

MTH 201 – Business Calculus: Practice Final Exam 2026 – Set 3

Time: 90 minutes

1.

a)

Given

$$f(x) = e^x(x^2 + 4x + 5),$$

find

$$f'(x), \quad f''(x).$$

b)

Find local maximum and local minimum of the function

$$f(x) = (x^2 - 9)e^x.$$

2.

A rectangular box with a square base and a cover is to have a volume of

$$500 \text{ ft}^3.$$

If the cost per square foot for the bottom is \$5, for the top is \$1, and for the sides is \$2, what should the dimensions be in order to minimize the cost?

3.

A manufacturer determines that in order to sell x units of a good, the price per unit, in dollars, must be

$$p(x) = 90 - x.$$

The manufacturer also determines that the total cost of producing x units is given by

$$C(x) = \frac{1}{3}x^3 - 5x^2 + 65x + 120.$$

a)

Find the total revenue $R(x)$.

b)

Find the total profit $P(x)$.

c)

How many units must the company produce and sell in order to maximize profit?

d)

What is the maximum profit?

e)

What price per unit must be charged in order to make this maximum profit?

4.

Evaluate the integral

$$\int (x + 4)e^{3x} dx.$$

5.

Sunrise, Inc. determines that its marginal revenue per day is given by

$$R'(t) = 80e^{0.1t} + 4t, \quad R(0) = 0,$$

where $R(t)$ is the total accumulated revenue, in dollars, on the t -th day.

The company's marginal cost per day is given by

$$C'(t) = 80 + 2t, \quad C(0) = 0,$$

where $C(t)$ is the total accumulated cost, in dollars, on the t -th day.

a)

Find the total profit from $t = 0$ to $t = 10$, the first 10 days.

b)

Find the average daily profit for the first 10 days.

6.

Given the demand equation

$$D(x) = 15 - x, \quad 0 \leq x \leq 15,$$

and supply equation

$$S(x) = \sqrt{x + 1},$$

calculate:

a)

The equilibrium point.

b)

The consumer surplus at the equilibrium point.

c)

The producer surplus at the equilibrium point.

7.

A computer company has the following Cobb-Douglas production function for a certain product:

$$p(x, y) = 120x^{3/5}y^{2/5},$$

where x is the labor, measured in dollars, and y is the capital, measured in dollars.

Suppose that the company can make a total investment in labor and capital of \$30000. What amount of labor and capital would maximize production?

8.

Find the relative maximum and minimum values of

$$f(x, y) = 4x^2 - 8xy + y^3 - 12y + 2.$$

9.

Consider the following data showing the average life expectancy of men in various years. Note that x represents the actual year.

| Year, x | 1988 | 1998 | 2008 | 2018 |

| ---|---:|---:|---:|---:|

| Life Expectancy of Men, y years | 70.4 | 72.6 | 74.2 | 76.1 |

a)

Find the regression line,

$$y = mx + b.$$

b)

Use the regression line to predict the life expectancy of men in 2028 and 2038.