Math-71 Sections 02, 03, 60

Homework #11 Solutions

Problem

You work for a robotics company that is making a new line of hamburger-making robots to be sold to fast-food chains. This is a big-ticket item, so sales will be slow at first, but should pick up over time. Your marketing department estimates that the sales growth rate will increase linearly by 2 robots per month per month. In the first month ($t = 0$), for which you have already booked sales for 10 units, the growth rate is expected to be 5 robots per month. How many total robots do you expect to sell by the end of the tenth month ($t = 9$)?

First, build the rate-of-change function:

$$f'(t) = 2t + 5$$

Now integrate to get the total function:

$$f(t) = \int (2t + 5)dt = t^2 + 5t + C$$

Now use the initial condition:

$$f(0) = 0^2 + 5(0) + C = 10$$

and so $C = 10$. Thus, the total function is:

$$f(t) = t^2 + 5t + 10$$

Now plug in $t = 9$:

$$f(9) = 9^2 + 5(9) + 10 = 81 + 45 + 10 = 136$$

Thus, you expect to sell 136 robots by the end of the tenth month.