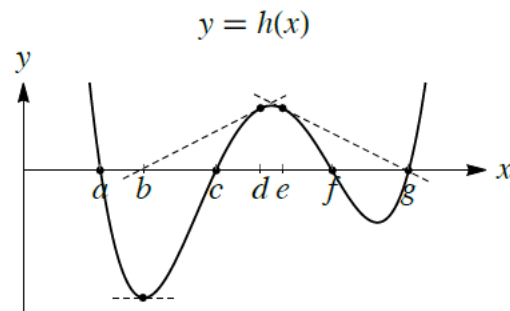
$$2 - 4 + 6 - 8 + \dots - 20$$

(b) (10 pts) Express the following definite integral as a limit of Riemann Sums using the right endpoints.

DO NOT evaluate the limit.

$$\int_0^3 (x^2 + 3) dx$$

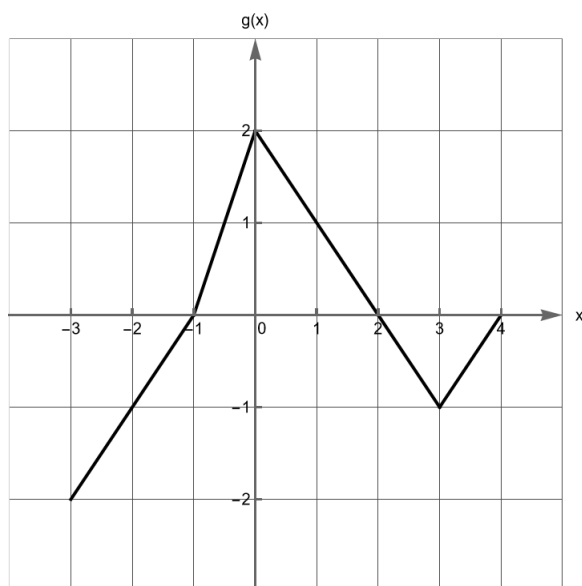
(c) (6 pts) Suppose Newton's Method is used to find a root of the function $h(x)$. The tangent lines at $x = b, d$ and e are shown. (No explanation is necessary for the following questions.)



- i. For which of the initial approximations $x_1 = a, b, c, d, e, f, g$ will Newton's Method fail to find a root? List or circle all that apply.
- ii. Which of the initial approximations $x_1 = b, d, e, g$ will lead to a second approximation x_2 that equals one of the roots of h ? List or circle all that apply.

2. (20 pts) The acceleration of a particle as a function of time t is given by $a(t) = \cos(\pi t) \text{ m/s}$. Find the position of the particle as a function of time t if the velocity and position at $t = 1 \text{ s}$ are 1 m/s and $\frac{1}{\pi^2} \text{ m}$, respectively.

3. The function f is defined as $f(x) = \int_{-3}^x g(t) dt$ where the graph of g is shown below



- (a) (10 pts) Find all the values of $x \in (-3, 4)$ where f has a point of inflection. Show your work.

- (b) (10 pts) Find the equation of the tangent line to the graph of f at $x = 1$.

4. (10 pts) Let f be an odd function and g be an even function with the following properties:

(i) $\int_{-1}^0 f(x) \, dx = 2$

(ii) $\int_0^3 f(x) \, dx = 7$

(iii) $\int_1^3 g(x) \, dx = -3$

Evaluate

$$\int_{-3}^{-1} (2f(x) - 4g(x)) \, dx$$

5. Evaluate the following integrals by any method you like

(a) (10 pts) $\int t^2 \sqrt{t-4} \, dt$

(b) (10 pts) $\int_{-1}^3 |x-1| \, dx$

(c) (10 pts) $\int_{-362}^{362} \sin(x^{99}) \, dx + \int_0^{\frac{\pi}{2}} \sin(\sin x) \cos x \, dx$