

Student Name

Mathematics Stage 5 Core

PROPERTIES OF GEOMETRICAL FIGURES

Book 1 Identify and describe the properties of
similar figures

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CONTENTS

Overview2

Similarity Statements3

Determining whether Two Figures are Similar.....6

OVERVIEW

SYLLABUS CONTENT

MA5-GEO-C-01 identifies and applies the properties of similar figures and scale drawings to solve problems

Identify and describe the properties of similar figures

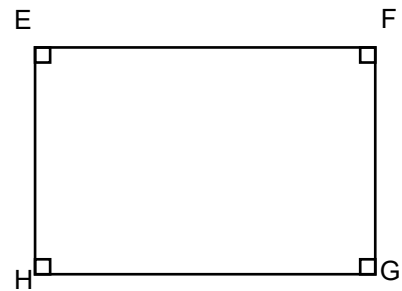
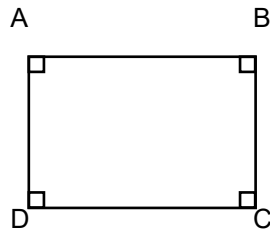
- Describe similar figures as having the same shape but not necessarily the same size
- Verify and explain that in similar polygons, the corresponding angles are equal and the corresponding side lengths are in the same proportion
- Name the vertices in matching order when using the similar symbol ($\sim$) in a similarity statement
- Match the corresponding sides and angles of similar polygons

SIMILARITY STATEMENTS

- **Similar figures** have the **same shape** but **different size**.
- **Corresponding** (matching) **angles** in similar figures are equal.
- The symbol $\sim$ indicates similarity.

1. Identify the corresponding vertices.
2. Write vertices in corresponding order.

Example Write a similarity statement.



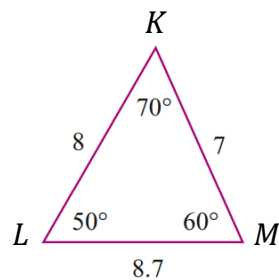
$AB \sim EF$
 $BC \sim FG$
 $DC \sim HG$
 $AD \sim EH$

$\angle BAD = \angle FEH$
 $\angle ABC = \angle EFG$
 $\angle BCD = \angle FGH$
 $\angle ADC = \angle EHG$

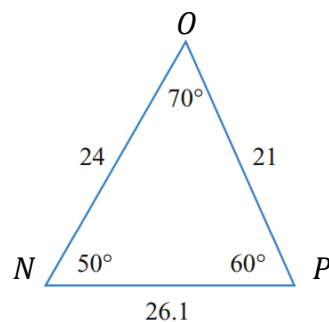
$\therefore ABCD \sim EFGH$

Do the order of the letters matter?

....., we list the vertices in order.



$LK \sim$
 $KM \sim$
 $ML \sim$



$\angle LKM =$
 $\angle KML =$
 $\angle MLK =$

$\therefore LKM \sim$

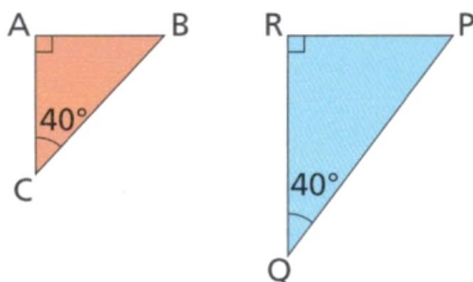
$LKM \sim NOP$

Key ideas

1. If two figures are similar, then they are the exact same, but not the same
2. When writing similarity statements, the vertices must be in order.

1 Identify the corresponding sides and write a similarity statement.

a



Corresponding angles

$\angle CAB$ and $\angle QRP$

$\angle ABC$ and

$\angle BCA$ and

Corresponding sides

BC and PQ

AC and

AB and

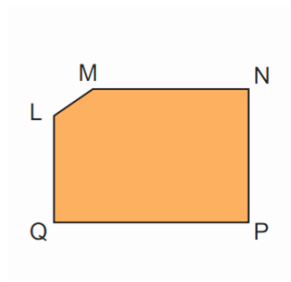
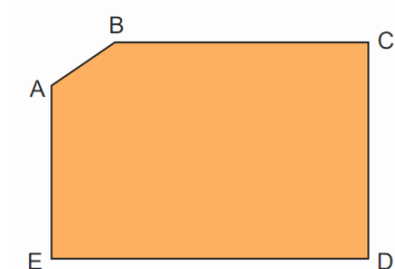
$\angle RPQ$

RQ

$\angle PQR$

RP

b



$AB \sim LM$

$\angle ABC = \angle LMN$

$BC \sim MN$

$\angle BCD = \angle \dots$

$\angle MNP$

$CD \sim \dots$

$\angle CDE = \angle \dots$

$\angle NPQ$

$\angle NPQ$

$ED \sim QP$

$\angle \dots = \angle LQP$

$\angle AED$

$AE \sim \dots$

$\angle \dots = \angle \dots$

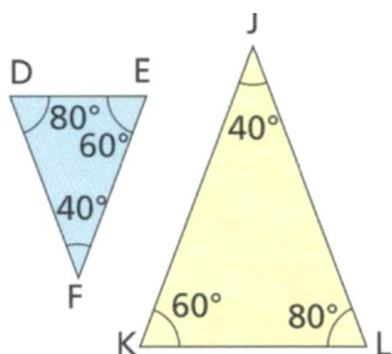
$\angle LQ$

$\angle EAB = \angle QLM$

$\therefore ABCDE \sim \dots$

$LMNPQ$

c



$DE \sim \dots$

$\angle DEF = \angle PQR$

$\angle LK$

$EF \sim \dots$

$\angle EFD = \angle \dots$

$\angle KJL$

$\angle KJL$

$FD \sim \dots$

$\angle FDE = \angle \dots$

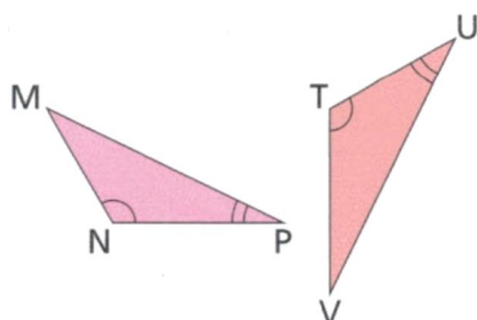
$\angle JL$

$\angle JLK$

$\therefore DEF \sim \dots$

LKJ

d



$MP \sim \dots$

$\angle MPN = \dots$

$\angle VU$

$\angle VUT$

$PN \sim \dots$

$\angle PNM = \dots$

$\angle UV$

$\angle UTV$

$\dots \sim \dots$

$\angle NMP = \dots$

$\angle TV$

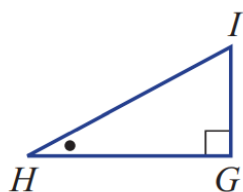
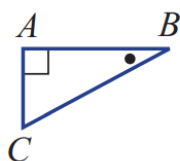
$\angle TVU$

$\therefore \dots \sim \dots$

$MPN \sim VUT$

2 Identify the corresponding sides and write a similarity statement.

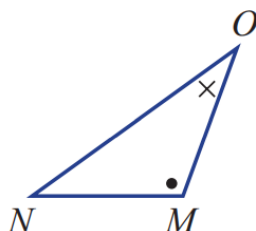
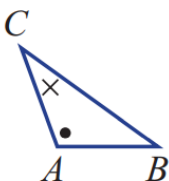
a



$AB \sim \dots\dots$
 $BC \sim \dots\dots$
 $CA \sim \dots\dots$
 $\therefore \dots\dots \sim \dots\dots$
 $ABC \sim GHI$

$\angle CAB = \dots\dots\dots$
 $\angle ABC = \dots\dots\dots$
 $\angle BCA = \dots\dots\dots$
 $\angle IGH$
 $\angle GHI$
 $\angle HIG$

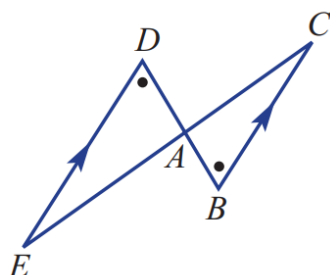
b



$AB \sim \dots\dots$
 $BC \sim \dots\dots$
 $CA \sim \dots\dots$
 $\therefore \dots\dots \sim \dots\dots$
 $ABC \sim MNO$

$\angle ACB = \dots\dots\dots$
 $\angle CAB = \dots\dots\dots$
 $\angle CBA = \dots\dots\dots$
 $\angle MON$
 $\angle OMN$
 $\angle ONM$

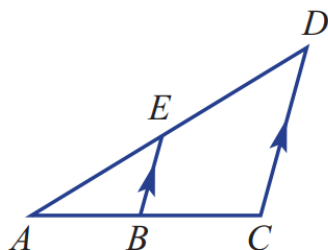
c (Hint: Redraw the diagram as two triangles)



$AD \sim \dots\dots$
 $DE \sim \dots\dots$
 $EA \sim \dots\dots$
 $\angle ADE = \dots\dots\dots$
 $\angle DEA = \dots\dots\dots$
 $\angle EAD = \dots\dots\dots$
 AB
 BC
 CA
 $\angle ABC$
 $\angle BCA$
 $\angle CAB$

$\therefore \dots\dots \sim \dots\dots$
 $ADE \sim ABC$

d (Hint: Redraw the diagram as two triangles)



$AB \sim \dots\dots$
 $AE \sim \dots\dots$
 $EB \sim \dots\dots$
 $\angle EAB = \dots\dots\dots$
 $\angle EBA = \dots\dots\dots$
 $\angle AEB = \dots\dots\dots$
 AC
 AD
 DC
 $\angle DAC$
 $\angle DCA$
 $\angle ADC$

$\therefore \dots\dots \sim \dots\dots$
 $ABE \sim ACD$

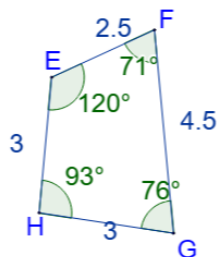
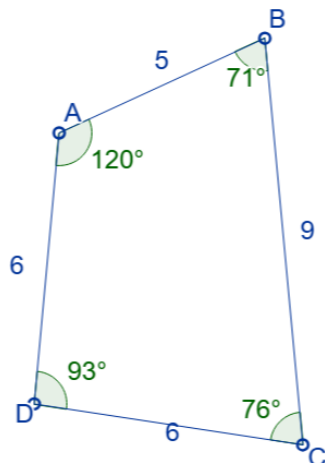
DETERMINING WHETHER TWO FIGURES ARE SIMILAR

- Similar figures have:
 - equal corresponding angles.
 - corresponding sides in the same ratio.

Investigation Determine whether two figures are similar.

Similar Figures: <https://www.geogebra.org/m/bvdzefpn>

Write down the corresponding sides.



$AB \sim$

$BC \sim$

$CD \sim$

$AD \sim$

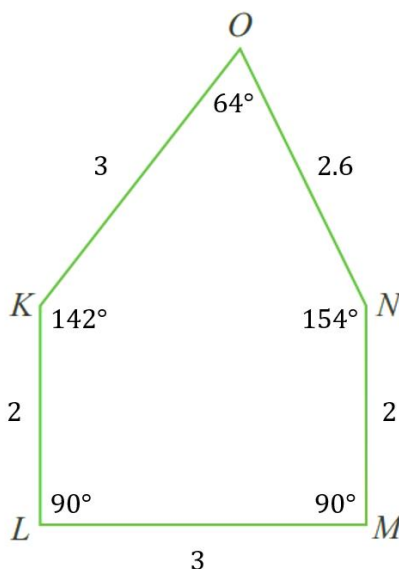
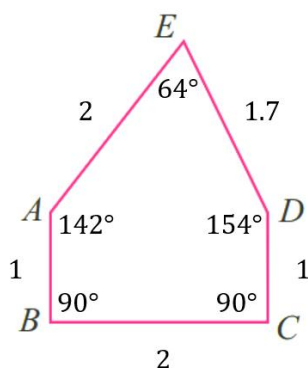
Compare the corresponding sides to see whether they are in the same ratio.

$$\frac{EF}{AB} = \frac{GH}{CD} =$$

$$\frac{FG}{BC} = \frac{EH}{AD} =$$

The two figures are similar because corresponding angles are, and corresponding sides are in the same

Determine whether these two figures are similar.



$$\frac{KL}{AB} =$$

$$\frac{LM}{BC} =$$

$$\frac{NM}{DC} =$$

$$\frac{ON}{ED} =$$

$$\frac{OK}{EA} =$$

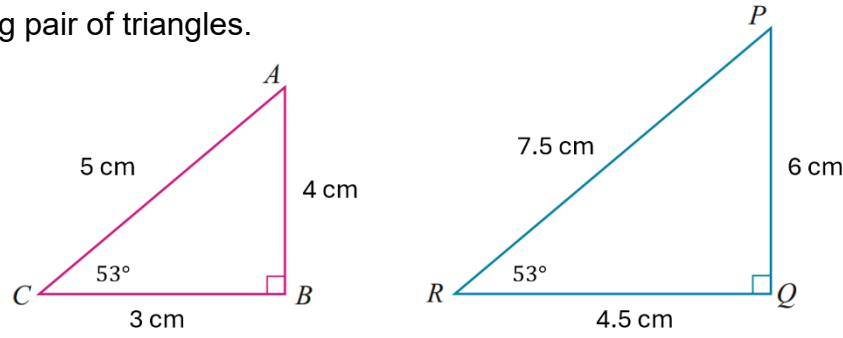
The two figures are because

Not similar. Corresponding sides not in equal ratio.

Key ideas

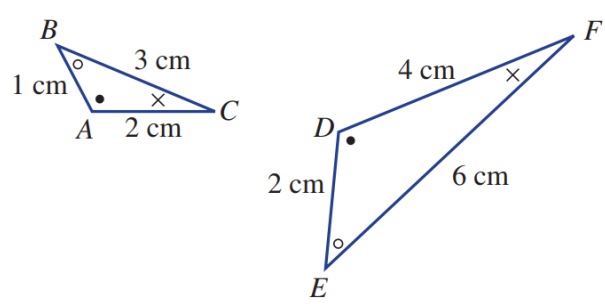
- If two figures are similar, then their angles are, and their sides are in the same

1 Look at the following pair of triangles.



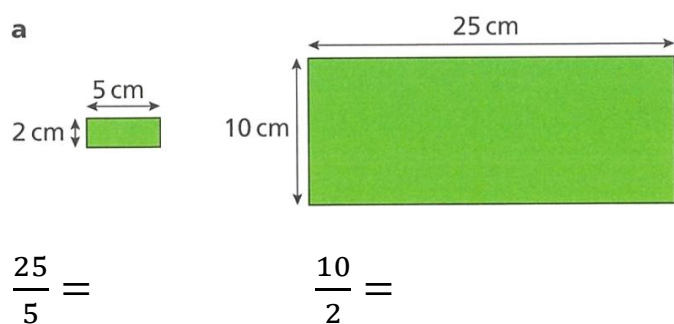
- a Find the size of the remaining angle in each of these triangles. 37°
- b Name the angle on the larger triangle that corresponds to:
- | | | |
|----------------|-----------------|------------------|
| i $\angle ACB$ | ii $\angle CBA$ | iii $\angle BAC$ |
| $\angle PRQ$ | $\angle RQP$ | $\angle QPR$ |
- c Are the corresponding angles equal? yes
- d Name the side on the larger triangle that corresponds to:
- | | | |
|--------|---------|----------|
| i BC | ii AB | iii AC |
| QR | PQ | PR |
- e Find the ratios of the sides.
- | | | |
|---------------------|----------------------|-----------------------|
| i $\frac{QR}{BC} =$ | ii $\frac{PQ}{AB} =$ | iii $\frac{PR}{AC} =$ |
| 1.5 | 1.5 | 1.5 |
- f Therefore, explain why the two triangles are similar. Corresponding angles are equal. Corresponding sides are in the same ratio.

2 Consider these two triangles.

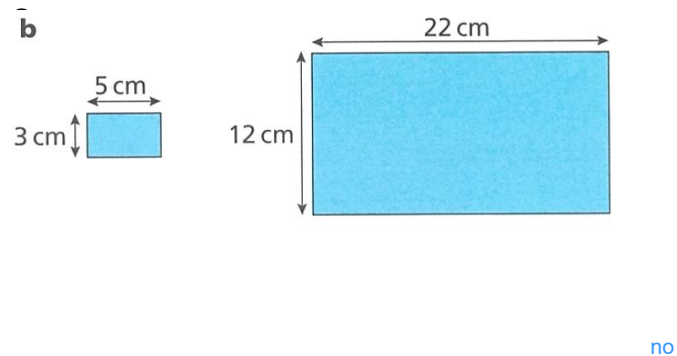


- a Name the angle on the larger triangle that corresponds to:
- | | | |
|----------------|-----------------|------------------|
| i $\angle BAC$ | ii $\angle ABC$ | iii $\angle BCA$ |
| $\angle EDF$ | $\angle DEF$ | $\angle EFD$ |
- b Name the side on the larger triangle that corresponds to:
- | | | |
|--------|---------|----------|
| i AB | ii BC | iii CA |
| DE | EF | FD |
- c Find the ratios of the sides.
- | | | |
|---------------------|----------------------|-----------------------|
| i $\frac{DE}{AB} =$ | ii $\frac{EF}{BC} =$ | iii $\frac{FD}{CA} =$ |
| 2 | 2 | 2 |
- d Therefore, explain why the two triangles are similar. Corresponding angles are equal. Corresponding sides are in the same ratio.

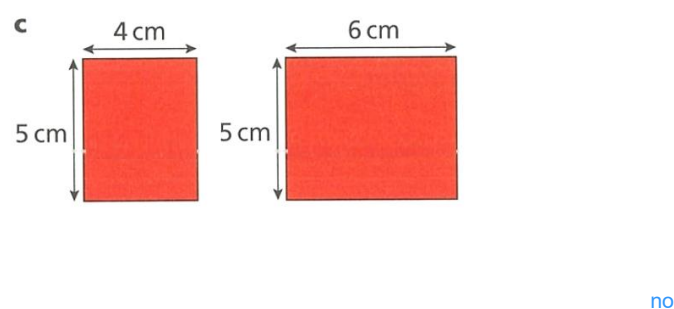
- 3 Decide whether these pairs of rectangles are similar by checking if corresponding sides are in equal ratio.



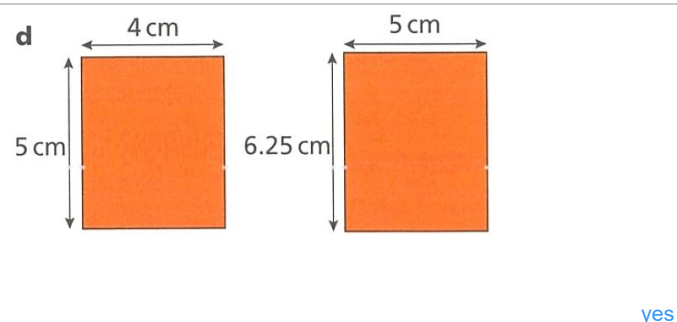
yes



no



no



yes

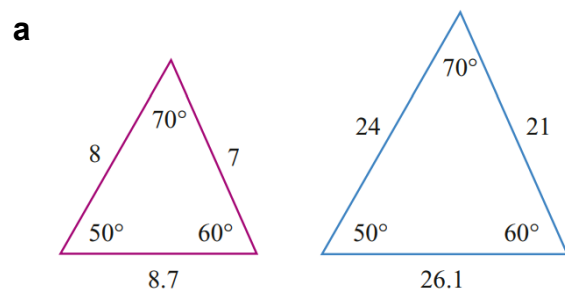
- 4 Why aren't all rectangles similar?

Although all rectangles always have the same angles, their side lengths are not always in the same ratio.

Angles, ratio

- 5 Decide whether these shapes are similar. Remember that two shapes are similar if:

- All corresponding angles equal.
- All corresponding sides in equal ratio.



All angles the same? Yes | No

yes

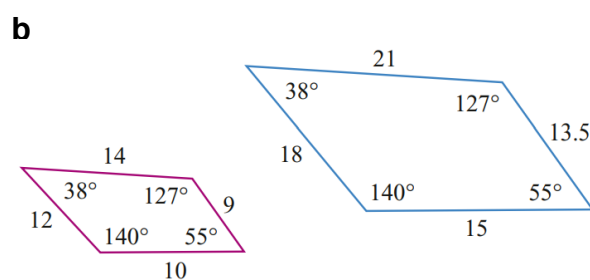
All sides in equal ratio? Yes | No

$$\frac{21}{7} = 3 \quad \frac{24}{8} = 3 \quad \frac{26.1}{8.7} = 3$$

Similar? Yes | No

yes

yes



All angles the same? Yes | No

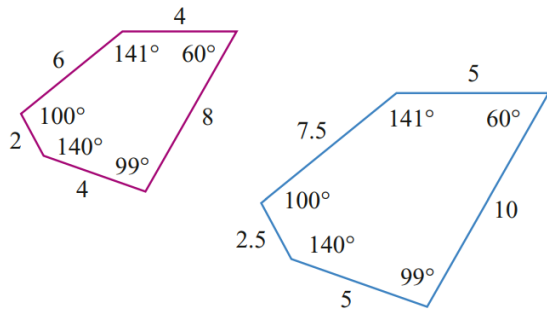
yes

All sides in equal ratio? Yes | No

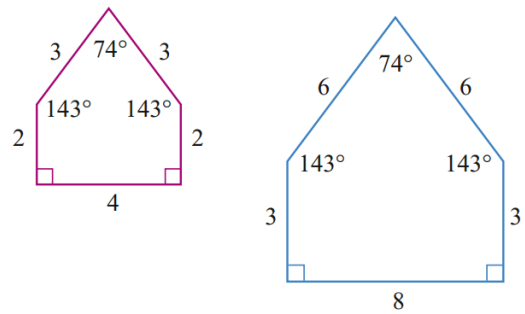
Similar? Yes | No

yes

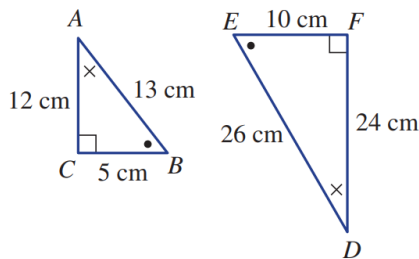
yes

c

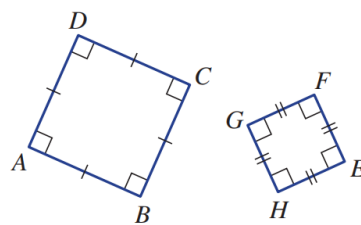
All angles equal, all corresponding sides in same ratio of 1.25
Yes, similar

d

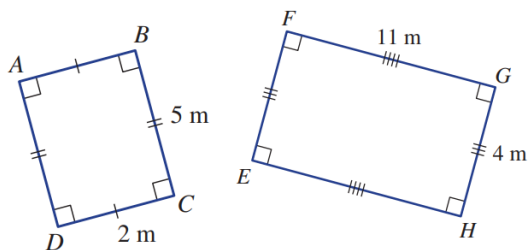
All angles equal, not all sides in same ratio
Not similar

e

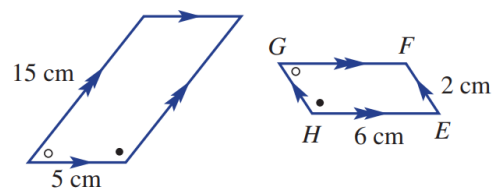
All angles equal, all corresponding sides in same ratio of 2
Yes, similar

f

Yes, all squares are similar

g

All angles equal, not all sides in same ratio
Not similar

h

All angles equal, all corresponding sides in same ratio of 2.5
Yes, similar

- 6 These statements are correct. Provide justification.
- a All squares are similar.

All angles are equal at 90°

If one side is multiplied by some factor k , then all sides must be multiplied by some factor k as a square has all equal sides.

Therefore, all sides would be in the same ratio. So, similar.

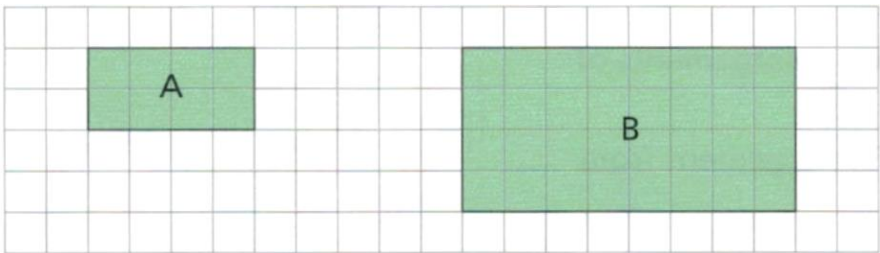
- b All equilateral triangles are similar.

All angles are equal at 60°

If one side is multiplied by some factor k , then all sides must be multiplied by some factor k as an equilateral triangle has all equal sides.

Therefore, all sides would be in the same ratio. So, similar.

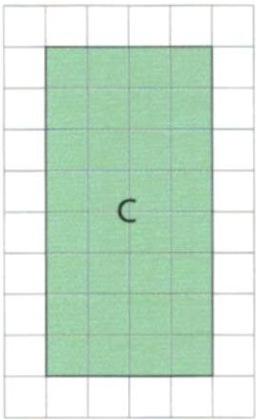
- 7 Here are two rectangles, A and B, drawn on a square grid.



- a Explain why rectangle B is similar to rectangle A

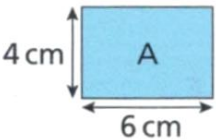
Each side has been doubled, so they are in the same ratio.

- b Here is a third rectangle, C.
Is rectangle C similar to rectangle A? Explain your answer.

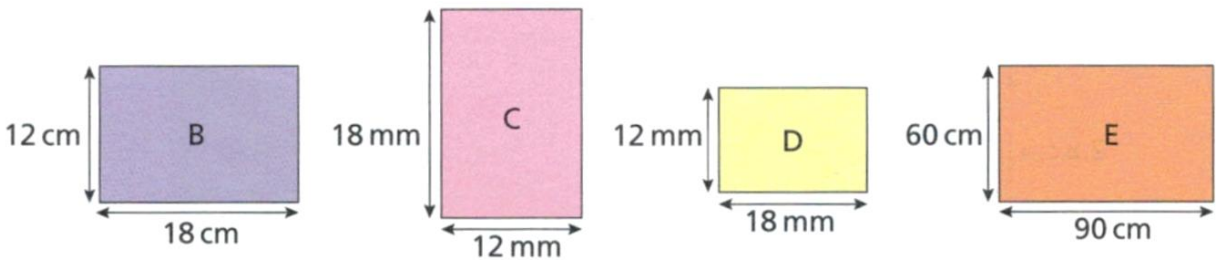


Yes, this is rectangle B but rotated.

- 8 Here is rectangle A.



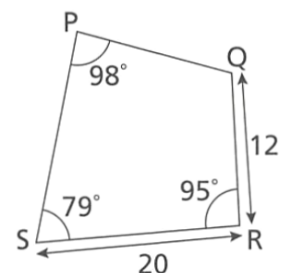
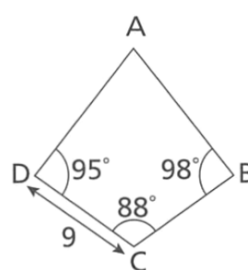
Which of these rectangles are similar to rectangle A?



All of them

9

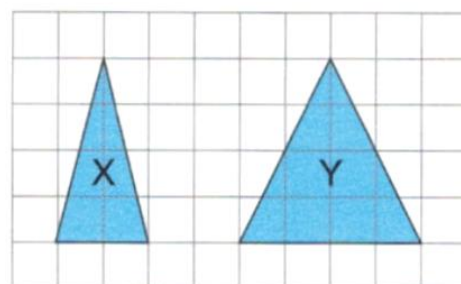
- a Find the missing angles in the quadrilaterals.
- b Explain why you can't say for certain these two quadrilaterals are similar.



The missing angles are 79° and 88°

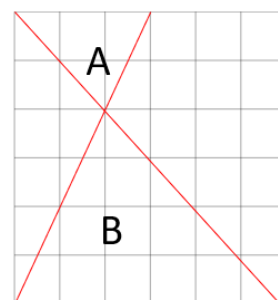
The two shapes don't have the same angles, so they cannot be similar.

- 10 Here are two triangles, X and Y.
Explain why triangle X is not similar to triangle Y.



No, the base has been doubled but the height has not been doubled.

- 11 Whitney says triangle A and B are similar. Do you agree? Why?



Yes, B has double the base and double the height of A.

- 12 Are all circles similar?

Yes.