

Name: \_\_\_\_\_  
Math 110

Date: \_\_\_\_\_

**Exam 3**  
**Show all work for full credit.**  
**Round answers to two decimal places.**

1. **(10 pts)** A company's sales  $x$  months after starting an advertising campaign can be modeled by

$$S(x) = \frac{8x^2 - 1}{x^2 + 15} \text{ thousand dollars.}$$

a. Find  $S(3)$

b. Find  $S'(x)$

c. Find  $S'(3)$  and interpret the meaning. Use correct units.

2. **(10 pts)** The temperature  $T$  of a person during an illness is given by  $T(x) = -0.2x^2 + 0.8x + 100.7$ , where  $T$  is the temperature in degrees Fahrenheit  $x$  days after the onset of the illness.
- Find the average rate of change in the person's temperature between day 1 and day 5 of the illness. Make sure to include correct units.
  - Find  $T'(x)$
  - Find  $T'(3)$ . Interpret the meaning. Make sure to include correct units.
3. **(10 pts)** A company that makes designer hairbrushes has a weekly profit function, in dollars, of  $P(x) = 410 + 5x + 0.2x^2 - \ln(x)$ , where  $x$  is the number of hairbrushes made and sold.
- Find  $P(200)$
  - Find  $P'(x)$
  - Find  $P'(200)$  and interpret the meaning. Use correct units.

4. **(12 pts)** Given  $f(x) = -x^3 + 3x^2 + 5$

a. Find the first derivative

b. Find the critical values

c. Find the second derivative

d. Evaluate  $f''(x)$  for all critical values. Find the coordinates of the maximums/minimums

Maximum: \_\_\_\_\_

Minimum: \_\_\_\_\_

5. **(8 pts)** Evaluate marginal cost and marginal revenue at a production level of 5 items increasing to 6 items. **Interpret the meaning of the marginal cost and revenue.** Should the company increase production?

$$C(x) = 0.2x^2 + 10x + 30, \quad R(x) = -4x^2 + 60x$$

6. **(5 pts)** Doctors at health services estimate that  $x$  days after the flu begins to spread at Bryant, the percentage of the student body infected by the flu is approximated by  $P(x) = x^2 + x$ .

a. Find  $P(3)$

b. Find  $P'(x)$

c. Find  $P'(3)$ . Interpret the meaning. Use correct units.

7. (12 pts) Given  $f(x) = x^3 - 3x^2 - 24x - 16$

a. Find the first derivative

b. Find the critical values

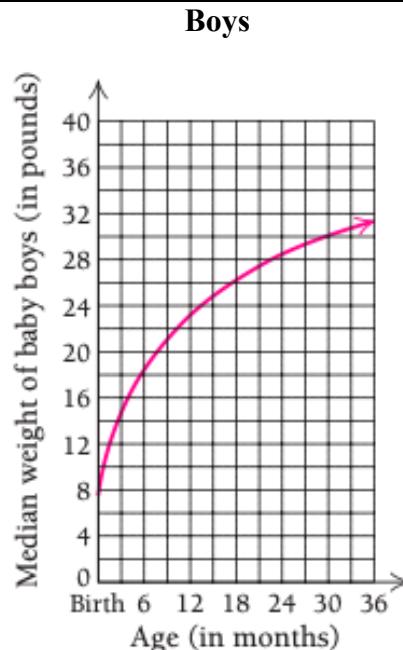
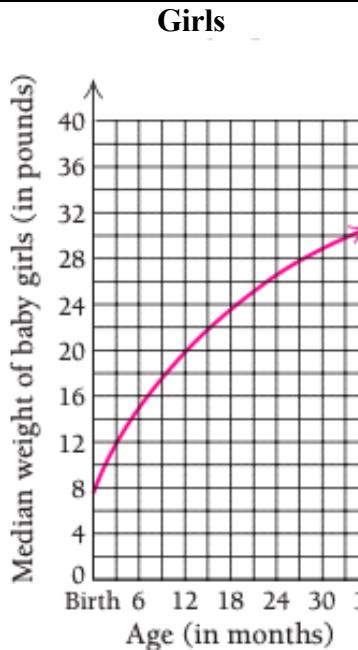
c. Find the second derivative

d. Evaluate  $f''(x)$  for all critical values. Find the coordinates of the maximums/minimums

Maximum: \_\_\_\_\_

Minimum: \_\_\_\_\_

8. (7 pts) The median weight of baby girls and baby boys, in pounds, between 0 and 36 months are shown in the graphs below.



- Find the average rate of change in a baby girl's weight between 12 months and 24 months. Make sure to include correct units.
- Find the average rate of change in a baby boy's weight between 12 months and 24 months. Make sure to include correct units.
- Between 12 and 24 months, which sex is gaining weight at a greater rate?

9. **(10 pts)** Given  $f(x) = x^2 - 6x + 8$

- a. Find the first derivative
- b. Find the critical values
- c. Find the second derivative
- d. Evaluate  $f''(x)$  for all critical values. Find the coordinates of the maximums/minimums

Maximum: \_\_\_\_\_

Minimum: \_\_\_\_\_

10. **(10 pts)** The number of hits (in thousands) on a company's website  $x$  hours after a news story break can be approximated by  $H(x) = 30xe^{-0.5x}$ .

a. Find  $H(5)$

b. Find  $H'(x)$

c. Find  $H'(5)$  and interpret the meaning. Include the correct units.

11. **(6 pts)** The number of electric vehicles, in thousands, in use in the United States can be modeled by  $E(x) = 0.167x^3 - 2.58x^2 + 24.75x - 1.39$ , where  $x$  is years since 2000.

a. Find  $E(25)$

b. Find  $E'(x)$

c. Find  $E'(25)$  and interpret the meaning. Use correct units.