Iteration 0

1.0 - Analysis of elevator movement

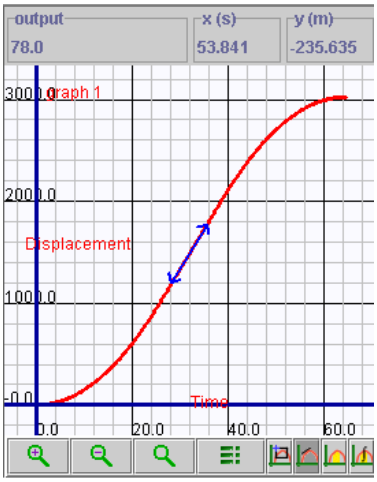


Figure 1: Displacement vs Time graph of an elevator

The graph above depicts the movement of an elevator from one floor to another. The red sections (non zero concavity) depict the elevator experiencing acceleration. The Blue section is when the elevator has reached maximum velocity. **The red section is of interest, where acceleration is involved** . The value of the second derivative will result in the magnitude of acceleration of the elevator.

2.0 - Data collected from Canal building

The building starts at 125m and its top is at 148m. Since there are 7 floors , we can assume (147-125)/7 = 3.2m per floor.

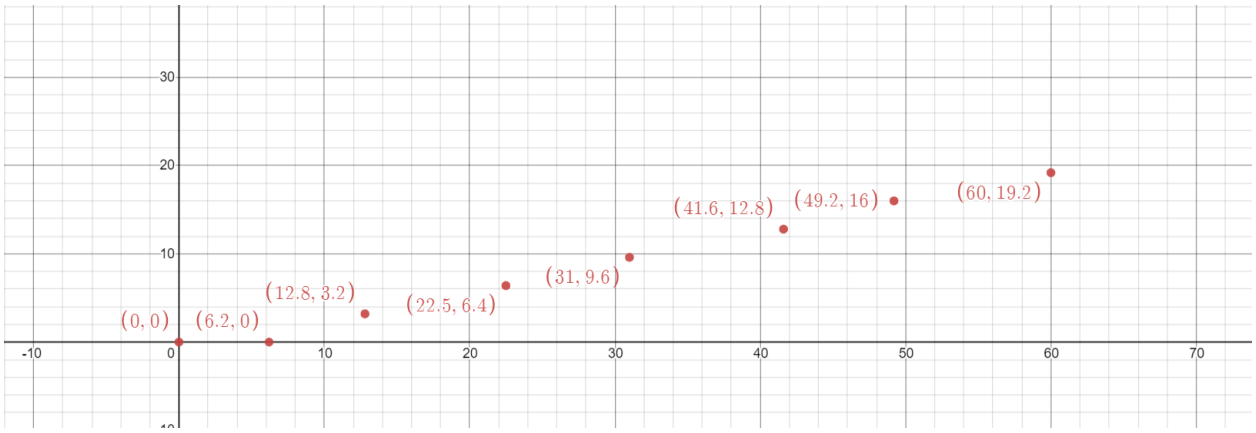


Figure 2: Canal Building elevator height vs time graph - Stopping at every floor

Time per floor	Cumulative time
1 0:06.2	0:06.2
2 0:06.5	0:12.8
3 0:09.7	0:22.5
4 0:08.5	0:31.0
5 0:10.6	0:41.6
6 0:07.7	0:49.2
7 0:10.7	1:00.0
8 0:12.7	1:12.7
9 0:10.2	1:22.9
10 0:08.4	1:31.3
11 0:11.0	1:42.3
12 0:13.2	1:55.5
13 0:08.2	2:03.7

Table 1 Time per floor and cumulative

Based on the data in Table 1 and the assumption that the odd numbers are the door opening and closing and the even numbers are the time it takes for the elevator to go to another floor.

(6.2s + 9.7s + 10.6s + 10.7s + 10.2s + 11s + 8.2s)/7 = 9.5s

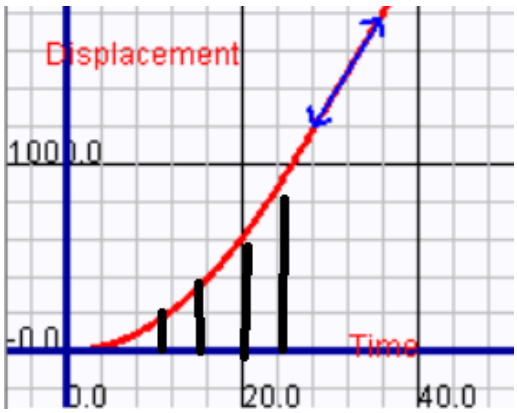
Average wait time to load is around 9.5s.

3.0 - Insufficient data

The only way to find an acceleration value would be if you had multiple displacement (and time) measurements throughout the red section of the curve.

The data set given does not provide data points in the critical section as mentioned in **Section-1**. The time intervals taken are *In between* the critical sections. The elevator has

stopped at the floor when the time measurement is being taken. We would need a graph with a non-zero acceleration to be able to find an acceleration value.



4- Conclusion

No reasonable deductions can be made from the provided data about acceleration, only loading times.

Therefore, our estimates will be based on real world research in mind.

Maximum velocity looks like it is around

Velocity = 2.3 m/s.

Based on research about elevator cars. Comfortability becomes an issue once an elevator accelerates over 1.5m/s^2. Based on my estimates for the graph.

Acceleration ≈ 1.3m/s^2

Negative Acceleration ≈ 1.25m/s^2

SOURCES

Alter, L. (2020, May 7). *How fast should an elevator go?* Treehugger. Retrieved February 4, 2022, from https://www.treehugger.com/how-fast-should-elevator-go-4858555#:~:text=The%20elevator%20could%20be%20going,pushing%20the%20limits%20of%20comfort.