ST. JEAN DE BREBEUF MATHEMATICS

CHAPTER 1.4 (PART 1)

MINIMUM PERIMETER FOR A GIVEN AREA

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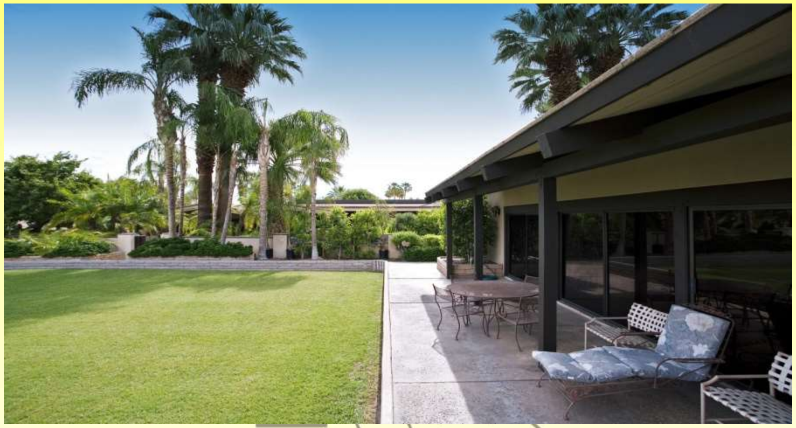
In life, especially when you own your home, you will often want to plan out a certain area that will have the least amount of perimeter. This is usually important because of cost of materials. The less material you need to enclose an area, the smaller your cost. In this activity you will look at exactly that: minimizing perimeter for a given area.



EXAMPLE

Jay has **36 square patio** tiles that have side measurements of **1ft**. In your notebook sketch three different rectangular arrangements and label the dimensions (length and width) of a patio that Jay could build.

Jay wants to put a railing around the patio to enclose it. To **minimize** the cost he wants the perimeter to be as small as possible, while still **maximizing** the area of the deck by using all the tiles. What are the dimensions of the deck that will **minimize** his cost?

TOTAL AREA

36 sq. ft. (36 ft^2)

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Area ÷ Length *Must find smallest perimeter* *Length × Width*

Length	Width	Perimeter	Area
1	36	= 2(L + W) = 2(1 + 36) = 2(37) = **74 ft.**	36sq ft
2	18	= 2(L + W) = 2(2 + 18) = 2(20) = **40 ft.**	36sq ft
3	12	= 2(L + W) = 2(3 + 12) = 2(15) = **30 ft.**	36sq ft
4	9	= 2(L + W) = 2(4 + 9) = 2(13) = **26 ft.**	36sq ft
6	6	= 2(L + W) = 2(6 + 6) = 2(12) = **24 ft.**	36sq ft

*The dimensions that would minimize cost is **6 ft. by 6 ft.***

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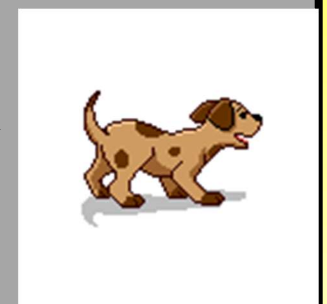
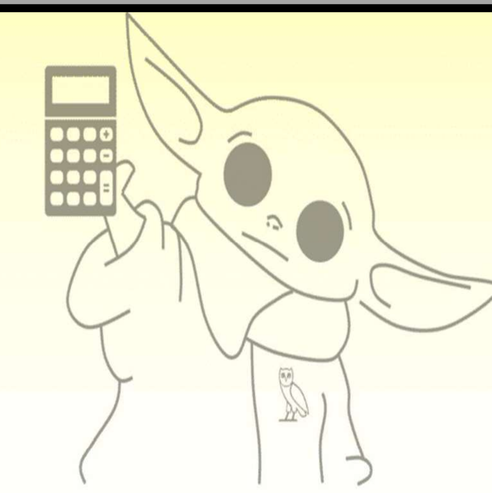
EXAMPLE

A new playful puppy needs an outdoor area to play in while the family is at work. The owner would like the area to be **60m²**. He will use **60** stones that have an area of **1m²**. How should the owner place the stones in order to **minimize** his *perimeter* and **maximize** the *area*?

What is the *minimum* possible **perimeter** for a **60m²** area?

TOTAL AREA
60 sq. m.
(60 m²)





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What is the *minimum* possible **perimeter** for a **60m²** area?

Area ÷ Length

Length (m)	Width (m)	Perimeter (m)	Area (m²)
60	1	P = 2(L + W) P = 2(61) P = 2(60 + 1) P = **122 m**	60
30	2	P = 2(L + W) P = 2(32) P = 2(30 + 2) P = **64 m**	60
20	3	P = 2(L + W) P = 2(23) P = 2(20 + 3) P = **46 m**	60
15	4	P = 2(L + W) P = 2(19) P = 2(15 + 4) P = **38 m**	60
12	5	P = 2(L + W) P = 2(17) P = 2(12 + 5) P = **34 m**	60
10	6	P = 2(L + W) P = 2(16) P = 2(10 + 6) P = **32 m**	60

The minimum possible perimeter is **32 metres**.

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Try to give a general rule for **maximizing** *area* while **minimizing** *perimeter*

Looking at the two examples, if the measurements of the rectangular are closer to a [redacted], the smaller the *perimeter.*

→ This can be achieved if both the *length* and *width* are [redacted]

EXAMPLE

Determine the dimensions of a rectangle with an area of **195m²** that will **minimize** the *perimeter.*

SOLUTION

We have learned that in order to **minimize** *perimeter* you must make your *area* as close to a **square** as possible.

→ Therefore, we know that the <u>length will equal the width.</u>

Given the formula *Area = length x width (Area =* ***195 m²****)*, with the *length* and *width* being <u>equal</u>

→ L = W

$$A = LW$$

$$195 = LW$$

$$195 = (W)W$$

$$195 = W^2$$

$$\sqrt{195} = \sqrt{W^2}$$

$$\boxed{13.96 = W}$$

The length and width must be ***13.96 metres*** *to maximize area*

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The length and width must be ***13.96 metres*** *to maximize area*

SOLUTION

Therefore the Perimeter would be

= **4** x **13.96**

= 55.84 metres

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PRACTICE

1. Alexander's parents want to build a rectangular ice rink in the family's back yard with an area of **200m²**.
   (i) What are the dimensions that will minimize the amount of material required to build the boards around the rink?
   (ii)If the material for the boards can be bought for **$1.75** a linear foot, how much will it cost to build the boards?

2. Trevor was given **15 square** concrete stones with a **1 ft.** side length. He decides to make a slab for a fire pit and put a garden around the outer edge of the concrete. What are the dimensions for his new fire pit that will minimize the amount of garden?

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<u>Homework</u>

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