

2.2 Applications to Business and Economics

Exercises

1. At a certain factory, the marginal cost is $3(x-4)^2$ euros per unit when the level of production is x units. By how much will the total manufacturing cost increase if the level of production is raised from 6 units to 8 units?
2. The resale value of a certain industrial machine decreases over a 10-year period at a rate that changes with time. When the machine is t years old, the rate at which its value is changing is $220(t-10)$ euros per year. By how much does the machine depreciate during the second year?
3. The promoters of a count fair estimate that t hours after the gates open at 9:00 visitors will be entering the fair at the rate $-4(t+2)^3 + 54(t+2)^2$ people per hour. How much people will enter the fair between 10:00 and noon?
4. After t hours on the job, a factory worker can produce $100te^{-0.1t^2}$ units per hour. How much units does a worker who arrives on the job at 8:00 produce between 10:00 and noon?
5. Suppose that t years from now one investment plan will be generating profit at the rate of $F'_1(t) = 100 + t^2$ hundred euros per year, while a second investment will be generating profit at the rate of $F'_2(t) = 220 + 2t$ hundred euros per year.
 - (a) For how many years does the rate of profitability of the second investment exceed that of the first?
 - (b) Compute the net excess profit for the time period determined in part (a)
6. Suppose that when it is t years old, a particular industrial machine generates revenue at the rate $R'(t) = 6025 - 8t^2$ euros per year and that operating and servicing costs related to the machine accumulate at the rate $C'(t) = 4681 + 13t^2$ euros per year.

- (a) How many years pass before the profitability of the machine begins to decline?
 - (b) Compute the net earnings generated by the machine over the time period determined in part (a).
- 7. It is estimated that t weeks from now, contributions in response to a fund-raising campaign will be coming in at the rate of $R'(t) = 5000e^{-0.2t}$ euros per week, while campaign expenses are expected to accumulate at the constant rate of 676 € per week.
 - (a) For how many weeks does the rate of revenue exceed the rate of cost?
 - (b) Compute the net profit generated by the campaign during the period of time determined in part (a).
- 8. Money is transferred continuously into an account at the constant rate of 2,400 € per year. The account earns interest at the annual rate of 6% compounded continuously. How much will be in the account by the end of 5 years?
- 9. An investment will generate income continuously at the constant rate of 1200 € per year for 5 years. If the prevailing annual interest rate remains fixed at 12% compounded continuously, what is the present value of the investment?
- 10. The government planned to build a highway by granting a 10-year concession. Experiences in similar locations suggest that the highway will be generating profit at a rate of 35 million euros per year. If the annual interest rate remains fixed at 8% compounded continuously, what is the present value of the concession?