

# Parallelograms

## Teacher Notes



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TI-Nspire CAS



Investigation



Student



30min

## Aim

The aim of this investigation is to learn the formulas for finding the perimeter and area of a parallelogram, and a rhombus, which is a special form of a parallelogram.

**National Curriculum Statement:** Find perimeters and areas of parallelograms, rhombuses and kites (ACMMG196)

## Equipment

For this activity you will need:

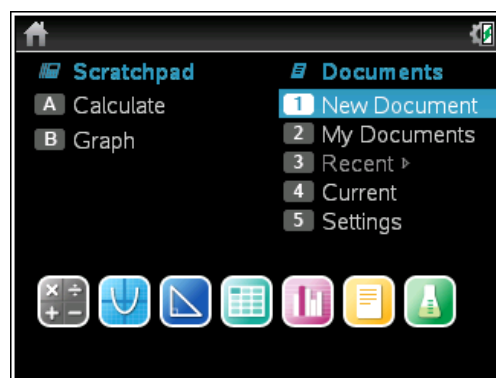
- TI-Nspire CAS (or TI-Nspire)
- TI-Nspire file – Parallelograms

## Introduction – Setting up the calculations

During this activity, students will need to use the TI-Nspire file: “Parallelograms”. This file can be distributed using TI-Navigator, the TI-Nspire docking station or the teacher/student software. To distribute the file using the Teacher software, use the **Tools** menu and select the **Transfer Tool**. Locate the TI-Nspire file on your computer and then start the transfer. Once the file is transferred to the first handheld, unplug the handheld and continue plugging in each student’s handheld device. Once all the students have the file, stop the transfer. Note that students can also transfer files from one handheld device to another from within the **My Documents** folder. Note also that multi-port USB connectors can be used to transfer files to several computers at the one time.


This activity requires access to the “Parallelograms” TI-Nspire file. This file should be loaded on your device before proceeding.

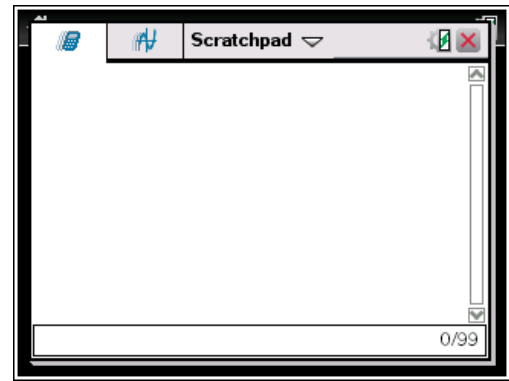
Once the file is on your handheld, press **home** and select **My Documents**. Locate the “Parallelograms” file and press **enter** to open.



The location of the file depends on the selected location during the file transfer.

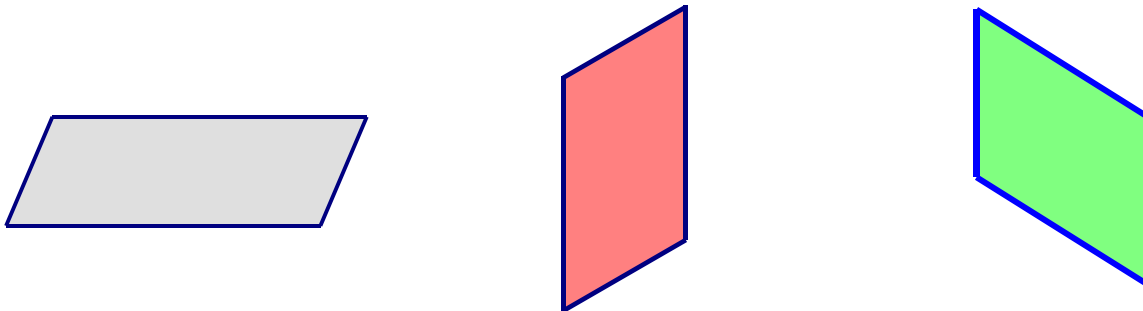


Part of in this investigation requires calculations to be performed. The Scratchpad is a place where calculations can be computed and then discarded. To access the Scratchpad press **home** and select **Scratchpad** (or press **A**). Alternatively, press the  key (this key is not available on a Clickpad).



## Definition of a Parallelogram

A **Parallelogram** is a four sided shape (known as a quadrilateral) where the pairs of opposite sides are parallel and equal in length. Here are three examples of parallelograms.



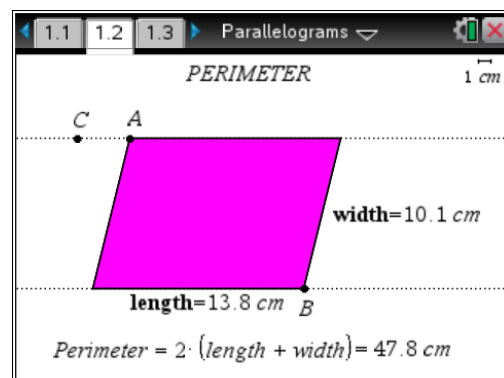
## Perimeter of a Parallelogram

Because the opposite sides are the same length, the formula for finding the perimeter of a parallelogram is:

$$\begin{aligned} \text{Perimeter} &= 2 \times (\text{length} + \text{width}) \\ &= 2(l + w) \end{aligned}$$

Open the TI Nspire **Parallelograms** document and go to page **1.2**. Adjust the size and shape of the parallelogram by grabbing and moving the following points:

- Drag point **A** to change the **shape**.
- Drag point **B** to change the **length**.
- Drag point **C** to change the **width**.



Complete the following table using different sets of measurements from page 1.2. Use the **Scratchpad** for your own calculations. The first calculation has been completed using the measurements from the screen above.

Several values are possible for the following table.

Point moved	length	width	Perimeter (from screen)	Perimeter using the Scratchpad
Initial position	13.8 cm	10.1 cm	47.8 cm	$2(13.8 + 10.1) = 47.8 \text{ cm}$
A	13.8 cm	11.2 cm	50.1 cm	$2(13.8 + 11.2) = 50 \text{ cm}$
B	16.2 cm	10.1 cm	52.5 cm	$2(16.2 + 10.1) = 52.6 \text{ cm}$
C	13.8 cm	11.5 cm	50.8 cm	$2(13.8 + 11.5) = 50.6 \text{ cm}$

Did you find that any of your Scratchpad calculations were different from the values on the screen? If so, why do you think the values were different? The measurements on the Geometry page are displayed as approximate values to one decimal place. The perimeter calculations on the Geometry page use more accurate values whereas the Scratchpad calculations use the approximate values. Therefore, the perimeter calculations on the Geometry page are more accurate.

## Area of a Parallelogram

The area of a parallelogram is found by multiplying the length by the height. Note that you need to use the height and not the width of the parallelogram.

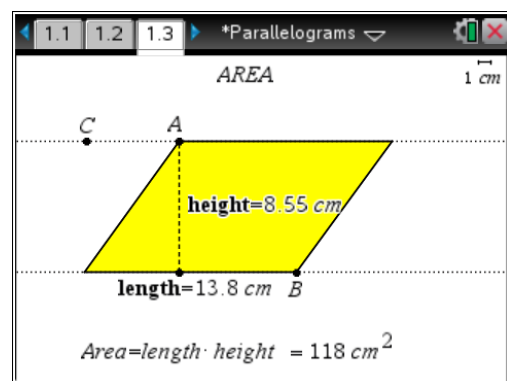
$$\begin{aligned} \text{Area} &= \text{length} \times \text{height} \\ &= l \cdot h \end{aligned}$$

Go to page 1.3 of the **Parallelograms** document. Adjust the size and shape of the parallelogram by grabbing and moving the following points:

Drag point **A** to change the **shape**.

Drag point **B** to change the **length**.

Drag point **C** to change the **width**.



Complete the following table using different sets of measurements from page 1.3. Use the **Scratchpad** for your own calculations. The first calculation has been completed using the measurements from the screen above.

Several values are possible for the following table.

Point moved	length	width	Area (from screen)	Area using the Scratchpad
Initial position	13.8 cm	8.55 cm	118 cm <sup>2</sup>	$13.8 \times 8.55 = 117.99 \text{ cm}^2$
A	13.8 cm	8.55 cm	118 cm <sup>2</sup>	$13.8 \times 8.55 = 117.99 \text{ cm}^2$
B	17.7 cm	8.55 cm	151 cm <sup>2</sup>	$17.7 \times 8.55 = 151.335 \text{ cm}^2$
C	13.8 cm	10.4 cm	143 cm <sup>2</sup>	$13.8 \times 10.4 = 143.52 \text{ cm}^2$

Did you find that any of your Scratchpad calculations for the area were different from the values on the screen? If so, why do you think the values were different? The area calculations on the Geometry page are rounded off to the nearest integer whereas the Scratchpad calculations are not. Therefore, the area calculations using the Scratchpad page are more accurate.

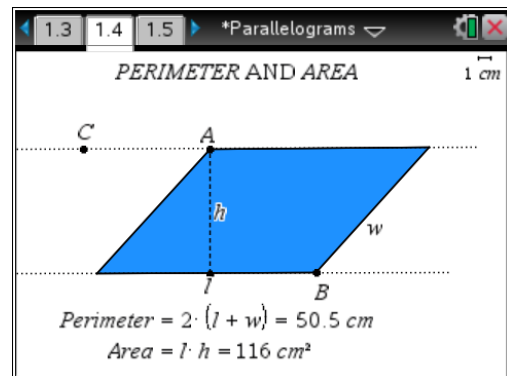
## Perimeter and Area

Go to page 1.4 of the **Parallelograms** document. Adjust the size and shape of the parallelogram by grabbing and moving the following points:

Drag point **A** to change the **shape**.

Drag point **B** to change the **length**.

Drag point **C** to change the **width**.



As you drag the different points, you will notice that the perimeter and area also change. As you move each point, complete the following table to indicate when the perimeter and area change.

Point moved	Did the perimeter change? (Y/N)	Did the area change? (Y/N)
A	Yes	No
B	Yes	Yes
C	Yes	Yes

When you move point A, you will find that the perimeter changes but the area does not. The shape is obviously changing so why do you think the area does not change? **Even though the shape changes, the length and height remain constant, therefore the area remains the same.**

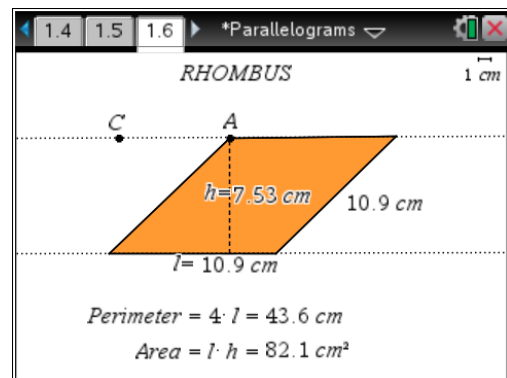
## Rhombus

A **rhombus** is a parallelogram with four equal sides. The formulas for finding the perimeter of a rhombus can be simplified because the four sides are the same length. The formulas for the perimeter and area are:

$$\begin{aligned} \text{Perimeter} &= 4 \times \text{length} \\ &= 4 \cdot l \end{aligned}$$

$$\begin{aligned} \text{Area} &= \text{length} \times \text{height} \\ &= l \cdot h \end{aligned}$$

Go to page **1.6** of the **Parallelograms** document. Adjust the size and shape of the rhombus by grabbing and moving the points **A** and **C**.



When you move point A on the parallelogram, the area does not change. However, when you move point A on the rhombus, the area does change. For both shapes, the height remained constant so why do you think the area changed on rhombus and not the parallelogram? **Unlike the parallelogram, when you move point A on the rhombus, the length changes which causes the area to change.**