

MYSTERY PICTURE

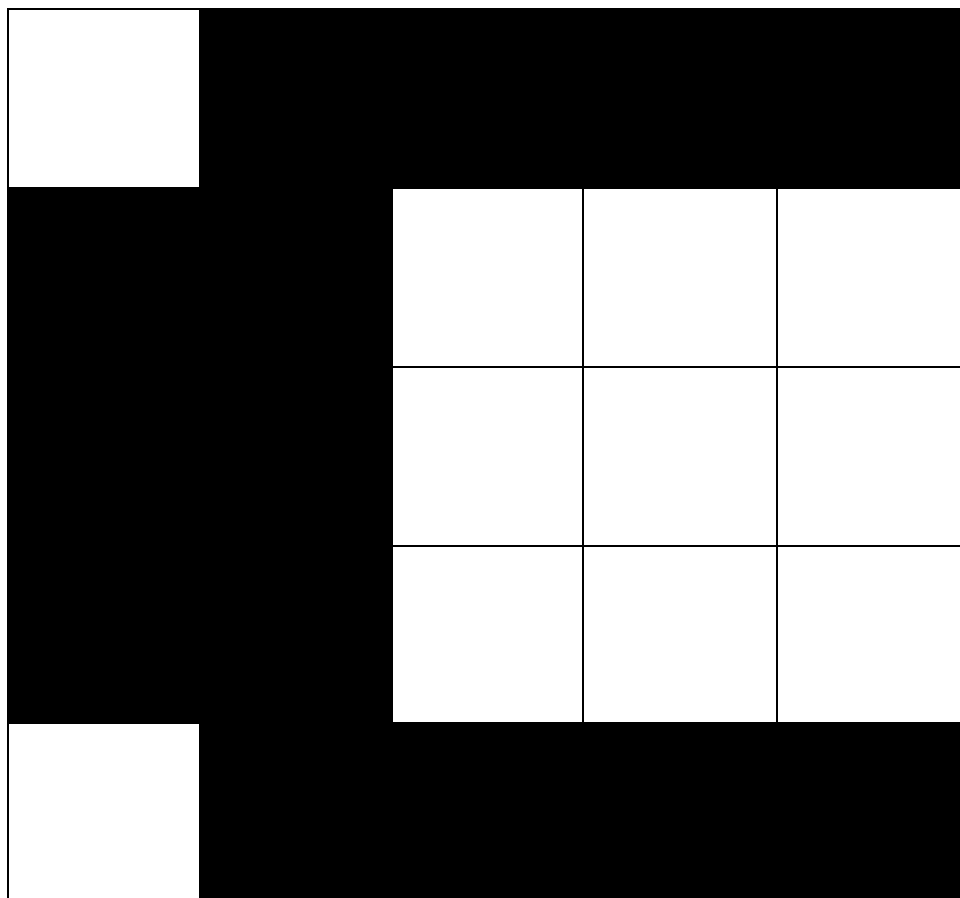


THE TRIANGLE PROPORTIONALITY THEOREM

Is This Proportion True?

25 proportions · three lettered figures · true or not?

FREE



1. **Hand out page 3**, one per student. Pencils. Nothing else is needed.
2. **Say this once:** *“Find the figure with the same letters. Check that both fractions are built the same way. If the proportion is true, fill the square with slanted lines. If not, leave it white.”*
3. **When a student finishes, look at the picture.** If it is not the letter C, a square is wrong. The student finds it and checks it again.

Student sheet	page 3, one per student. The three figures and the three true forms of the proportion are printed at the top.
Answers	page 4: the finished picture and the reason for every square.

This sheet practices one question: is this proportion true? A segment parallel to one side of a triangle cuts the other two sides into pieces that are in proportion. A true proportion builds both fractions the same way: corner piece over other piece ($AD/DB = AE/EC$), or corner piece over whole side ($AD/AB = AE/AC$). The segment across goes with the third side and with a corner piece over its whole side ($DE/BC = AD/AB$). Turning both fractions upside down keeps a proportion true. A “corner piece” is the piece that touches the corner where the two cut sides meet.

Each white square shows a common mistake. Four put the segment across into a proportion with the wrong lengths, usually two pieces. This is the most common mistake on this topic. Others mix a piece over a piece with a piece over a whole side, or turn one fraction upside down. In Figure 2 nothing says the segment is parallel, so none of its four squares is sure, even though every one of them would be true with arrowheads. The segment looks parallel on purpose: looking parallel is not a reason.

Fourteen squares are filled and eleven are white. Figure 3 stands with its shared corner at the bottom, because students often miss the pattern when the figure is turned. A student who fills every proportion that would be true with arrowheads gets four squares wrong, all in Figure 2. Guessing does not work: every simple guessing rule gets at least seven squares wrong.



This is the free lesson this activity came from. The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.
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Mystery Picture

Is the proportion true?

Name _____

Period _____

Date _____

Each square is a proportion. Its letters tell you which figure to look at. Is the proportion true? If yes, fill the square with slanted lines. If no, leave it white. When you finish, look at the picture. If part of it is missing, or one square does not fit, check that square again.

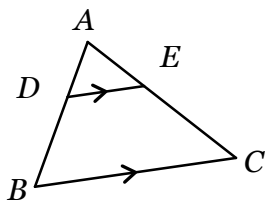


Figure 1. $DE \parallel BC$

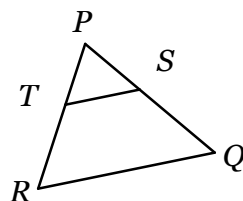


Figure 2. Nothing says ST is parallel to QR .

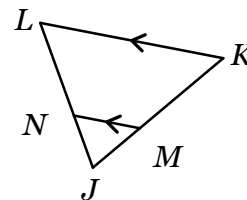


Figure 3. $MN \parallel KL$

A, P and J are the corners where two sides are cut. A piece that touches that corner is a **corner piece**. A proportion is true when both fractions are built the same way:

$$\frac{AD}{DB} = \frac{AE}{EC}$$

$$\frac{AD}{AB} = \frac{AE}{AC}$$

$$\frac{DE}{BC} = \frac{AD}{AB}$$

Both fractions may be turned upside down. **Only arrowheads show that a segment is parallel.** The figures are not to scale, so a segment that only looks parallel does not count.

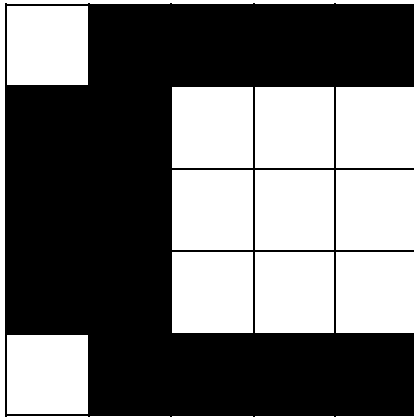
1 $\frac{AD}{DB} = \frac{DE}{BC}$	2 $\frac{JM}{JK} = \frac{JN}{JL}$	3 $\frac{AD}{DB} = \frac{AE}{EC}$	4 $\frac{MK}{JM} = \frac{NL}{JN}$	5 $\frac{DE}{BC} = \frac{AD}{AB}$
6 $\frac{JN}{NL} = \frac{JM}{MK}$	7 $\frac{AB}{AD} = \frac{AC}{AE}$	8 $\frac{PS}{SQ} = \frac{PT}{TR}$	9 $\frac{JM}{JK} = \frac{JN}{NL}$	10 $\frac{AD}{DB} = \frac{AE}{AC}$
11 $\frac{MN}{KL} = \frac{JN}{JL}$	12 $\frac{DB}{AB} = \frac{EC}{AC}$	13 $\frac{JN}{NL} = \frac{MN}{KL}$	14 $\frac{ST}{QR} = \frac{PS}{PQ}$	15 $\frac{AD}{DB} = \frac{EC}{AE}$
16 $\frac{EC}{AE} = \frac{DB}{AD}$	17 $\frac{KL}{MN} = \frac{JK}{JM}$	18 $\frac{DE}{BC} = \frac{DB}{AB}$	19 $\frac{PS}{PQ} = \frac{PT}{PR}$	20 $\frac{MN}{KL} = \frac{JM}{MK}$
21 $\frac{SQ}{PS} = \frac{TR}{PT}$	22 $\frac{JM}{JK} = \frac{MN}{KL}$	23 $\frac{AC}{EC} = \frac{AB}{DB}$	24 $\frac{JN}{JL} = \frac{JM}{JK}$	25 $\frac{AE}{AC} = \frac{DE}{BC}$



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Mystery Picture — answers

For the teacher



The finished picture is **the letter C**: a back two squares thick, with a bar of four squares at the top and at the bottom.

A square is filled when its figure has arrowheads and both fractions are built the same way. It is white when the fractions are built differently, or when the figure has no arrowheads.

To check a square with a student, point at each of the four segments in the figure and ask: “Is this a corner piece, the other piece, a whole side, or the segment across?”

1–5	1 · white $AD/DB = DE/BC$ DE is not one of the four pieces. Beside DE/BC the other fraction must be a corner piece over its whole side, not a piece over a piece.	2 · FILL $JM/JK = JN/JL$ Both fractions are a corner piece over its whole side, built the same way on the two cut sides.	3 · FILL $AD/DB = AE/EC$ Both fractions are a corner piece over the other piece, built the same way on the two cut sides.	4 · FILL $MK/JM = NL/JN$ Both fractions are the other piece over a corner piece, built the same way on the two cut sides.	5 · FILL $DE/BC = AD/AB$ DE goes with BC, and AD/AB is a corner piece over its whole side, the same way up.
6–10	6 · FILL $JN/NL = JM/MK$ Both fractions are a corner piece over the other piece, built the same way on the two cut sides.	7 · FILL $AB/AD = AC/AE$ Both fractions are its whole side over a corner piece, built the same way on the two cut sides.	8 · white $PS/SQ = PT/TR$ Nothing marks ST parallel to QR, so the theorem says nothing. It may look parallel, but only arrowheads count.	9 · white $JM/JK = JN/NL$ One fraction is a corner piece over its whole side. The other is a corner piece over the other piece. Both must be built the same way.	10 · white $AD/DB = AE/AC$ One fraction is a corner piece over the other piece. The other is a corner piece over its whole side. Both must be built the same way.
11–15	11 · FILL $MN/KL = JN/JL$ MN goes with KL, and JN/JL is a corner piece over its whole side, the same way up.	12 · FILL $DB/AB = EC/AC$ Both fractions are the other piece over its whole side, built the same way on the two cut sides.	13 · white $JN/NL = MN/KL$ MN is not one of the four pieces. Beside MN/KL the other fraction must be a corner piece over its whole side, not a piece over a piece.	14 · white $ST/QR = PS/PQ$ Nothing marks ST parallel to QR, so the theorem says nothing. It may look parallel, but only arrowheads count.	15 · white $AD/DB = EC/AE$ One fraction is a corner piece over the other piece. The other fraction is turned upside down.
16–20	16 · FILL $EC/AE = DB/AD$ Both fractions are the other piece over a corner piece, built the same way on the two cut sides.	17 · FILL $KL/MN = JK/JM$ MN goes with KL, and JK/JM is a whole side over its corner piece, the same way up.	18 · white $DE/BC = DB/AB$ DE/BC matches a corner piece over its whole side. DB/AB is the other piece over its whole side.	19 · white $PS/PQ = PT/PR$ Nothing marks ST parallel to QR, so the theorem says nothing. It may look parallel, but only arrowheads count.	20 · white $MN/KL = JM/MK$ MN is not one of the four pieces. Beside MN/KL the other fraction must be a corner piece over its whole side, not a piece over a piece.
21–25	21 · white $SQ/PS = TR/PT$ Nothing marks ST parallel to QR, so the theorem says nothing. It may look parallel, but only arrowheads count.	22 · FILL $JM/JK = MN/KL$ MN goes with KL, and JM/JK is a corner piece over its whole side, the same way up.	23 · FILL $AC/EC = AB/DB$ Both fractions are its whole side over the other piece, built the same way on the two cut sides.	24 · FILL $JN/JL = JM/JK$ Both fractions are a corner piece over its whole side, built the same way on the two cut sides.	25 · FILL $AE/AC = DE/BC$ DE goes with BC, and AE/AC is a corner piece over its whole side, the same way up.