Lesson 3: Introduction to DDS

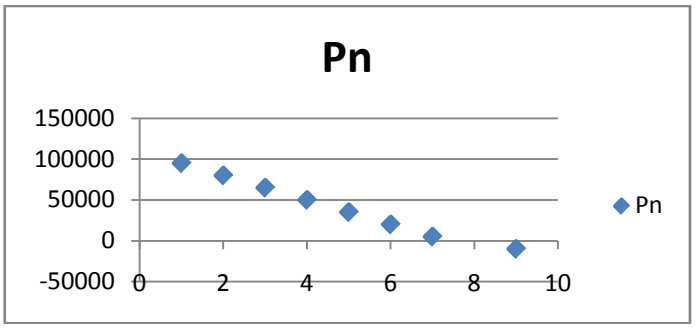
Question 1 The M1091 fuel/water tanker (Figure 1.8) is designed to support soldiers on the battlefield. It can transport 1500 gallons of either water or fuel. You are in charge of a supply station that has been established in a secure area to supply water to troops on the front lines. You have 95,000 gallons of water in a tank and every day a convoy of ten M1091 tankers leaves your station with a full load of water. Develop a model for the water in your tank. Draw a graph for this model. When will you need to be resupplied?

We will assume that the tank farm starts out with 95,000 gallons and loses 15,000 gallons a day due to the 10 trucks leaving.

$$P_1 = 95000$$

$$P_n = P_{n-1} - 15000$$

n	Pn
1	95000
2	80000
3	65000
4	50000
5	35000
6	20000
7	5000
9	-10000

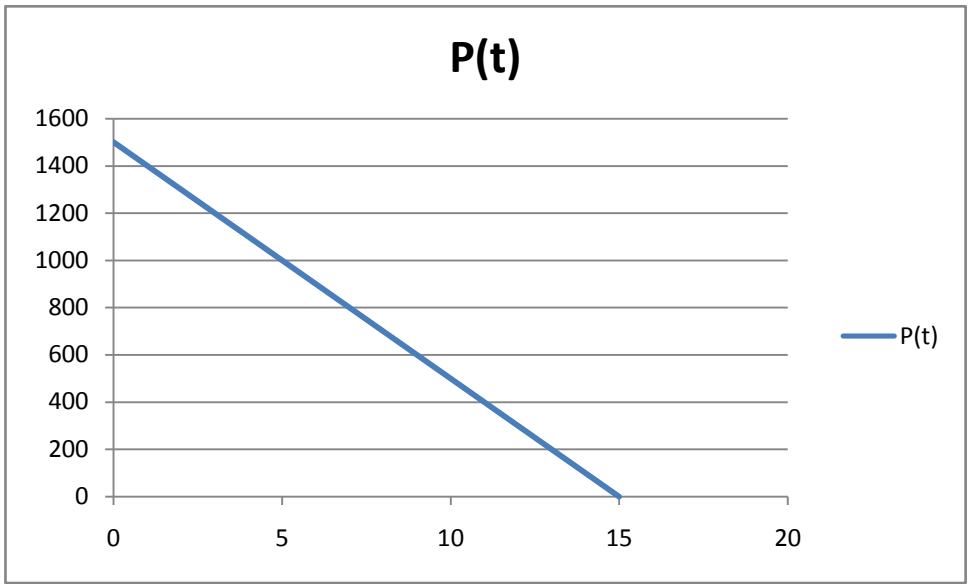


As the data above indicates, we will need a resupply on the 7th day to prevent running out of fuel.

Question 2: Water can be pumped from the M1091 at a rate of 100 gallons per minute. Develop a model showing how much water is in an M1091 starting at the moment it starts pumping water out. Draw a graph for this model. How long will it take to completely empty each tanker?

Since water leaving the tanker seems to be flowing continuously, we may want to try a function. Here we want to model how the water leaves the tank, where n is in minutes.

$$p(t) = 1500 - 100t$$



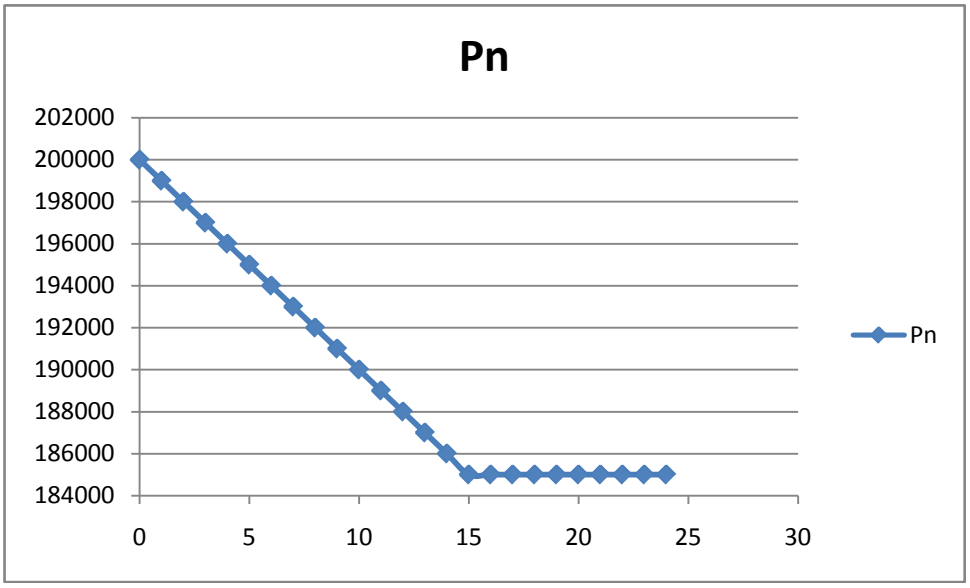
As indicated above, the tank will be completely empy after 16 minutes.

Question 3. You are posted at a mobile command center. Every morning you receive an update from a unit in the field reporting how much fuel they have. This morning they reported that they have 200,000 gallons of fuel. You know that every day they have reported having 15,000 gallons less fuel than the day before. You post the most recent report every morning immediately after it comes in at 0700. Develop a model for the number posted. Draw a graph for this model.

Assume that the unit utilizes their fuel at a constant rate during the hours from 0700-2200 (15 hours a day). If the unit consumes 1000 gallons an hour during this period, and then nothing during the hours 2200 to 0700 the next day, that will account for 15000 per day. The graph below depicts this model, where n is in hours and $n = 0$ corresponds to 0700.

$P_0 = 200000$

$P_n = P_{n-1} - 1000$



Notice after 2200, we revert to the sequence $P_n = P_{n-1}$.