SIMILAR SHAPES
Student Notes

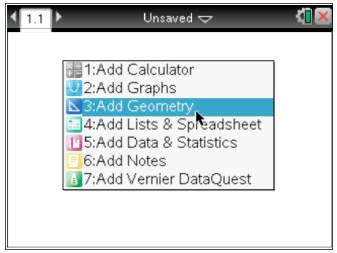
This TI-Nspire activity will help you to:

- understand, recognise, visualise and construct enlargements of objects;
- enlarge objects, given a centre of enlargement and scale factor;
- understand the mathematical meaning of the word *similar*.

1. Enlarge a rectangle

a) Open a new document and create a page for plane geometry.

Press ctrl doc 3.

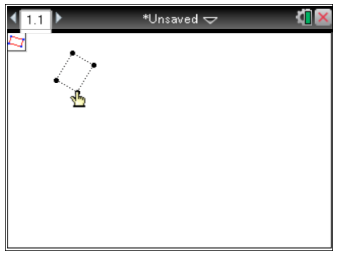


To hide the scale press menu 2 8.

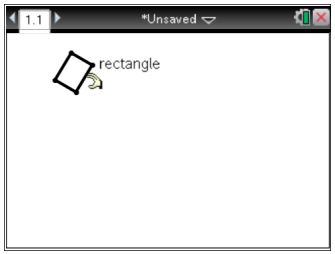
b) Use the *Shapes* menu to draw a small rectangle in the top left part of the screen.

This is the ***Object*** to be enlarged.

Press menu 9 3.
Move the point to where you want a corner and press ·.
Repeat for two more corners.



Finally press esc to stop drawing rectangles.

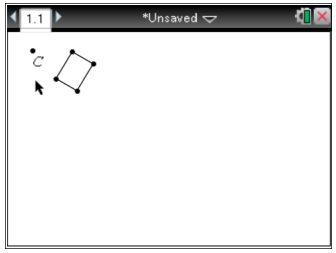


c) Use the *Points & Lines* menu to put a point called C in the top left corner.

C will be the
Centre of Enlargement

Press
menu 7 1.

Move the point into position and press
· ⇧shift C · esc.

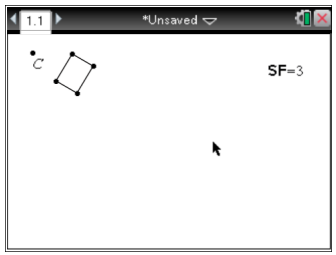


d) Use the *Actions/Text* menu to put the number 3 in the top right corner.

This will be the ***Scale Factor*** of the enlargement, labelled SF.

Press menu 1 6
and move to the top right corner.
Press enter 3 enter esc

Click on the 3 and press
var 1
⇧shift S ⇧shift F
enter



You now have:

- an Object,
- a Centre of Enlargement,
- a Scale Factor.

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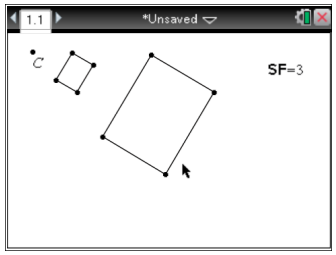
e) Now you are ready to enlarge the object using Option 5 in the *Transformations* menu.

You will select SF, point C and the object and the enlargement will appear automatically.

The bigger rectangle is the ***Image***.

Press menu B 5.
Move to SF=3.
Press ⬚.
Move to point C.
Press ⬚.
Move to the rectangle.
Press ⬚.



Finally press esc.

You have enlarged the Object and made an Image.

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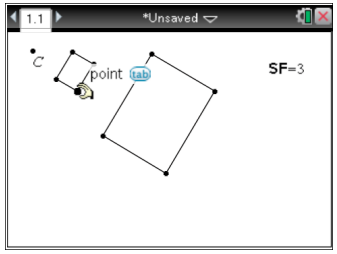
2. Explore the enlargement

a) What happens to the image if you change the size of the object?

Move to one of the corners of the object. When you see the hand over a point, like this…



…grab it by pressing ctrl ⬚. The hand closes up.

Move the corner around – what happens to the image?

Press esc.

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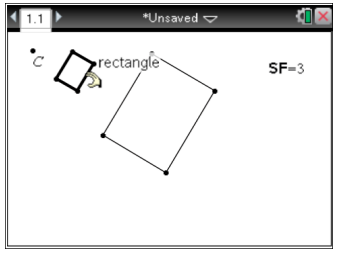
b) What happens if the whole object moves?

Move to one of the sides of the object.

When you see the word **rectangle** …



…grab it and move it around.
What happens to the image?

Press esc.

c) What if point C moves?

Move to point C. Grab it and move it around.
Which way does the image move if C moves up, or left?
Try moving C inside the object.
Move C back to its original position and press esc.

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d) What happens if the scale factor is changed?

Move to SF=3 and press enter enter.
Change 3 to 2, or 2.5, etc.
What would you expect to happen if SF=0.5? Try it to see.

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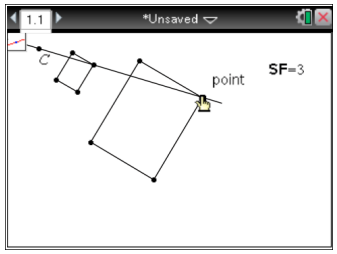
3. Construction lines

a) Use the *Points and lines* menu to construct lines from point C to each corner of the image.

Press menu 7 4.
Move to point C.
Press enter.
Move to a corner of the image.
Press enter.



Draw lines from C to each corner of the image.

Press esc.

Notice that the lines pass through the corners of the object too

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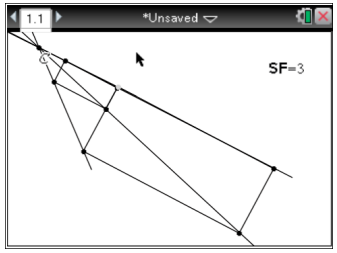
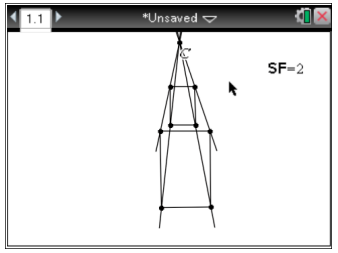
b) Experiment with moving the object and point C and changing the scale factor.
Can you make your screen look like those shown here?
Try to draw other interesting enlargements.



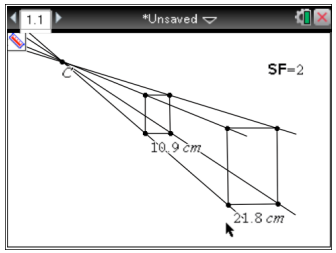


4. Making measurements

a) Use the *Measurement* menu to compare the lengths from C to the corners of the object and to the corners of the image.

Press menu 8 1.
Move to C. Press enter.
Move to a corner of the object. Press enter enter.
Repeat for the corresponding corner of the image.
Press esc.

What do you notice?



Try moving the object or point C.

What do you notice?

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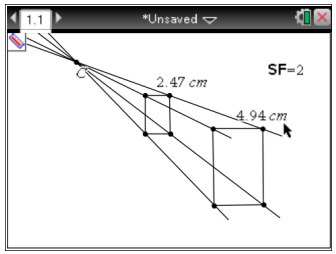
b) Measure and compare the lengths of corresponding sides of the object and image

First delete the previous measurements by moving to them and pressing enter del.
Then use a similar method as above to measure lengths of the sides.



Try changing the scale factor.

What do you notice?

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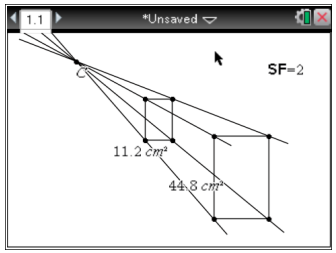
c) Measure and compare the areas of the object and image.

To measure areas, use menu 8 2.

Then move to the object and press enter enter.



How does the scale factor affect the area of the image?

5. Negative scale factors

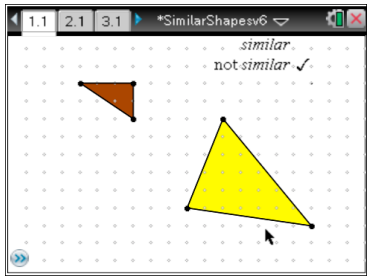
What would you expect to happen if you use a negative scale factor?

Move point C to the middle of the screen and try SF= ⁻2 or SF= ⁻1 or SF= ⁻0.5. What is going on?

6. Similarity Detector

This section uses a different TI-Nspire document. Press [on] [2] for *My Documents*.
From the list of documents select ***SimilarShapes.tns*** by moving to it and pressing [enter].

a) On page 1.1 there are two triangles on the screen.
Also notice the tick on the screen. These triangles are *not similar*.



You can change either triangle by grabbing and dragging one of the corners– but you can only move to points on the grid!

Move any points and try to make the two triangles have the same shape– that is, make them mathematically **similar**.

When the triangles are the same shape, the tick will move to the word *similar.*

There are many different ways to make the two triangles similar.
Find as many as you can.

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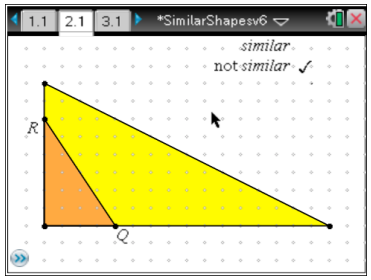
b) Press [ctrl] ▶ to move to page 2.1.

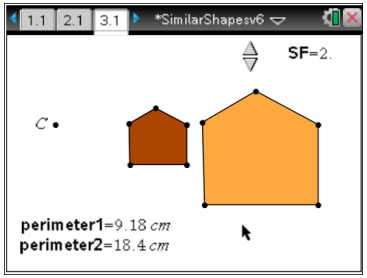
Here the two triangles are on top of each other.



By moving only the points Q and R, how many different pairs of similar triangles can you find?

7. Perimeters and areas

a) Press ctrl ▶ to move to page 3.1.
Here there is a pentagon, its enlargement and measurements of the two perimeters.



You can:

- click (use) on the up and down arrows to change **SF**, the scale factor of the enlargement;
- drag any corner of the smaller pentagon to change its shape;
- move point C.

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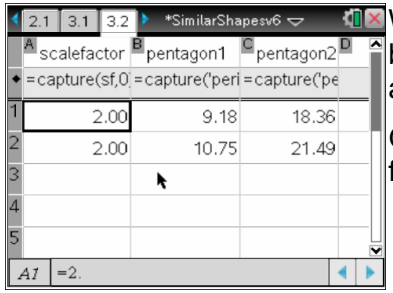
b) You can save the current values of the scale factor and the two ***perimeters*** by pressing ctrl .

This saves each of the values in the spreadsheet on page 3.2.

Move between pages by pressing ctrl ▶ or ctrl ◀.



What is the connection between the perimeters and SF?

Give reasons for your findings.

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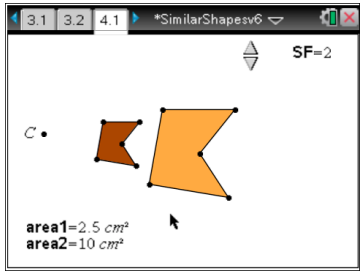
c) Page 4.1 is like page 3.1 but this time the **areas** of the pentagons are measured.

Pressing ctrl . on this page saves the current values of the scale factor and the two ***areas*** in the spreadsheet on page 4.2.



What is the connection between the areas and SF?

Why is this?