Key

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Math 118 - Dr. Miller - Exam #3 - Spring 2006

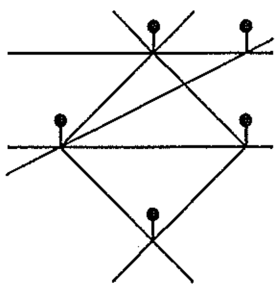
(-2) all sides + angles...

1. *[6 pts]* State any two meanings of the term "congruent."

Objects are congruent if:
1) they are exactly the same size + shape.
2) all of their measurements are identical.
3) one can be moved to coincide with the other.

(-2) wrong acronym

(*) 2. *[6 pts]* Will this pin-and-straw construction be rigid? Explain, naming the congruence acronym that is most prevalent in considerations of rigidity.



Yes. Because each straw has been pinned to create the vertices of a triangle, SSS says those triangles can't change shape.

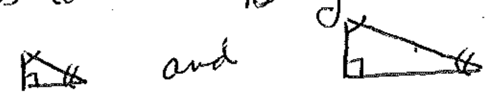
3. *[4 pts]* We know that the acronym "SAS" stands for the phrase "side-angle-side." Explain precisely what this statement says mathematically (either version is acceptable).

Version #1 - Given the lengths of 2 sides + an included angle, exactly one shape of triangle can be built.

Version #2 - If 2 sides + the included angle of one triangle are congruent to those of another triangle, the triangles themselves are congruent.

4. *[6 pts]* Give an acronym that cannot guarantee triangle congruence, then explain why not, referring to a supporting diagram if you wish.

AAA - It's possible for 2 triangles to have congruent pairs of angles without being the same size:



ASS - It's possible for 2 triangles to have a pair of congruent angles not included between pairs of congruent sides without the triangles themselves being congruent.

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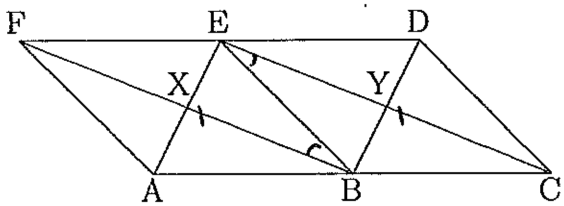
5. *[18 pts - 6 each]* Apply the given information to each diagram to find a pair of congruent triangles. For each:

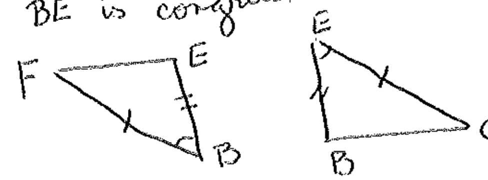
- Use correct notation to tell which two triangles they are.
- Specify the acronym that guarantees their congruence.
- Thoroughly explain how you arrived at your conclusion.

① Δs ① acro. ④ expl.

(a) Assume *nothing* except that $\overline{FB} \cong \overline{EC}$ and that $\angle FBE \cong \angle BEC$.



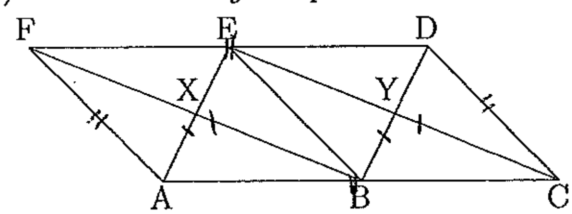
$\overline{BE}$ is congruent to itself, so



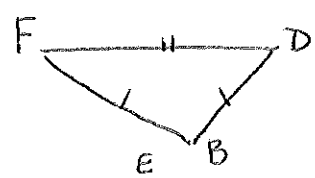
$\triangle FBE \cong \triangle CEB$
by SAS.

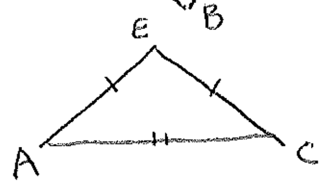
③ Δs

* (b) Assume *nothing* except that $\overline{AE} \cong \overline{CE} \cong \overline{FB} \cong \overline{DB}$ and that $ACDF$ is a rhombus.



$\overline{DF} \cong \overline{AC}$ because we have a rhombus, so

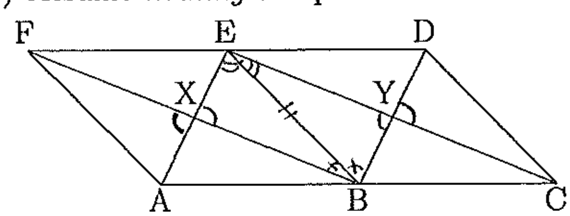




by SSS

$\triangle FDB \cong \triangle CAE$ or $\triangle ACE$

* (c) Assume *nothing* except that $\angle AXF \cong \angle DYC$ and that $\overline{BE}$ bisects $\angle AEC$.



Because $\angle EXB$, $\angle EYB$ are vertical with the given ones, they're $\cong$.
Now the third angles in $\triangle EXB$ and $\triangle EYB$ must be $\cong$ due to the 180° total.

$\overline{BE} \cong \overline{BE}$, so

$\triangle EXB \cong \triangle EYB$ by ASA

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6. *[6 pts]* I hope to view the Gateway Arch in St. Louis while at my conference (if it's a good conference, I won't get time!). If my shadow is 3.2 feet long while the Arch's is 376.8 feet long, how tall is the arch? I am 5.25 feet tall. Show clear work, but you need not explain. Round to the nearest tenth if needed.

me Arch

$$\frac{5.25}{3.2} = \frac{x}{376.8}$$

$$3.2x = 1978.2$$

$$\boxed{x = 618.2\text{ft}}$$

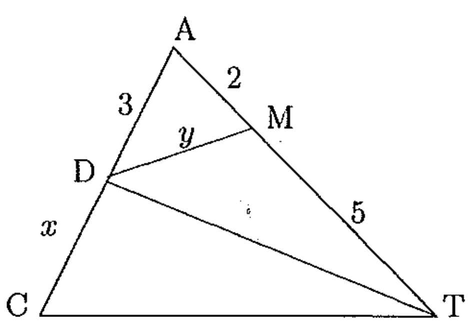
* 7. *[4 pts]* An adult giraffe and its young are geometrically similar. The adult is 18 feet tall and the youngster is 6 feet tall. How many times stronger is the adult than the youngster? Briefly explain.

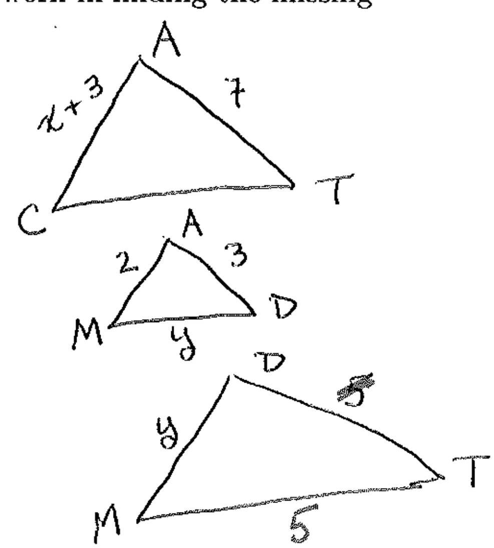
The scale factor from young to adult is 3. Strength is related to area of muscle bundle:
new area = $(s.f.)^2$ old area
The adult is 9 times stronger.

-3 3
-2 27
-3 324...

* 8. *[12 pts]* In the figure, $\triangle CAT \sim \triangle MAD \sim \triangle MDT$. Show work in finding the missing lengths x and y, rounded to the nearest tenth.

4 prop.





$$\frac{x+3}{2} = \frac{7}{3}$$

$$3(x+3) = 14$$

$$3x+9 = 14$$

$$3x = 5$$

$$\boxed{x = 5/3} = 1.7$$

$$\frac{2}{y} = \frac{y}{5}$$

$$10 = y^2$$

$$\boxed{y = \sqrt{10}} = 3.2$$

$\frac{26}{26}$

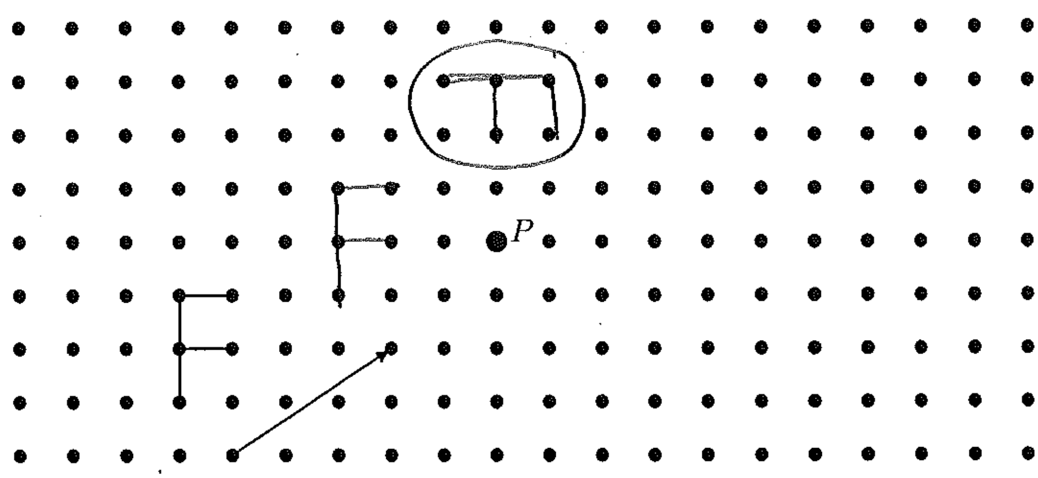
* 9. *[8 pts]* Two rectangular boxes are mathematically similar. The surface area of one is 15.2 square meters while that of the other is 237.5 square meters. If the volume of the smaller one is 100 cubic meters, what is the volume of the larger? Show work, but you need not explain. Round to the nearest tenth.

-6 no A,V consider

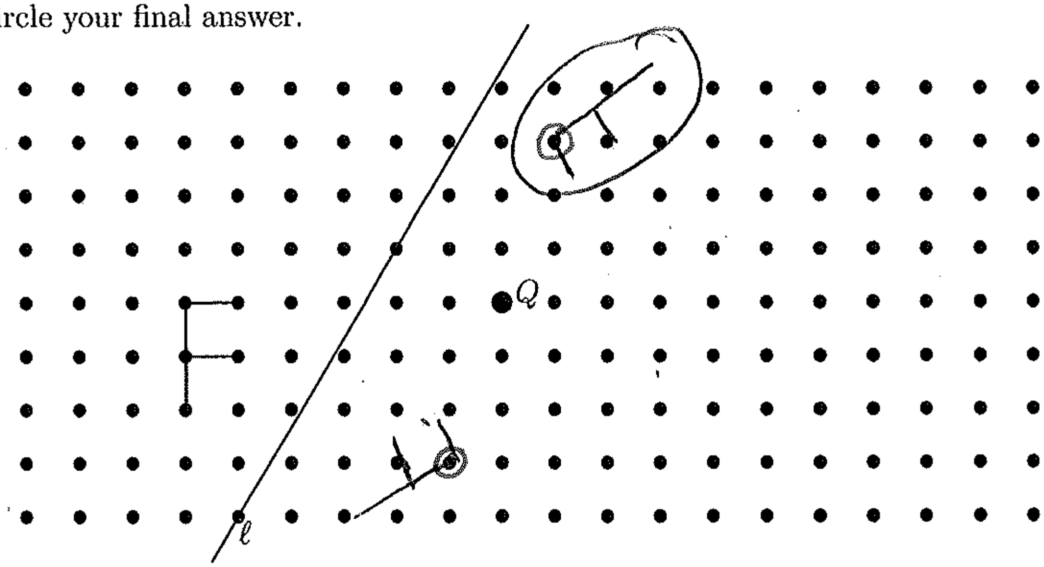
$$\text{new area} = (s.f.)^2 \cdot \text{old area}$$
$$237.5 = (s.f.)^2 \cdot 15.2$$
$$15.625 = (s.f.)^2$$
$$3.9 = (s.f.)$$

$$\text{new vol} = (3.9)^3 \cdot 100 = \boxed{5931.9\ m^3}$$

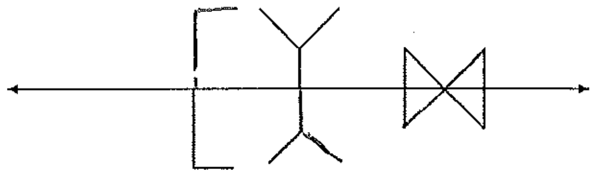
10. (a) *[8 pts]* Translate the "F" via the arrow, then rotate the result 90° clockwise around point O. Circle your final answer.



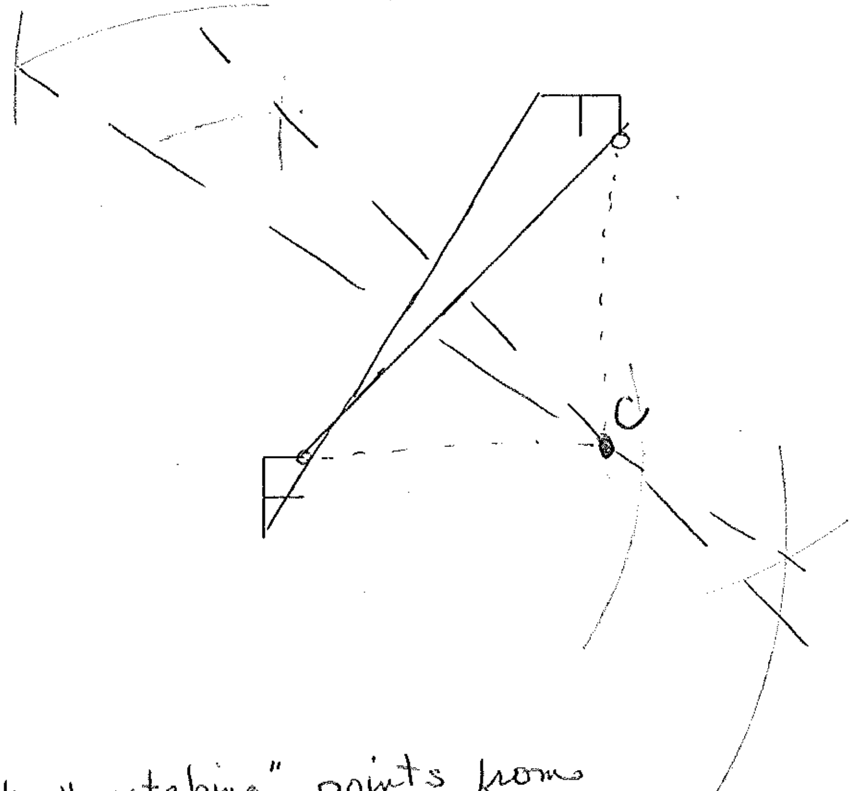
(b) *[10 pts]* Reflect the "F" through line ℓ, then rotate the result 180° around point Q. Circle your final answer.



11. *[4 pts]* Complete the diagram so that line ℓ is a line of reflection.



12. *[8 pts]* One of these figures is the image of the other after a rotation about point C. *Precisely* locate the center of rotation, explaining your technique. (Leave any scratch marks in place for grading purposes.)



Connect "matching" points from the two F's, then construct the perpendicular bisector of the segment you just made. Repeat with a second pair of matching points. Where the bisectors intersect is the center of rotation.