

Areas of Shapes between Parallel Lines

Introduction

In this learning unit, we will explore some properties of shapes between parallel lines.

Task 1

1. Draw a line l and choose a point P not on l .

a) How many lines can pass through P ? _____

b) Out of these how many lines will be (i) perpendicular to l ? (ii) parallel to l ?

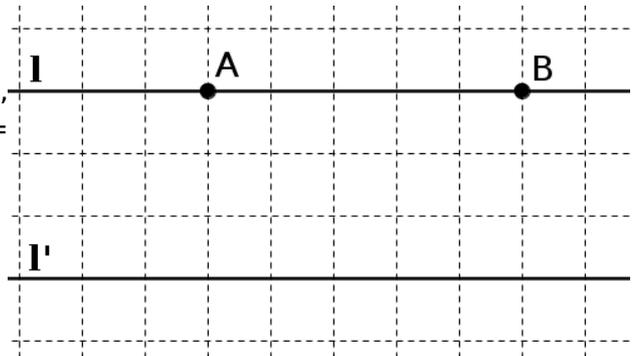
2. Draw a line l' through P parallel to l .

Starting from l and P , what are the steps required to construct l' ?

Compare your steps of construction with those of your friends. Why do you think these steps given you a parallel line? Justify it.

Task 2A

Given parallel lines l, l' and points A, B on l :
 Construct 4 parallelograms $ABC_1D_1, ABC_2D_2, ABC_3D_3, ABC_4D_4$, with points C_i and D_i on l' for $i = 1, 2, 3, 4$.



Calculate the area of each of the parallelograms constructed by you.

| Parallelogram | Base (unit) (AB) | Side (unit) (BC _i) | Area (unit ²) | Perimeter (units) |
|---------------|---------------------|-----------------------------------|---------------------------|----------------------|
| ABC_1D_1 | | | | |
| ABC_2D_2 | | | | |
| ABC_3D_3 | | | | |
| ABC_4D_4 | | | | |

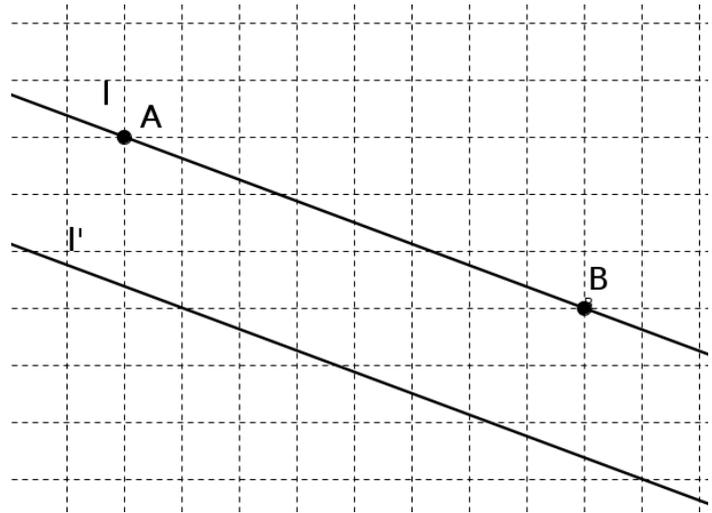
Compare the area of the parallelograms with those of the parallelograms drawn by your neighbours. What do you observe? What can say on the basis of your observations?

If we were to construct another parallelogram ABC_5D_5 , what can say about its height or its area? Would you need to measure its height or calculate its area? Discuss your reasons with your friends.

Task 2B

Given parallel lines l, l' and points P, Q on l :

Construct 4 parallelograms $PQR_1S_1, PQR_2S_2, PQR_3S_3, PQR_4S_4$, with points R_i and S_i on l' for $i = 1,2,3,4$.



Calculate the area of each and compare them.

| Parallelogram | Base (unit) (PQ) | Side (unit) (QR_i) | Area (unit^2) | Perimeter (unit) |
|---------------|---------------------|---------------------------|--------------------------|---------------------|
| PQR_1S_1 | | | | |
| PQR_2S_2 | | | | |
| PQR_3S_3 | | | | |
| PQR_4S_4 | | | | |

Compare the area of the parallelograms with those of the parallelograms drawn by your neighbour. What do you observe? What can say on the basis of your observations?

Task 2C

Look at the parallelograms drawn in tasks 2A and 2B. How does the area of a parallelogram vary with its base, side and height?

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Task 3A

Now calculate the perimeter of each of the parallelograms that you drew and tabulate it. What is your observation about the perimeters of different parallelograms drawn? What is the smallest possible perimeter?

Task 3B

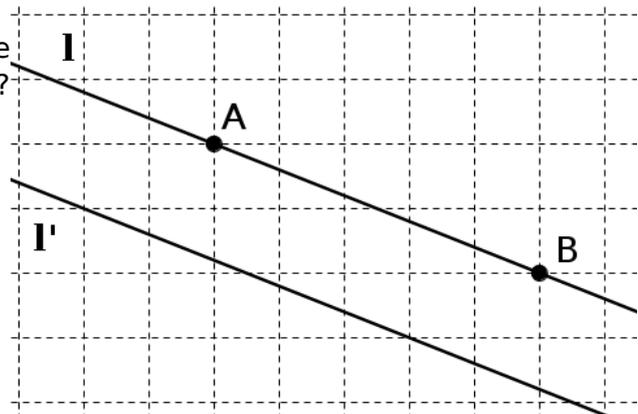
If you have a cabbage patch in the shape of a parallelogram of area 24 square metres. What are the possible dimensions of the patch? How much fencing will be needed? When will the fencing material needed be minimum?

Task 4

What is the minimum information needed to construct a unique parallelogram? (That is all of you get only congruent parallelograms)?

Task 5

a) Draw three triangles with base AB, and the third vertex on l' . How do their areas compare? Justify your observation.



b) Draw three trapeziums with base AB and the opposite side on l' . Compare their areas. What can you say about the areas?

c) Can you draw two different trapezia such that their base is AB and the opposite side is on l' and areas are the same?

References :

<https://www.mathopenref.com/constparallelrhombus.html>

<https://www.mathopenref.com/constparalleltt.html>