Investigation 1

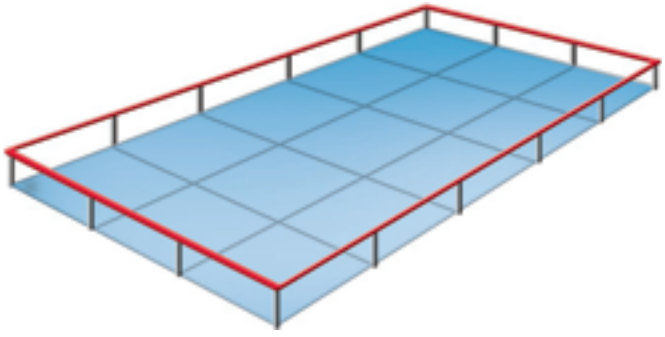
Designing Bumper Cars

Most people enjoy the rides at amusement parks and carnivals, from merry-go-rounds and Ferris wheels to roller coasters and bumper cars.

Suppose a company called Midway Amusement Rides (MARS for short) builds rides for amusement parks and carnivals. To do well in their business, MARS designers have to use mathematical thinking.

1.1 Designing Bumper-Car Rides

Bumper cars are a popular ride at amusement parks and carnivals. Bumper cars ride on a smooth floor with bumper rails all around it. MARS makes their bumper-car floors from 1 meter-by-1 meter square tiles. The bumper rails are built from 1-meter sections.



Problem 1.1 Understanding Area and Perimeter

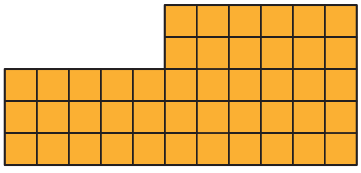
When a customer sends an order, the designers at MARS first use square tiles to model possible floor plans. MARS has received the customer orders below. Experiment with square tiles and then sketch some designs for the customer to consider.

A. Badger State Shows in Wisconsin requests a bumper-car ride with 36 square meters of floor space and 26 meters of rail sections. Sketch two or three floor plans for this request.

B. Lone Star Carnivals in Texas wants a bumper-car ride that covers 36 square meters of floor space and has lots of rail sections. Sketch two or three possible floor plans for this customer.

C. Two measures tell you important facts about the size of the bumper-car floor plans you have designed. The number of tiles needed to cover the floor is the **area.** The number of rail sections needed to surround the floor is the **perimeter.**

1. What are the area and perimeter of this bumper-car floor plan?



2. Which measure, perimeter or area, do you think better describes the *size* of a bumper-car floor plan? Why?

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1.2 Pricing Bumper-Car Rides

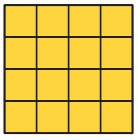
When it is time to prepare the estimates or bills for customers, the designers at MARS turn over the plans to the billing department. The company charges $25 for each rail section and $30 for each floor tile.

Problem 1.2 Finding Area and Perimeter

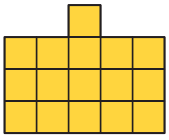
The Buckeye Amusement Company in Ohio wants some sample floor plans and cost estimates for bumper-car rides. The designers come up with these bumper-car floor plans.

bumper-car tile: 1 m × 1 m

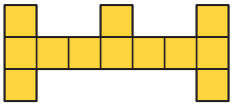
Design A



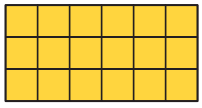
Design B



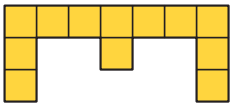
Design C



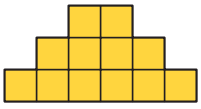
Design D



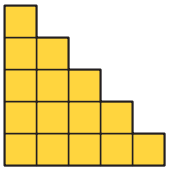
Design E



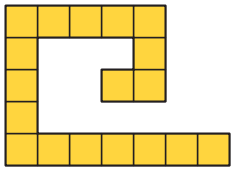
Design F



Design G



Design H



A. Find the area and perimeter for each design. Record your data in a table such as the one started at the right.

Design	Area	Perimeter	Cost
A			
B			

B. Use the data in your table.

1. Which designs can be made from the same number of floor tiles?

2. Choose a set of designs that can be made from the same number of floor tiles. What is the perimeter of each design?

3. In the designs with the same floor area, which design costs the most? Which design costs the least? Why?

C. 1. Rearrange the tiles in Design H to form a rectangle. Can you make more than one rectangle using the same number of tiles? If so, are the perimeters of the rectangles the same? Explain.

2. Design B and Design D have the same perimeter. Can you rearrange Design B to make Design D? Explain.

D. 1. The Buckeye Amusement Company said that it is willing to pay between $1,000 and $2,000 for a bumper-car ride. Design two possible floor plans. Find the area, perimeter, and cost for each.

2. Suppose you were the manager. Which design would you choose? Why?

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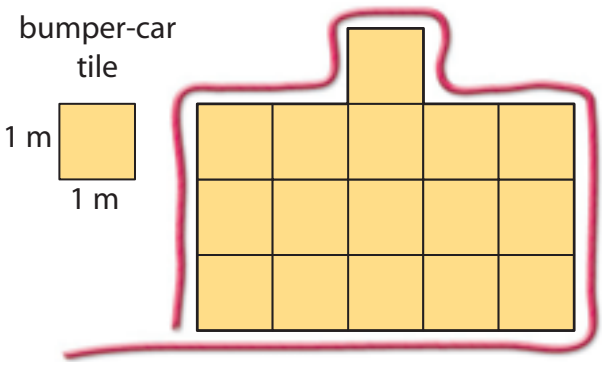
Getting Ready for Problem 1.3

A student is tired of counting the individual rail sections around the outside of each bumper-car track. She starts to think of them as one long rail. She wraps a string around the outside of Design B, as shown.

What do you think she does next? How does this help her to find the perimeter of the figure? How could she determine the area?



1.3 Decoding Designs

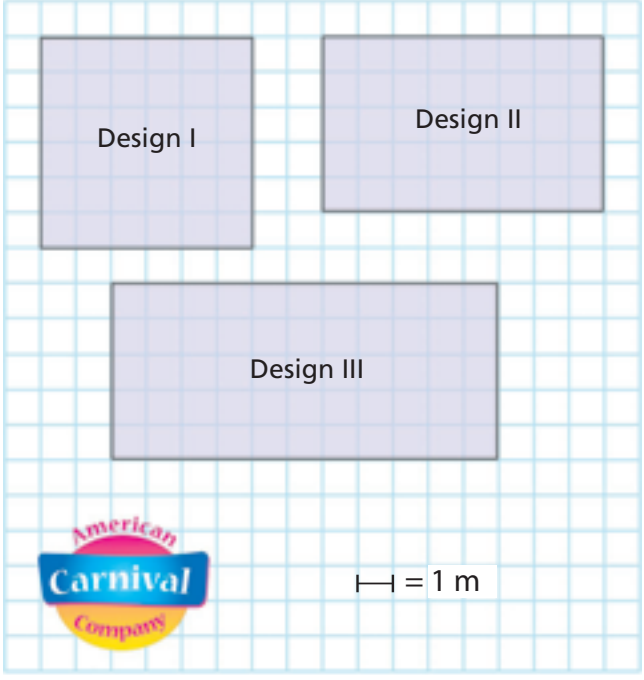
The Portland Community Events Council is planning its annual summer festival. The council asks for bids from different traveling carnival shows. Each carnival show sends descriptions of the rides they offer.

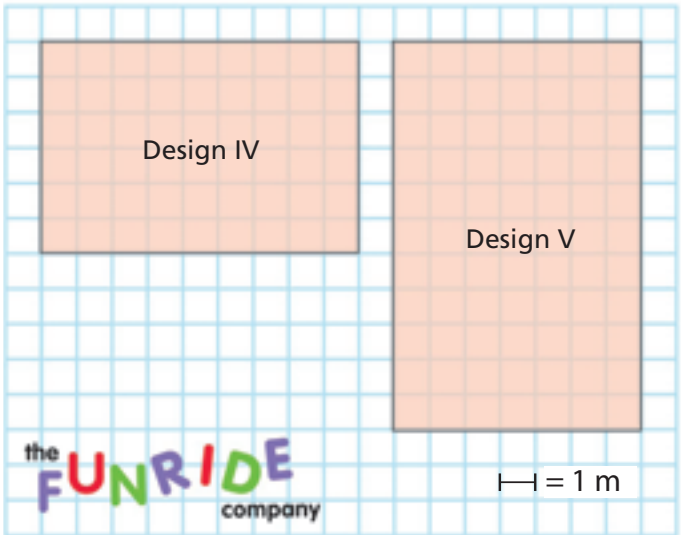
Problem 1.3 Finding Area and Perimeter of Rectangles

The council wants to have a bumper-car ride in the shape of a rectangle at the festival.

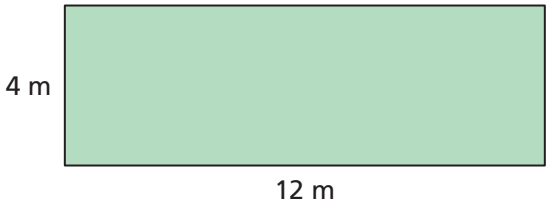
A. American Carnival Company sends Designs I, II and III. The Fun Ride Company sends Designs IV and V (on the next page).

1. What is the area of each design? Explain how you found the area.
2. What is the perimeter of each design? Explain how you found the perimeter.





B. One carnival company sends the rectangular floor plan below. Find the area and the perimeter of this floor plan.



C. Another carnival company sends a description rather than a diagram. They describe the ride as a rectangle that is 17 meters by 30 meters.

1. What is the area of this floor plan?

2. What is the perimeter of this floor plan?

D. The dimensions of a rectangle are called **length** and **width.** Length can be represented using ℓ and width can be represented using w.

1. Using ℓ for length and w for width, write a rule for finding the perimeter of a rectangle.

2. Using ℓ for length and w for width, write a rule for finding the area of a rectangle.

ACE **Homework starts on page 10.**