Online HW 8: Similarity

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Contents

Transformations

Short-answer problems about transformations.

Question 1 *Under a dilation about center O and scale factor $r > 0$, the image of P is a point Q so that Q lies on $\overrightarrow{OP}$ and $\boxed{?}$. The image of O is $\boxed{?}$.*

Question 2 *Compare and contrast the ideas of equal triangles, congruent triangles, and similar triangles.*

Question 3 *Explain why all equilateral triangles are similar to each other.*

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Question 4 *Explain why all isosceles right triangles are similar to each other.*

Question 5 *Explain why when given a right triangle, the altitude of the right angle divides the triangle into two smaller triangles each similar to the original right triangle.*

Question 6 *The following sets contain lengths of sides of similar triangles. Solve for all unknowns—give all solutions. In each case explain your reasoning.*

(a) $\{3, 4, 5\}$, $\{6, 8, \boxed{?}\}$

(b) $\{3, 3, 5\}$, $\{9, 9, \boxed{?}\}$

(c) $\{5, 5, x\}$, $\{10, 4, y\}$

(d) $\{5, 5, x\}$, $\{10, 8, y\}$

(e) $\{3, 4, x\}$, $\{4, 5, y\}$

Question 7 *A Pythagorean Triple is a set of three positive integers $\{a, b, c\}$ such that $a^2 + b^2 = c^2$. Write down an infinite list of Pythagorean Triples. Explain your reasoning and justify all claims.*

Question 8 *Here is a right triangle, **not** drawn to scale:*
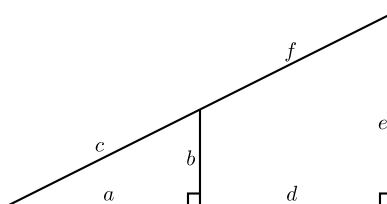
Solve for all unknowns in the following cases.

(a) $a = 3$, $b = \boxed{?}$, $c = \boxed{?}$, $d = 12$, $e = 5$, $f = \boxed{?}$

(b) $a = \boxed{?}$, $b = 3$, $c = \boxed{?}$, $d = 8$, $e = 13$, $f = \boxed{?}$

(c) $a = 7$, $b = 4$, $c =?$, $d =?$, $e = 11$, $f =?$

(d) $a = 5$, $b = 2$, $c =?$, $d = 6$, $e =?$, $f =?$

In each case explain your reasoning.

Question 9 *Suppose you have two similar triangles. What can you say about the area of one in terms of the area of the other? Be specific and explain your reasoning.*

Question 10 *During a solar eclipse we see that the apparent diameter of the Sun and Moon are nearly equal. If the Moon is around 240000 miles from Earth, the Moon's diameter is about 2000 miles, and the Sun's diameter is about 865000 miles how far is the Sun from the Earth?*

(a) *Draw a relevant (and helpful) picture showing the important points of this problem.*

(b) *Solve this problem, be sure to explain your reasoning.*

Question 11 *When jets fly above 8000 meters in the air they form a vapor trail. Cruising altitude for a commercial airliner is around 10000 meters. One day I reached my arm into the sky and measured the length of the vapor trail with my hand—my hand could just span the entire trail. If my hand spans 9 inches and my arm extends 25 inches from my eye, how long is the vapor trail? Explain your reasoning.*

  (a) *Draw a relevant (and helpful) picture showing the important points of this problem.*

  (b) *Solve this problem, be sure to explain your reasoning.*

Question 12 *David proudly owns a 42 inch (measured diagonally) flat screen TV. Michael proudly owns a 13 inch (measured diagonally) flat screen TV. Dave sits comfortably with his dog Fritz at a distance of 10 feet. How far must*

Michael stand from his TV to have the "same" viewing experience? Explain your reasoning.

(a) *Draw a relevant (and helpful) picture showing the important points of this problem.*

(b) *Solve this problem, be sure to explain your reasoning.*

Question 13 *You love IMAX movies. While the typical IMAX screen is 72 feet by 53 feet, your TV is only a 32 inch screen—it has a 32 inch diagonal. How close do you have to sit to your screen to simulate the IMAX format? Explain your reasoning.*

(a) *Draw a relevant (and helpful) picture showing the important points of this problem.*

(b) *Solve this problem, be sure to explain your reasoning.*

Question 14 *Here is a personal problem: Suppose you are out somewhere and you see that when you stretch out your arm, the width of your thumb is the same apparent size as a distant object. How far away is the object if you know the object is:*

(a) *6' long (as tall as a person).*

(b) *16' long (as long as a car).*

(c) *40' long (as long as a school bus).*

(d) *220' long (as long as a large passenger airplane).*

(e) *340' long (as long as an aircraft carrier).*

Explain your reasoning.

Question 15 *I was walking down Woody Hayes Drive, standing in front of St. John Arena when a car pulled up and the driver asked, "Where is Ohio Stadium?" At this point I was a bit perplexed, but nevertheless I answered, "Do you see the enormous concrete building on the other side of the street that looks like the Roman Colosseum? That's it."*

The person in the car then asked, "Where are the Twin-Towers then?" Looking up, I realized that the towers were in fact just covered by top of Ohio Stadium. I told the driver to just drive around the stadium until they found two enormous identical towers—that would be them. They thanked me and I suppose they met their destiny.

I am about 2 meters tall, I was standing about 100 meters from the Ohio Stadium and Ohio Stadium is about 40 meters tall. If the Towers are around 500 meters from the rotunda (the front entrance of the stadium), how tall could they be and still be obscured by the stadium? Explain your reasoning—for the record, the towers are about 80 meters tall.

Question 16 *Explain how to use the notion of similar triangles to multiply numbers with your answer expressed as a segment of the appropriate length.*

Question 17 *Explain how to use the notion of similar triangles to divide numbers with your answer expressed as a segment of the appropriate length.*

Question 18 *Consider the following combinations of S's and A's. Which of them produce a Congruence Theorem? Which of them produce a Similarity Theorem? Explain your reasoning.*

SSS, SSA, SAS, SAA, ASA, AAA

Question 19 *Explain how the following picture "proves" the Pythagorean Theorem.*