

# Exam 2 Review

## Question 1

For each of the following functions, find  $f'(x)$ . You do not need to simplify the expressions for  $f'(x)$ .

a.  $f(x) = 3x^7 + 5x - 7$

b.  $f(x) = \frac{x^2+4}{x^2-4}$

c.  $f(x) = 3e^{x^3}$

d.  $f(x) = x^2e^{2x}$

**Question 2**

At what point is the tangent line to the curve  $f(x) = x^3 - 3x^2 + 4$  horizontal?

**Question 3**

Consider the function  $f(x) = \frac{1}{3}x^3 - 2x^2 + 3x$ . Find the critical values of  $f(x)$ . Use the first derivative test to find the local minimum and maximum of the function.

#### Question 4

Suppose a company models its profit  $P$  in thousands of dollars as a function of the number of units (in hundreds) sold  $x$  using the function  $P(x) = x^3 - 6x^2 + 9x$ .

- a) Find  $P(2)$  and interpret its meaning in context.
  
  
  
  
  
  
  
  
  
  
- b) Find  $P'(2)$  and interpret its meaning in context.
  
  
  
  
  
  
  
  
  
  
- c) Using the first or second derivative test, find the production level that maximizes the profit if the company produces between 0 and 350 units. What is the maximum profit made?
  
  
  
  
  
  
  
  
  
  
- d) If the company must produce a minimum of 50 units and a maximum of 500 units per day, find the absolute minimum and maximum profit made in that range.

### Question 5

A herring swimming along a straight line has traveled  $s(t) = \frac{t^2}{t^2+2}$  feet in  $t$  seconds.

- a) How fast is the herring travelling after 2 seconds?.
- b) How far has the herring traveled after 3 seconds?
- c) At three seconds, is the herring speeding up or slowing down? Justify your answer.

### Question 6

Owners of a car rental company have determined that if they charge customers  $p$  dollars per day to rent a car, where  $0 \leq p \leq 200$  the number of cars  $n$  they rent per day can be modeled by the linear function  $n(p) = 1000 - 5p$ . If they charge \$50 per day or less, they will rent all their cars. If they charge \$200 per day or more, they will not rent any cars. Assuming the owners plan to charge customers between \$50 per day and \$200 per day to rent a car, use the calculus tools learned in the course to find how much they should charge to maximize their revenue.