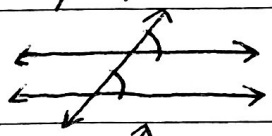
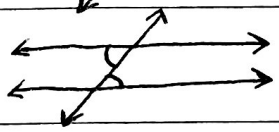
# 10.5 Two-Column Proofs and Application Problems

**Two Column Proofs**

Sometimes you will be asked to give a more formal proof, which is traditionally done in a two-column format. The left column is where you state what you know, and the right column is where you state how you know it.

| **Important Properties** | |
|---|---|
| Addition or Subtraction | Adding or subtracting numbers<br>ex: $2+3=5$ (Addition) $10-6=4$ (subtraction) |
| Multiplication or Division | Multiplying or dividing numbers<br>ex: $6 \cdot 2 = 12$ (Multiplication) $\frac{20}{5}=4$ (Division) |
| Substitution | Plugging stuff in, substituting for something else<br>ex: For $5x+3$, $x=-1$, so $5(-1)+3=-2$ |
| Reflexive | Something equals itself<br>ex: $a=a$ |
| Commutative | Multiplication order doesn't matter<br>ex: $5 \cdot 3 = 3 \cdot 5$, $ab=ba$ |
| Transitive | If $a=b$ and $b=c$, then $a=c$<br>ex: $x=4$, $x=y$, $y=4$ |
| Vertical Angles |  Vertical angles are congruent |
| Corresponding Angles |  Corresponding angles (angles in the same spot between top & bottom) are congruent |
| Alternate Interior Angles |  Alternate interior angles are congruent |

Questions to ask yourself when writing a similarity two-column proof:

1) What do I know before I start any of the math? (This is your given information)

2) Can I show that any of the angles are congruent?

- If yes, how?

3) Can I show that the side lengths are proportional?

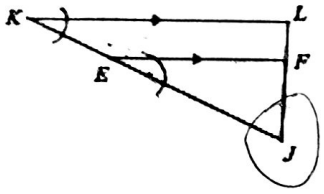
- Once you set up the fractions, what are the **names** of the sides you used?

4) What similarity theorem fits the situation? Write the similarity statement and how you know.

We are going to use the informal proofs to write two-column proofs. **Nothing different is happening than what you did in 10.4;** you are doing the same thing and then justifying each step that you took.

The first thing that you should list in any two-column proof is the given information.

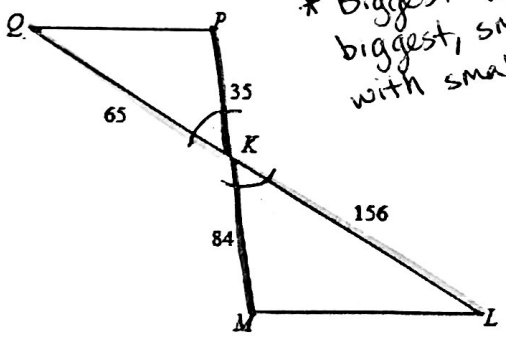
1) Prove that the two triangles are similar.




$\Delta JKL \sim$ _____

| Statement | Reason |
|---|---|
| $\overline{KL}$ is parallel to $\overline{EF}$ | Given |
| $\angle J \cong \angle J$ | Reflexive property |
| $\angle JKL \cong \angle JEF$ | Corresponding angles |
| $\Delta JKL \sim \Delta JEF$ | AA Similarity |

2) Prove that the two triangles are similar.



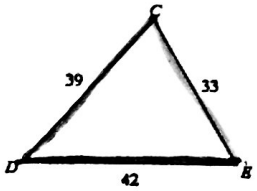

* Biggest with biggest, smallest with smallest

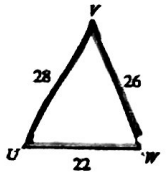
$\frac{35}{84} = \frac{65}{156}$

$0.42 = 0.42$

| Statement | Reason |
|---|---|
| $\angle QKP \cong \angle MKL$ | Vertical angles |
| $\frac{35}{84} = \frac{65}{156}$ | Division property |
| $\frac{PK}{KM} = \frac{QK}{KL}$ | Substitution property |
| $\Delta QPK \sim \Delta LMK$ | SAS Similarity |

3) Prove that the two triangles are similar.




$\Delta EDC \sim$ _____

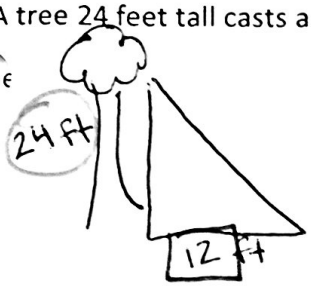
$\frac{42}{28} = \frac{33}{22} = \frac{39}{26}$

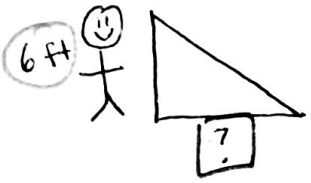
$1.5 = 1.5 = 1.5$

| Statement | Reason |
|---|---|
| $\frac{42}{28} = \frac{33}{22} = \frac{39}{26}$ | Division property |
| $\frac{DE}{UV} = \frac{CE}{UW} = \frac{DC}{VW}$ | Substitution property |
| $\Delta EDC \sim \Delta UVW$ | SSS Similarity |

**Application Problems**

1) A tree 24 feet tall casts a shadow 12 feet long. Brad is 6 feet tall. How long is Brad's shadow?



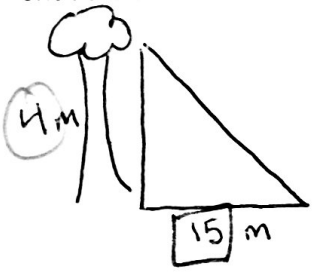

$\frac{24}{6} \times \frac{12}{x}$

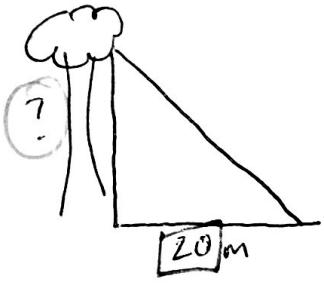
$\frac{24x}{24} = \frac{72}{24}$

$x =$ 3 feet

* Make sure answer has units

2) A tree with a height of 4m casts a shadow 15 m long on the ground. How high is another tree that casts a shadow which is 20 m long?



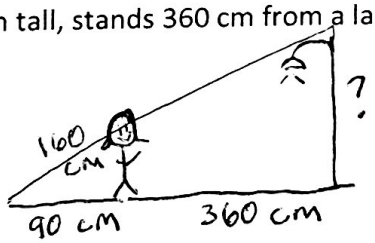



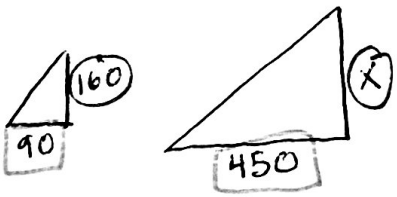

$\frac{4}{x} \times \frac{15}{20}$

$\frac{15x}{15} = \frac{80}{15}$

$x =$ 5.33 m

3) A girl 160 cm tall, stands 360 cm from a lamp post at night. Her shadow is 90 cm long. How high is the lamp post?




$\frac{160}{x} \times \frac{90}{450}$

$\frac{90x}{90} = \frac{72000}{90}$

$x =$ 800 cm

Big idea of word problems:

Draw it!

One sentence/piece at a time.