ECON 331 Tutorial Questions: Onve Variable Optimization (Chapter 9)

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

1) The profit equation for a taco stand is given by $P(x) = -0.4x^2 + 100x - 100$, where x is the number of tacos sold, and $P(x)$ is the profit in dollars. Use the first–derivative test to find when relative extrema occur. 1) ________

2) The cost equation for a bakery is given by $C(x) = 10(x - 2)^2 - 120(x - 2) + 450$, where x is the number of doughnuts made (in dozens), and $C(x)$ is the cost in dollars. Use the first–derivative test to find when relative extrema occur. 2) ________

3) The cost equation for a cookie store is given by $C(x) = x^3 - 6x^2 + 250$, where x is the number of cookies made (in dozens) and $C(x)$ is the cost in dollars. Use the first–derivative test to find when relative extrema occur. 3) ________

4) A new book has its monthly revenue given by $R(x) = \dfrac{40x}{x^2 + 25}$ where x is the number of months after its release and R is in thousands of dollars. Find the relative extrema and use this information to determine which month will bring the greatest revenue. 4) ________

5) Let $y = x^3 - 3x^2 - 9x + 10$. 5) ________
(a) Determine y' and y''.
(b) Determine intervals on which the function is increasing; determine intervals on which the function is decreasing.
(c) Determine the coordinates of all relative maximum and relative minimum points
(d) Determine intervals on which the function is concave up; determine intervals on which the function is concave down;
(e) Determine the coordinates of all inflection points.
(f) With the aid of the information obtained in parts (a)–(e), give a reasonable sketch of the curve.

6) Let $y = x^4 - 4x^3$. 6) ________
(a) Determine y' and y''.
(b) Determine intervals on which the function is increasing; determine intervals on which the function is decreasing.
(c) Determine the coordinates of all relative maximum and relative minimum points.
(d) Determine intervals on which the function is concave up; determine intervals on which the function is concave down;
(e) Determine the coordinates of all inflection points.
(f) With the aid of the information obtained in parts (a)–(e), give a reasonable sketch of the curve.

7) If $y = 3x^4 - 6x^2$, use the second–derivative test to find all values of x for which (a) relative maxima occur (b) relative minima occur. 7) ________

8) Use the second derivative test to find the points of relative maxima and relative minima for the function $y = \dfrac{x^4}{2} - 2x^3 + 5$. 8) ________

9) The cost equation for a company is $C(x) = 2x^3 - 39x^2 + 180x + 21{,}200$. Use the second–derivative test, if applicable, to find the relative maxima and the relative minima. 9) ________

10) The revenue equation for a company is given by $R(x) = 1296x - 0.12x^3$. Determine when relative extrema occur on the interval $(0, \infty)$. 10) ______________

11) The demand equation for a monopolist's product is $p = 2700 - q^2$, where p is the price per unit (in dollars) when q units are demanded. 11) ______________
(a) Find the value of q for which revenue is maximum.
(b) What is the maximum revenue?

12) The demand equation for a monopolist's product is $p = \frac{10,000}{q^2 + 25}$, where p is the price per unit (in dollars) when q units are demanded. 12) ______________
(a) Determine the value of q for which revenue is maximum.
(b) What is the maximum revenue?

13) A manufacturer found that the total cost c of producing q units of a product is given by $c = 0.02q^2 + 2q + 800$. At what level of production will average cost be a minimum? 13) ______________

14) The demand equation for a monopolist's product is $p = 200 - 0.98q$, where p is the price per unit (in dollars) of producing q units. If the total cost c (in dollars) of producing 8 units is given by $c = 0.02q^2 + 2q + 8000$, find the level of production at which profit is maximized. 14) ______________

15) The demand function for a monopolist's product is $p = 100 - 3q$, where p is the price per unit (in dollars) for q units. If the average cost $\overline{c}$ (in dollars) per unit for q units is $\overline{c} = 4 + \frac{100}{q}$, find the output q at which profit is maximized. 15) ______________