1. Acne toy company finds the price function to be given by
   \[ p(x) = \frac{2x^2 + x}{x^2 - 3x} \]
   a) Find the revenue function and simplify.
   b) The cost function is defined as
   \[ C(x) = \frac{4x^2 - 4x - 3}{x - 3} \]
   Find the profit function and simplify.

2. The following data shows the relationship between a student’s homework average and their final grade.

| Homework Average | 95.75 | 79.64 | 59.64 | 67.43 | 88.34 |
| Final Average    | 99.64 | 82.34 | 49.32 | 70.56 | 92.47 |

   a) Find the quadratic function that best represents the data. State \( r^2 \).
   b) Find the maximum Homework Average and the Final Average. \textit{Hint:} The Homework average can be over 100.

3. The concentration of a certain drug (in \( \text{mg/cm}^2 \)) in a patient’s bloodstream \( t \) hour after the injection is given by the following function
   \[ C(t) = \frac{-2t^2 + t - 5}{t^3 + 4t^2 + 5t - 3} \]
   How much of the drug remains in the system as time increases without bound? Explain your answer.

4. The profit (in millions) function for a company is given by
   \[ P(x) = \frac{x^2 - 100}{x^2 - 15x + 50} \]
   where \( x \) is the number of units produced and sold (in hundreds). What happens to the company’s profit \( P(x) \) as the number of units sold approaches 1000? That is, evaluate
   \[ \lim_{x \to 10^4} P(x) \]

5. Given the following revenue functions, find the marginal revenue.
   a) \( R(x) = 7x^4 - 3x^2 + 5x^{-6} + x + 8 \)
   b) \( R(x) = (x^7 + e^{4x}) \ln(3x^2 + 1) \)

6. The number of people visiting Six Flags Over Texas is given by the function \( f(x) \). Here \( f(x) \) is measured in thousands and \( x \) is the week number the park is open
   \[ f(x) = \sqrt[3]{(4x^2 + x - 9)^4} \]
   a) How fast is the number of visitors of Six Flags Over Texas is changing?
   b) How fast is the number of visitors changing in week 10? That is, calculate \( f'(10) \).
7. The weekly cost for making Christmas tree lights is represented by the function
   \[ C(x) = x^4 - 2x^3 - x^2 + 7x + 62 \]
   where the cost is in hundreds of dollars and \( x \) is Christmas tree light sets. Find the cost of producing the 10th set of Christmas tree lights.

8. If exactly 200 people sign up for a charter flight, Leisure World Travel Agency charges $320 per person. However, if more than 200 people sign up for the flight (assume this is the case), then each fare is reduced by $2 for each additional person. How many passengers will result in a maximum revenue for the travel agency? What is the maximum revenue? *Hint:* Let \( x \) denote the number of passengers above 200.

9. The altitude (in feet) of a rocket \( t \) minutes into the flight is given by the following function
   \[ s = f(t) = -t^4 + t^3 + 200t + 7 \]
   At what time does the rocket reach its maximum velocity? What is the maximum velocity? When is the velocity increasing and decreasing? *Hint:* Find the inflection point.

10. A new restaurant wants to enclose a rectangular patio for customers to eat outdoors on nice days. The cost of the stone to make a fence is $4 per foot. The area to be enclosed is 90ft\(^2\). What are the dimensions of the rectangular area to minimize the cost?

11. Evaluate the following integrals.
   a) \[ \int \frac{x - 3}{\sqrt{x^2 - 6x + 5}} \, dx \]
   b) \[ \int_1^2 \left(3x^4 - 3e^x + \frac{1}{x^5} + \frac{5}{x} + 2\right) \, dx \]

12. Carlota Music Company estimates that marginal cost of manufacturing its Christmas series CD is given by the following in dollars/week when the level of production is \( x \) CD/week.
   \[ C'(x) = 0.04x^2 - 3x + 201 \]
   The fixed costs incurred by Carlota are $2500/week. Find the total weekly cost \( C(x) \) incurred by Carlota in manufacturing \( x \) CD/week.

13. Annual sales (in millions of units) of Christmas wrapping paper are expected to grow in accordance with the following function, where \( t \) is measured in years, with \( t = 0 \) corresponding to 2000.
   \[ f(t) = 0.21t^3 + 0.12t + 4.26; \quad (0 \leq t \leq 6) \]
   How many packages of Christmas wrapping paper will be sold over the 7 year period between the beginning of 2000 and the end of 2006?

14. Find the area between the two curves \( f(x) = 3x + 1 \) and \( g(x) = x^2 - 3 \).

15. The demand function for a can of popcorn is given by the following equation where \( p \) is the unit price in dollars and \( x \) is the quantity demanded each week, measured in units of a thousand.
   \[ p = -2x^2 - 10x + 16 \]
   Determine the consumers’ surplus if the market price is set at $4/can.