DISCLAIMER:

- We took inspiration from a previous science investigation that was carried out last year 2018.
- we did not take our information or strategy straight from that investigation and copy it. We looked over it to see what necessary information we could take from it that would be useful to keep in mind while doing our own investigation. We redid any of the information that we thought was necessary from the previous investigation, to make sure the calculations were correct and that we could do it ourselves.
- Some of the information that we used has been provided by the internet. My group and i checked out the websites chosen to make sure they were reliable by cross-checking.

Content:

First thoughts:

Originally we thought we were thinking more about costs than other things we ended up including in our finished ivestigation such as (map to scale,ratio, workers schedueles, location and land.) But when we read the success critea we decided to add more different areas of maths to our investigation.

Question:

The final question is.....

How much will it cost to plan to build and run a carpark efficiently(area of 6000m2) for an entire year, and how much would we earn from it.

We had some draft questions aswell.....

- How much will I cost to build, and run a car park efficiently
- How much will it cost to build and uphold a carpark in Ireland
- How many cars would be able to fit in a 50m by 120m car park
- How many cars would be able to fit in a 50m by 120m car park, with 2+ Disabled spaces
- How much will It cost to build, and run a car park efficiently
- We chose our final question because it covers all the maths we did.

pg 3

Poses a problem statement.

Findings:

Land: The national average cost of an acre of land in Ireland is just over 9000 euro.

1 Acre=4046.86m2 = €9000

(50m by 120m) 6000M2 = 1.5 acres= around €13500

Location: we would need to locate our car park close to a town, main roads ,offices etc, so we can fill up our car park fully on a day to day basis.

For example if we are near a shopping center we would benefit hugely because of all the people who need places to do their shopping. Same with offices, workers need a trustworthy and safe place to leave their cars during work hours.

pg 4

Simplifies the problem by making assumptions.

Area:

Our car park is 120m x 50m with an area of 6000m2

Originally we had a car park of 120m2 which we then realized that would be very very small car park. So we decided to change the measurements from 60m x 20m to 120m x 50m.

Open hours:

Monday – Friday = 8am-7pm

Saturday-Sunday = 9am-6pm

As a group we decided on the open hours above. During the week, most people who work drive to their job. We based our open hours on that and the weekend hours were based on the amount of time people do shopping and leisure on weekends.

Total hours during the week: 55 hours

Total during the Weekend: 18 hours

All together: 73 hours a week

pg 5

Breaks the problem down into manageable steps.

Employees:

We decided together that we would have 4 employees.

The employee's jobs will be very simple. They will be in charge of clamping, collecting entrance fee (by validating tickets while going in and checking how long the car was in the carpark and charge when they are leaving) and making sure everything is in order.

Work shifts/timetables:

Time:	monday	tuesday	wednesday	thursday	friday
8am-1:30pm	Jim	Amber	Jim	Amber	Jim
1:30pm-7pm	Pablo	Lucy	Pablo	Lucy	Pablo

Time:	Saturday
9am-4:25pm	amber
4:25pm-6pm	lucy

Time:	Sunday
9am-10:55am	pablo
10:55am-12:10pm	jim
12:10-6pm	lucy

For the names of our workers we used a random name website.

pg 7

Records data

Employees salary:

The worker's salary was based on the Irish minimum wage which is €9.80 a hour.

Our employees work 18 hours and 25 minutes a week meaning they get €180.483 (rounded to 180.480) per week and per person.

1 hour= €9.80

18 hours= 9.80x18=176.40

25 minutes= 60 divided by 9.80(0.1633333333333)round to 0 to see what they earn for one minute then x by 25 to see how much they earn in 25 minutes= (€4.0833333333325) round to €4.08

Each week we lose €721.92 per week for the employee's wages (180.48 x 4). The employees would earn €9,384.96 each a year. Every year us as a company would lose €37,539.84 for all of their wages.

This yearly earning is before taxes in this scenario

pg 8

Suitable mathematical procedures are followed.

Signs:

The signs i will need are:

- Speed limit signs
- Exit and entrance
- Clamping in operation
- Cameras in operation
- Direction signs
- Disabled space signs
- Not free

The average cost of signs is aproximately €15

So 15 x by amount of signs we need=€105

pg 9

Costs:

- Tarmac: €50 per m2
- Clamps: €€233.09 for =2 clamps
- Concrete for path: €60 per m2
- Salaries: €721.92 per week €37,539.84 a year
- (50m by 120m)6000m2 =1.5 acres= €13500
- Receipt Machine = €41.79
- Paint (5 L) = €62.99 x10 = €629.90#
- Signs: €105
- Street lights: €256.54 x 20(we want 20 street lights)=€5130.80
- Concrete for path at the bottom of carpark: €60per m2 so x by area of path(286m2)= €17,160
- Architect: this information is not easy to find because each architect is different and we dont actually have a real architect so on estimate we would pay our architect €100,000. *In Ireland it is illegal to build without and architect.*

Total: €447,990.42

We didnt buy barriers or parking meters because as i said on page 7 the employees will take car of the cars that enter and exit the carpark and the amount they have to pay.

pg 10

Mathematical language used.

Our weekly and yearly intake if we fill up the car park fully(from opening to closing) every day:

We decided as a group that the first hour in our carpark would be free and every hour after that would be €1

So, for one car space full for the full seven days:

Mon – Fri = €50

Sat – Sun = €16 which is €66 per car space per week

X by 234 (for every car space) is €15,444 if the carpark is full every day

€15,444 × 365 (days in a year) is €56,370.60 a year if the carpark is completely full every day

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Another way to work out our yearly intake is.....

For 1 weekday: we are open from 8am-7pm which means we get €10 from one car if they stay fom opening to closing. If every car stayed from opening to closing on 1 week day we would get (10 x by amount of car spaces which is 234) €2340

For 1 weekend day: we are open from 9am-6pm which means we get €8 from one car if they stay from opening to closing. If every car stayed the full day on one weekend day we would get (8 x 234 which is amount of car spaces) €1872

For 1 whole week we would get *1872x by 2 (3744) for Saturday- Sunday + 2340x by 5(11700) for monday to Friday* (3744+11700) €15444

So for one year we would get (15444 x by 365) €56,370.60

Pg 12

Revisists the strategy

Our map to scale:

Boarder and ratio

We did a to scale map of our carpark on an A4 peice of paper.

We know that an A4 piece of paper is 297mm x 210mm. We wanted a 10mm boarder so our map is not in the corners of the page and to make it easier to see and understand.

So we took away 20mm(10mm on each side) from 297mm and we ended up with 277mm.

Since our real life car park is in metres to make it to scale we needed to tur 277mm into metres. (277divided by 1000) 0.277m.

To find the ratio.....

0.277x?=120 120=lenght of real car

?= magic number (our ratio)this number will change for different measurements.

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Breaks down problem into manageable parts.

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0.277 x ? = 120

Put it over 0.277. the 0.277s cross out so im left with

?= 120 all over 0.277. so i 120 divided by 0.277 and i get... 433.212996 i round that down to **433**.

1:433 is our ratio

1:433 means 1 thing on my page is multiplied by 433 to get the measurement of that 1 thing on the real map.

pg 14

Breaks down problem into manageable parts.

Suitable mathematical procedures are followed

How we worked out the height of our to scale carpark:

Now using the same ratio but with the height(50m) we know...

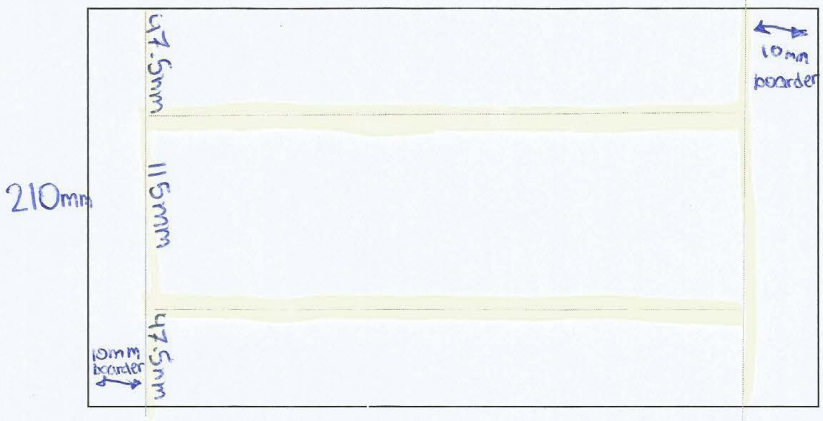
? x 433=50 so to find ? we did 50 divided by 433 and got

? = 0.115473441108547 round to 115m

Turn to mm- 0.115mm

We took 115mm away from 210 to see the remainder space on our page.

277mm



We were left with 95mm which we divided by 2 to find how much extra space is on each half. 95 divided by 2 to get 47.5mm.

pg 16

Roads (two way roads):

The road down the middle:

7.2m is the width of the road in real life. To get in on my to scale map.....

7.2m ÷ 433 to find it on our map = 0.01662817552

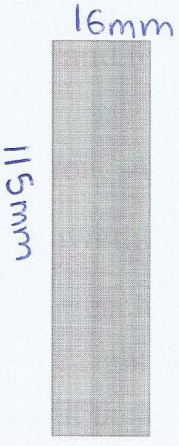
Rounded down to 0.016m and to convert to mm multiply by xby 1000 =

16mm is the width of the roads on the map.

To get the road exactly down the middle I.....

277mm - 16mm = 261mm ÷ each side by 2 = 130.5mm to get the measurements of the right and left side of the main road . we already figured out the length while doing the boarder 115mm.

for size reference



Pg 17

Diagram provides insights.

All the other roads are the exact same measurements so all the info about the roads are on the previous page.

pg 18

Car spaces:

each car space on the real map is 2.4m x 4.8m

To find that on our map drawing we....

2.4 ÷ 433 = 0.00554272517 rounded up to 0.006

0.006m turned to mm = (by multiplying by 1000) 6mm

4.8 ÷ 433 =0.01108545034 rounded down to 0.011

turned to mm = (by multiplying my 1000) 11mm

so on our map it **was** 6mm by 11mm.

But there was a problem.....

When we did 130 divided by 6(to find how many car spaces in one row) we got 21.66 car spaces which would make no sense so when we went to fix this problem we re did the math..

130 divided by 6 =21.66

130 divided by **21**= **6.2**

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Revisits the strategy/iterates

When you do it back 21 fits in to 130 6.2 times so to make it fit in evenly we added .2 mm on to 6mm to then get 11mm by 6.2mm

This change is so small because it is a .2mm it wont change enough to show on our real life carpark.

We will not show the change because it goes into great detail which we dont understand yet.

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Disabled car spaces:

In real life disabled spaces need 1.2m more than a normal car space so (in real life) that would be

2.4 × 4.8 turns into 3.6 × 4.8

We want 4 disabled spaces in total in our carpark (2 on each side)

3.6 + 3.6 =**7.2** on one side and 3.6 +3.6 on the other aswell

So I know that 1 normal space is 2.4 and two disabled spaces = 7.2 and 7.2 divided by 2.4 = 3 so i know 2 disabled spaces is the same as 3 normal spaces.

We already knew what 1 space was to scale on our map

6.2mm

So when i multiply that by three i get the length of 2 disabled spaces added.

6.2 x 3=18.6 so if i divide that by 2 i know the width of 1 disabled space

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Records observations systematiclly throughout.

Path at the bottom of the carpark:

In the beginning we didn't plan for a path at all so when we realized there was spare space at the bottom of our car park we decided to turn it into a path.

We knew that on the scale map the space was

130mm by 5mm

And to find it in real life size

130mm = 0.13m × 433 = 56.29

5mm = 0.005m × 433 = 2.165

Rounded up to 56.3m by 2.2m

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Problems:

We had many problems during our CBA:

2. We weren't sure how many workers we needed and we tried different numbers so many times that we ended up rethinking the number again. We looked at every possibility and in the end, we think we made a good choice with the number of workers.

3. We couldn't find a cost for barriers and a pay station. We decided it would be cheaper and easier to make the workers collect the money and give the customers a receipt.

4. We mistakenly divided some things wrong and instead of dividing the number (X) by 60 to get the amount of money the workers would get in a minute, then multiplying by 25 to find the amount of money earned in 25 hours, we only divided by 4.Once again we fixed this simple mistake immediately after we realised it.

5. Originally, we didn't have a path at the very bottom of the car park. Instead there was extra space at the bottom so we used it by turning it into a path.

5. We got the measurements of a double way road wrong. We said it was 3.7m when actually it was 7.2. Originally we got the 3.7 from the internet. I knew that right outside my house was a double way road so i got a measuring tape and measured it. It was 7.2 metres.

Pg 23

Comments on the reasonableness of the solution and makes a concrete connection to the original question.

Resources

- https://www.name-generator.org.uk/
- https://askeatonpaving.ie/
- https://www.pittman.ie//
- · https://www.drivewaypaving.ie/cost-of-paving-a-driveway/

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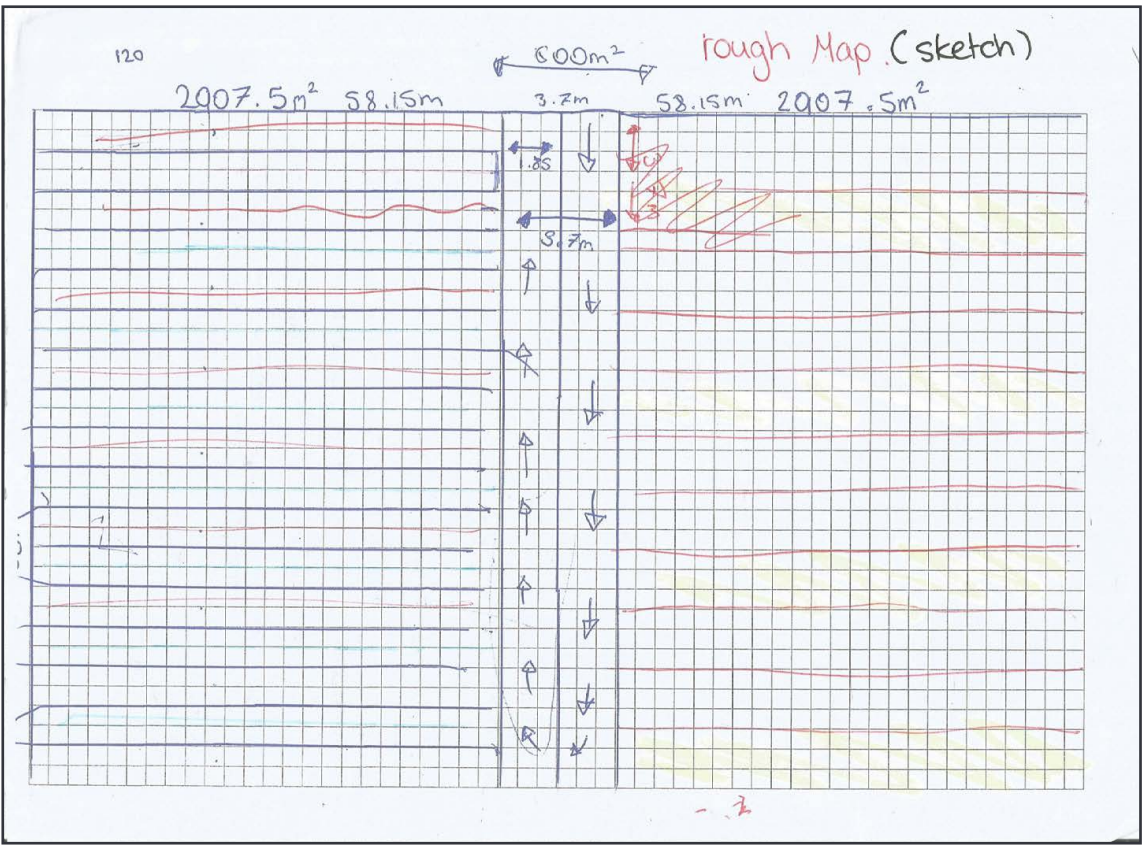
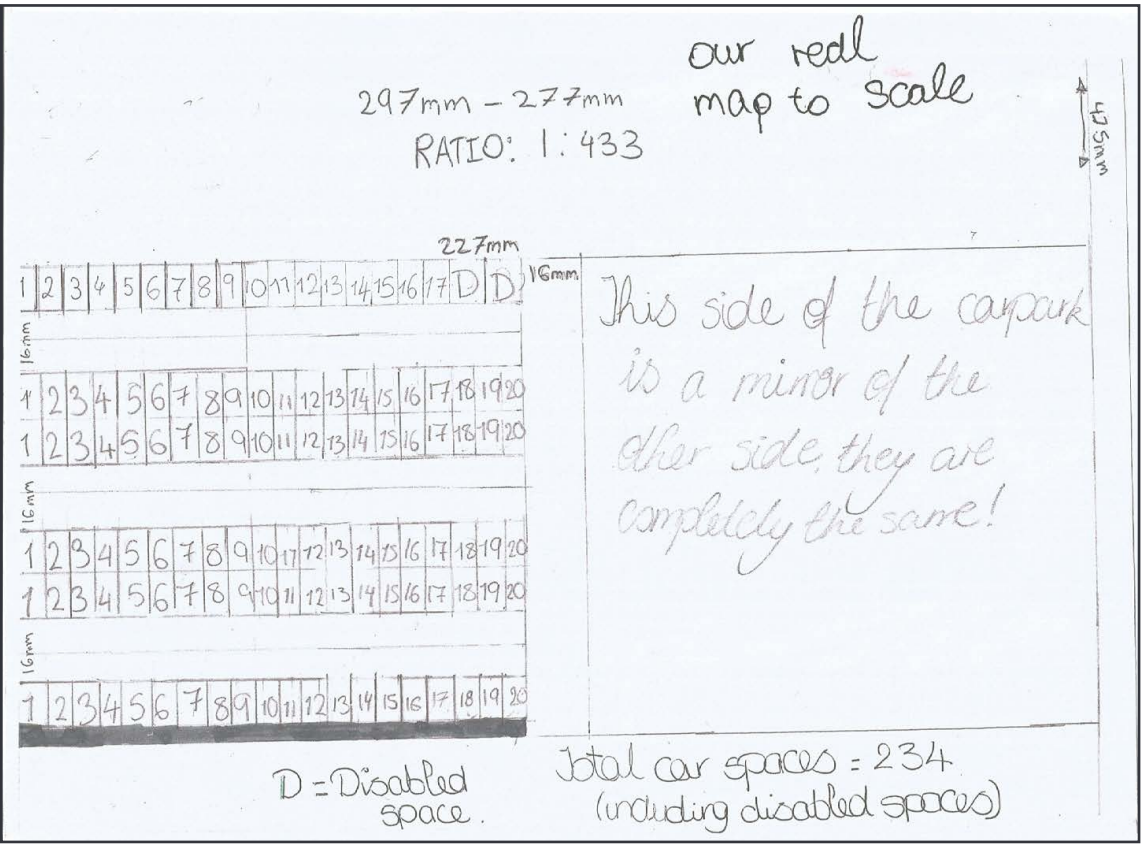


Diagram provides insights.



Visual representations are used.

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location of our carpark in Dublin

o-plot of land in Dublin for carpark

CBA1 Mathematical Investigation: Making Doughnuts

Conclusion

In conclusion it would cost €447,990.42 to plan to build and run a carpark efficiently with an area of 6000m2 for an entire year and we would earn €56,370.60 from it. Our budget was 3 million euro. Take away our total cost(447,990.42)=our left over money 2,552,009.58€

What i learned:

I learned how to do maps to scale and ratio.

I would use this maths in architecture,baking etc.

If we had more time:

We would represent the car park in a 3d model, find the cost of getting electricity into our car park and maybe make a car park underground or have 2 floors.

thank you

pg 25

Justifies the strategy that was used.

Uses mathematical language to communicate ideas.

Overall judgement: In line with expectations