Name: ____________________________________ Date: __________________

INTRODUCTION TO GEOMETRY
UNIT 5: SIMILARITY

Lesson 1: Ratio & Proportion

AIM: → *To define ratio & proportion*
→ *To solve for different values in proportions*

Def: A ***ratio*** is the comparison of two numbers that can be written in the form of $\frac{a}{b}, b \neq 0$

Ex. $\frac{4}{7}$ $\frac{2x+1}{4}$ $5x:8x$

Simplifying Ratios**:** When we simplify a ratio, we cancel all common factors of both the numerator and denominator, ***similar to when we simplify a fraction***.

Practice **–** Simplify the following ratios:

$\frac{30}{12}$ $\frac{4x+6}{8}$ $\frac{x^2+10x+25}{x+5}$

Def: A ***proportion*** is an equation that states that two ratios are equal.

The proportion $\frac{a}{b}=\frac{c}{d}$ can be written as $a:b=c:d$. The four numbers $a, b, c,$ and d are the terms of the proportion.

Practice **–** Determine whether each pair of ratios can form a proportion.

(a) $6:15;\ 4:10$ (b) $\frac{8}{7};\ \frac{56}{49}$ (c) $49:7;\ 1:7$

(d) $\frac{10}{15};\ \frac{8}{12}$ (e) $9:3;\ 16:4$ (f) $3a:5a;\ 12:20$

Find the value of *x* in each proportion.

(a) $4:x=10:15$

(b) $\frac{9}{8}=\frac{x}{36}$

(c) $\frac{12}{x+1}=\frac{8}{x}$

(d) $\frac{2}{x}=\frac{36}{12}$

(e) $3:x+5=4:8$

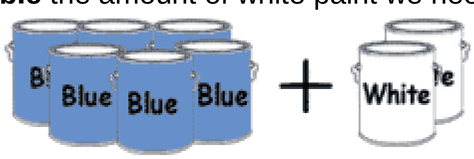
(f) $x+3:6=x-2:4$

Application of Ratios & Proportions

- Ratio is the number of **parts** to a mix. A paint mix is 4 parts, with 3 parts blue and 1 part white. Mixing paint in the ratio 3:1 (3 parts blue paint to 1 part white paint) means 3 + 1 = 4 parts in all.

- Two quantities are in **direct proportion** when they increase or decrease in the **same ratio.** This amount of paint will only decorate two walls of a room. What if you wanted to decorate the whole room (four walls)?

  You have to **double** the amount of paint and **increase** it in the **same ratio**.
  If we **double** the amount of blue paint we need 6 pots.
  If we **double** the amount of white paint we need 2 pots.



Ratio & Proportion Homework

Solve the given proportions.

1. $\frac{3}{x} = \frac{9}{15}$

2. $12:18 = x:9$

3. $3:8 = x:20$

4. $15:n = 12:16$

5. $\frac{3}{5} = \frac{9}{x}$

6. $\frac{w}{6} = \frac{7}{2}$

7. $\frac{24}{h} = \frac{16}{4}$

8. $\frac{x+2}{15} = \frac{42}{45}$

9. $\frac{x+1}{8} = \frac{9}{24}$

10. $y+1:12 = 3:4$

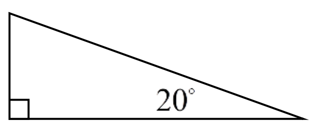
11. $\frac{2}{3} = \frac{p-2}{15}$

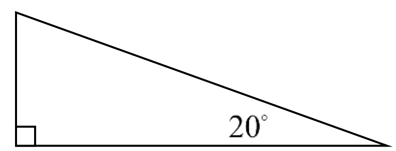
12. $\frac{x-2}{4} = \frac{x+5}{3}$

Lesson 2: Similar Right Triangles - Introduction to Trigonometry

Trigonometry is an ancient mathematical tool with many applications, even in our modern world. Ancient civilizations used right triangle trigonometry for the purpose of measuring angles and distances in surveying and astronomy, among other fields. When trigonometry was first developed, it was based on **similar right triangles**. We will explore this topic first in the following two exercises.

***Exercise* #1:** For each triangle, measure the length of each side to the nearest *tenth* of a *centimeter*, and then fill out the table below. Round each ratio to the nearest *hundredth*. When determining opposite and adjacent sides, refer to the 20° angle. To fill in the small box on the right, use your calculator, in **DEGREE MODE**, and express the values to the nearest *hundredth*.





	$\frac{\text{Opposite}}{\text{Adjacent}}$	$\frac{\text{Opposite}}{\text{Hypotenuse}}$	$\frac{\text{Adjacent}}{\text{Hypotenuse}}$
Triangle #1			
Triangle #2			

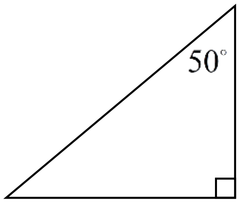
$\tan 20^\circ =$
$\sin 20^\circ =$
$\cos 20^\circ =$

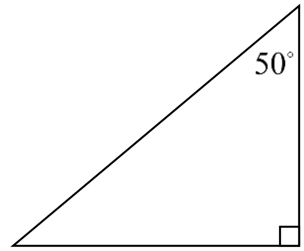
You should notice that the decimal $\tan 20^\circ$ is close to the decimals found in the first column for both triangles. Same goes for $\sin 20^\circ$ and the second column, and $\cos 20^\circ$ and the third column. The values in each column were found by turning the side ratios into decimals, yet the calculator gave us similar results.

When the calculator gives you these seemingly random decimals when you take the sine, cosine, or tangent of an angle, what it is really doing is calculating the **ratio** of the sides of any right triangle with acute angles of those measurements.

Let's try the exercise again and see if we get the same results.

***Exercise* #2:** Repeat Exercise #1 for the triangles show below that each have an acute angle of 50°.





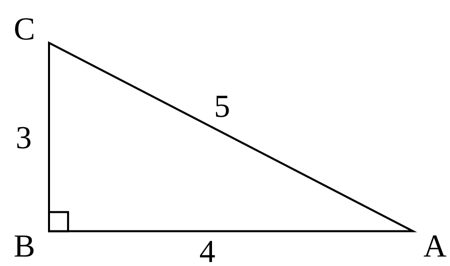
	$\frac{\text{Opposite}}{\text{Adjacent}}$	$\frac{\text{Opposite}}{\text{Hypotenuse}}$	$\frac{\text{Adjacent}}{\text{Hypotenuse}}$
Triangle #1			
Triangle #2			

$\tan 50^\circ =$

$\sin 50^\circ =$

$\cos 50^\circ =$

<u>The Right Triangle Trigonometric Ratios</u> – Although we won't prove this fact until a future geometry course, all right triangles that have a common acute angle are similar. Thus, the ratios of their corresponding sides are equal. A very long time ago, these ratios were given names. These trigonometric ratios (trig ratios) will be introduced through the following exercises, each of which refer to the diagram below.



In a right triangle:

$$\text{tangent of an angle} = \frac{\text{leg opposite of the angle}}{\text{leg adjacent to the angle}}$$

***Exercise* #3:** $\tan A =$ $\qquad$ $\tan C =$

$$\text{sine of an angle} = \frac{\text{leg opposite of the angle}}{\text{hypotenuse}}$$

***Exercise* #4:** $\sin A =$ $\qquad$ $\sin C =$

$$\text{cosine of an angle} = \frac{\text{leg adjacent to the angle}}{\text{hypotenuse}}$$

***Exercise* #5:** $\cos A =$ $\qquad$ $\cos C =$

Lesson 3: Trigonometry and SOH CAH TOA
Intro to Geometry

Yesterday, we began exploring the ratios associate with the sine, cosine, and tangent of the acute angles.

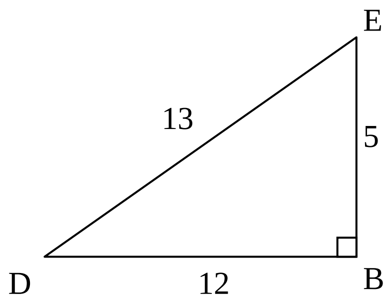
A Helpful Mnemonic For Remembering the Ratios:

SOH-CAH-TOA

Sine is **O**pposite over **H**ypotenuse – **C**osine is **A**djacent over **H**ypotenuse – **T**angent is **O**pposite over **A**djacent

YOU MUST BE ABLE TO SPELL THIS MNEMONIC CORRECTLY TO USE IT!!!!

***Exercise* #1:** Using the diagram below, state the value for each of the following trigonometric ratios.



(a) $\sin D =$

(b) $\cos D =$

(c) $\tan D =$

(d) $\tan E =$

(e) $\cos E =$

(f) $\sin E =$

Exercise # 2 : Using the diagram below, state the value for each of the following trigonometric ratios.

(a) $\tan Q =$

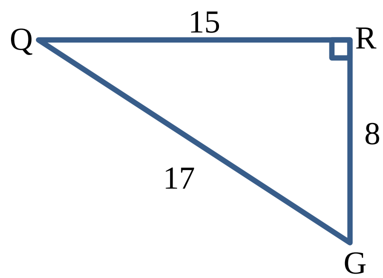
(b) $\cos Q =$

(c) $\sin Q =$

(d) $\sin G =$

(e) $\tan G =$

(f) $\cos G =$



NOTE: You will **NEVER** be asked to find the sine, cosine, or tangent of the right angle.

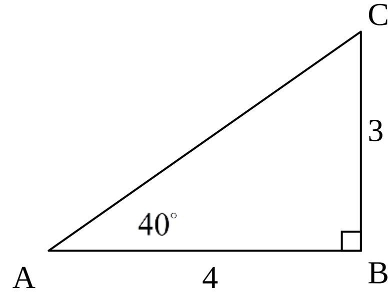
Now that we are in **DEGREE MODE**, we can start evaluating some trig ratios without referring to any right triangles whatsoever. The **SIN**, **COS**, and **TAN** buttons are located in the center of the key pad.

***Exercise* #3:** Evaluate each of the following. Round your answers to the nearest *thousandth*.

(a) $\tan(40^\circ)$ (b) $\cos(20^\circ)$ (c) $\sin(63^\circ)$

It is important to remember that each of the answers from ***Exercise* #3**, represent the **ratio of two sides of a right triangle**. In each case the ratio has already been divided and the calculator is giving the decimal form of the ratio.

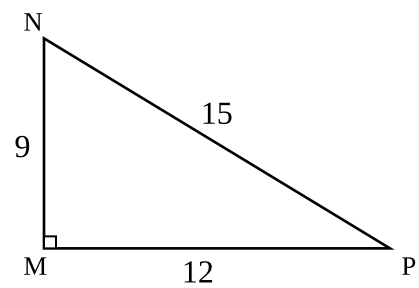
***Exercise* #4:** Could the right triangle below exist with the given measurements? Explain your answer.



Trigonometry and SOH CAH TOA

Skills

For problems 1 – 6, use the triangle to the right to find the given trigonometric ratios.



1. cos N =

2. sin N =

3. tan N =

4. sin P =

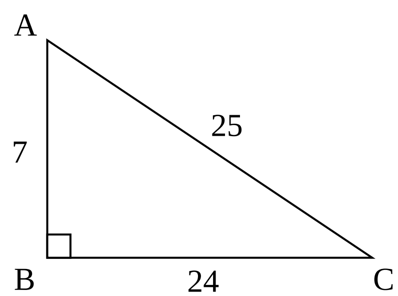
5. cos P =

6. tan P =

7. Given the right triangle shown, which of the following represents the value of $\tan A$?

(1) $\frac{25}{24}$ (3) $\frac{7}{24}$

(2) $\frac{24}{7}$ (4) $\frac{24}{25}$



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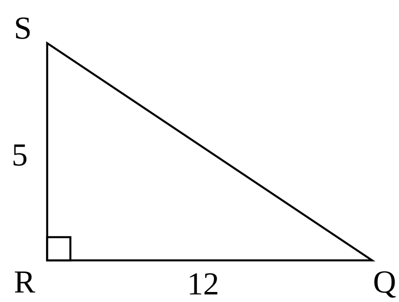
8. In the right triangle below, $\cos Q = ?$

(1) $\frac{12}{5}$ (3) $\frac{12}{17}$

(2) $\frac{5}{12}$ (4) $\frac{12}{13}$



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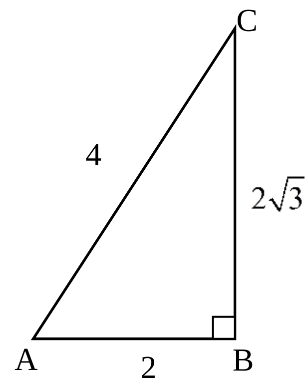
For problems 9 – 14, use the figure at the right to determine each trigonometric ratio. Make sure to reduce your trig ratios to their simplest form.

9. sin C =

10. cos C =



11. tan C =

12. sin A =

13. cos A =

14. tan A =

For problems 15 through 20, evaluate each trigonometric function. Round your answers to the nearest *thousandth*.

15. $\sin(55^\circ)$

16. $\cos(45^\circ)$

17. $\tan(20^\circ)$

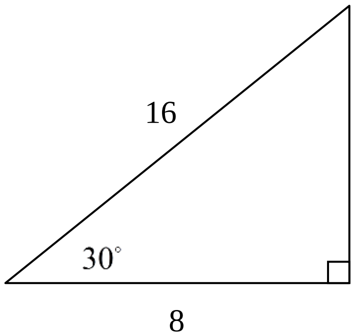
18. $\sin(85^\circ)$

19. $\tan(60^\circ)$

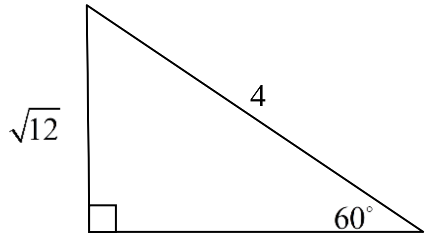
20. $\sin(23^\circ)$

21. Are the triangles below labeled with correct measurements? For each right triangle below, determine if the ratio of the sides accurately corresponds to the angle.

(a)



(b)



Lesson 4: Using Trigonometry to Solve for Missing Sides

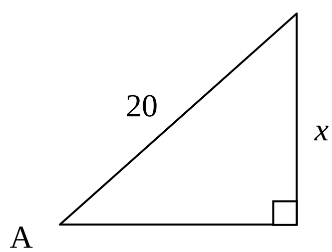
Right triangle trigonometry was developed in order to find missing sides of right triangles, similar to the Pythagorean Theorem. The key difference, though, is that with trigonometry as long as you have one side of a right triangle and one of the acute angles, you can then find the other two missing sides.

TRIGONOMETRIC RATIOS

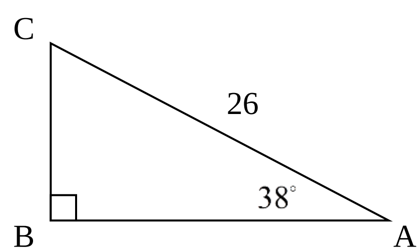
Recall that in a right triangle with acute angle A, the following ratios are defined:

$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}} \qquad \cos A = \frac{\text{adjacent}}{\text{hypotenuse}} \qquad \tan A = \frac{\text{opposite}}{\text{adjacent}}$$

***Exercise* #1:** For the right triangle below it is known that $\sin A = \frac{3}{4}$. Find the value of *x*.

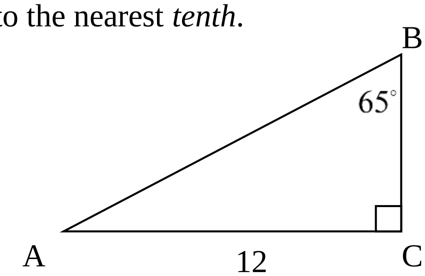


***Exercise* #2:** In the right triangle below, find the length of $\overline{AB}$ to the nearest *tenth*.



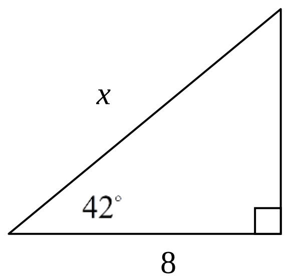
The key in all of these problems is to properly identify the correct trigonometric ratio to use.

***Exercise* #3:** For the right triangle below, find the length of $\overline{BC}$ to the nearest *tenth*.

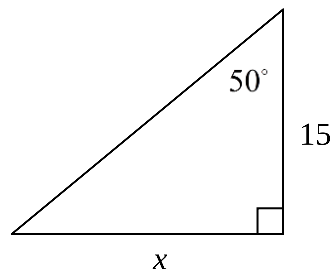


***Exercise* #4:** In each triangle below, use the appropriate trig function to solve for the value of x. Round to the nearest *tenth*. Triangles are not drawn to scale.

(a)



(b)



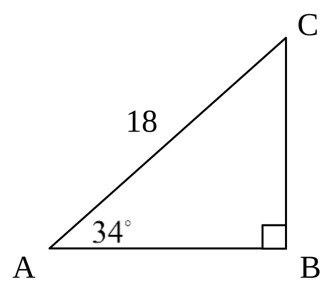
***Exercise* #5:** Which of the following would give the length of $\overline{BC}$ shown below?

(1) $18\sin\left(34^\circ\right)$

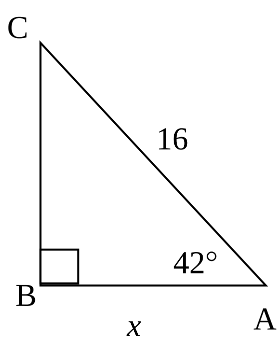
(2) $\dfrac{18}{\sin\left(34^\circ\right)}$

(3) $\dfrac{18}{\cos\left(34^\circ\right)}$

(4) $18\tan\left(34^\circ\right)$



***Exercise* #6:** Using right triangle ABC below, which of the following equations is used to solve for x?



(1) $\cos 42° = \dfrac{x}{16}$

(2) $\cos 42° = \dfrac{16}{x}$

(3) $\sin 42° = \dfrac{x}{16}$

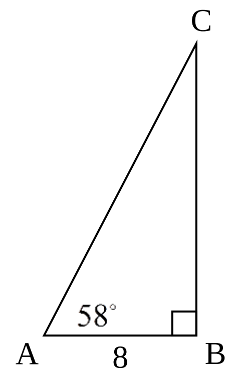
(4) $\tan 42° = \dfrac{x}{16}$

Using Trigonometry to Solve for Missing Sides
Intro to Geometry Homework

Skill

In problems 1 through 3, determine the trigonometric ratio needed to solve for the missing side and then use this ratio to find the missing side.

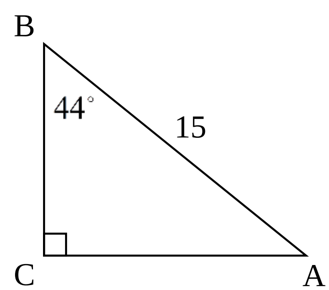
1. In right triangle ABC, $m\angle A = 58^{\circ}$ and $AB = 8$. Find the length of each of the following. Round your answers to the nearest *tenth*.



(a) BC

(b) AC

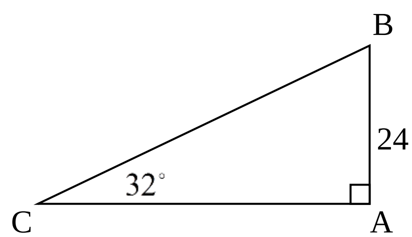
2. In right triangle ABC, $m\angle B = 44^{\circ}$ and $AB = 15$. Find the length of each of the following. Round your answers to the nearest *tenth*.



(a) AC

(b) BC

3. In right triangle ABC, $m\angle C = 32^{\circ}$ and $AB = 24$. Find the length of each of the following. Round your answers to the nearest *tenth*.



(a) AC

(b) BC

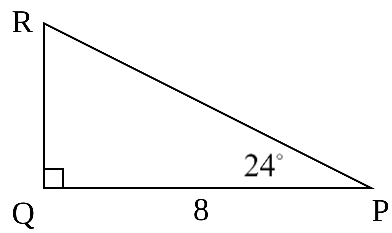
4. Which of the following would give the length of hypotenuse $\overline{PR}$ in the diagram below?

(1) $8\cos\left(24^\circ\right)$

(3) $8\tan\left(24^\circ\right)$

(2) $\dfrac{8}{\cos\left(24^\circ\right)}$

(4) $\dfrac{8}{\tan\left(24^\circ\right)}$



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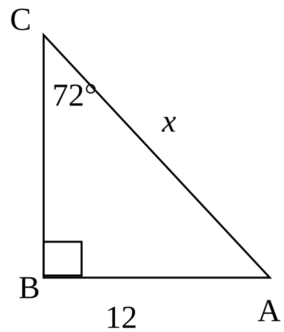
5. Using the trig ratios and the right triangle ABC below, find AB to the ***nearest tenth*** is:



(1) 38.8

(3) 11.4

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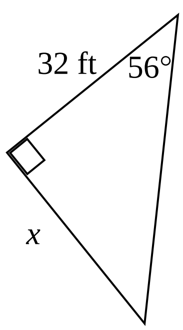
(2) 12.6

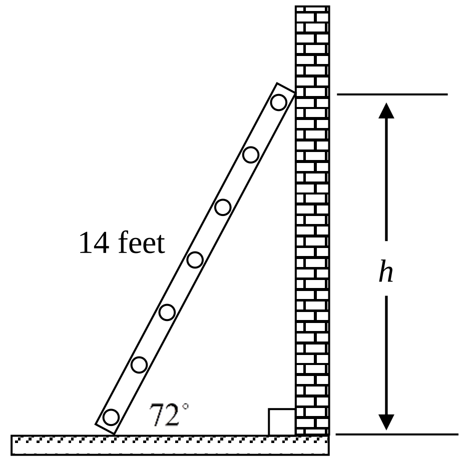
(4) 346.3

6. Find x to the ***nearest foot***.

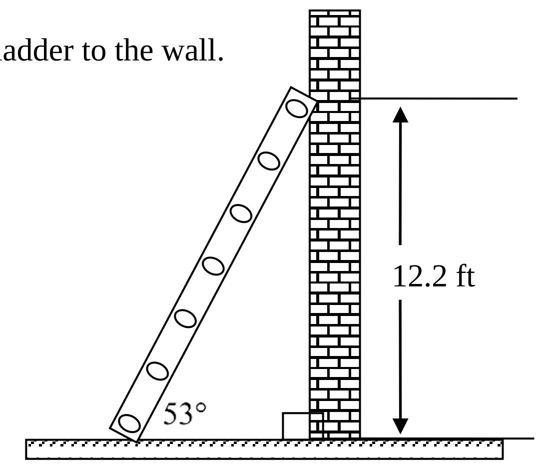


Lesson 5: Using Trigonometry to Solve for Missing Sides – Day 2

***Exercise* #1:** A ladder leans against a building as shown in the picture below. The ladder makes an acute angle with the ground of 72°. If the ladder is 14 feet long, how high, *h*, does the ladder reach up the wall? Round your answer to the nearest *tenth* of a foot.

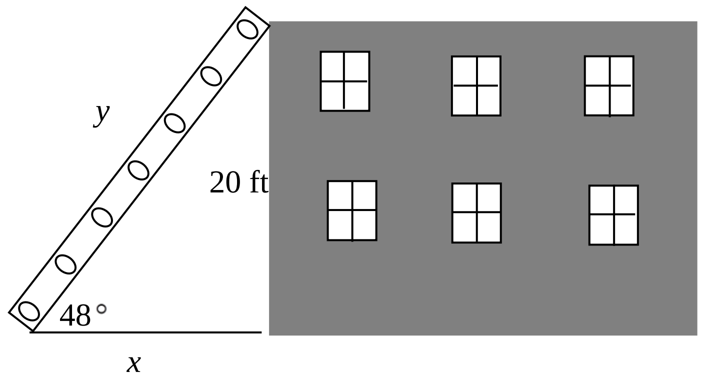


***Exercise* #2**: As shown in the accompanying diagram, a ladder is leaning against a vertical wall, making an angle of 53° with the ground and reaching a height of 12.2 feet on the wall.
Find, to the *nearest foot*, the length of the ladder.
Find, to the *nearest foot*, the distance from the base of the ladder to the wall.

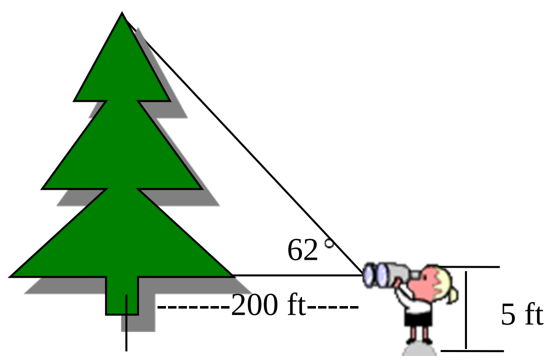


***Exercise* #3:** Draw and label a diagram of the path of an airplane climbing at an angle of 25° with the ground. Find, to the *nearest foot,* the ground distance the airplane has traveled when it has attained an altitude of 500 feet.

***Exercise* #4:** In the accompanying diagram, *x* represents the length of a ladder that is leaning against a wall of a building, and *y* represents the distance from the foot of the ladder to the base of the wall. The ladder makes a $48°$ angle with the ground and reaches a point on the wall 20 feet above the ground. Find the number of feet in *x* and *y* to the *nearest whole number*.



***Exercise* #5:** In the picture below, Luisa is 5 feet tall. She sees, at eye level, the top of a tree that is 200 feet away at a $62°$ angle. Find the height of the tree to the *nearest tenth* of a foot.

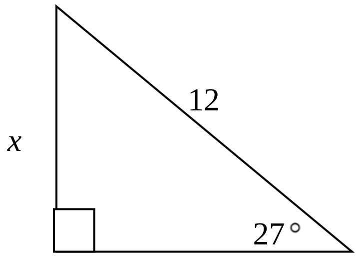


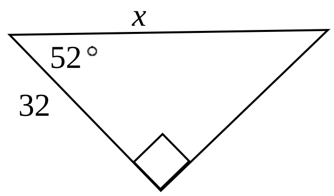
***Exercise* #6:** An isosceles triangle has a base of 24 feet and base angles that measures $34°$. Find the height of the isosceles triangle to the *nearest tenth* of a foot.

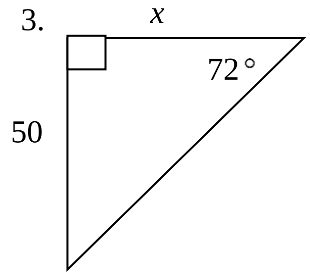
Using Trigonometry to Solve for Missing Sides
Intro to Geometry Homework

Skills

Find x in each of the following to the *nearest tenth*.

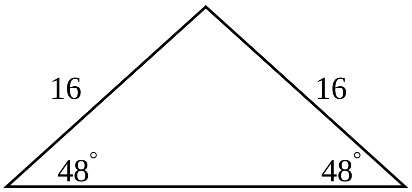
1. 

2. 

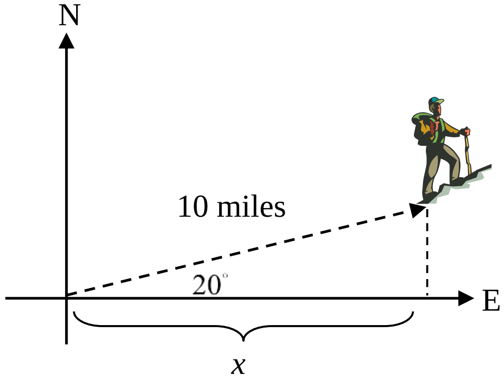
3. 

Applications

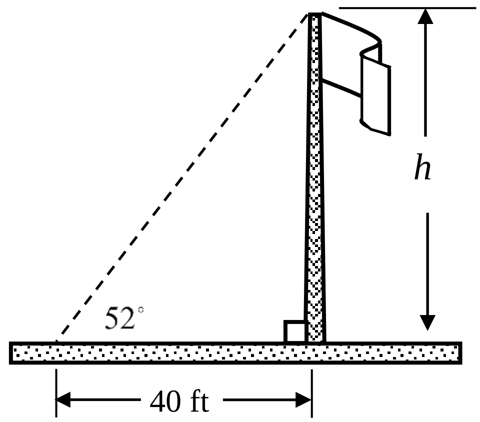
4. An isosceles triangle has legs of length 16 and base angles that measure 48°. Find the height of the isosceles triangle to the *nearest tenth*. Hint – Create a right triangle by drawing the height.



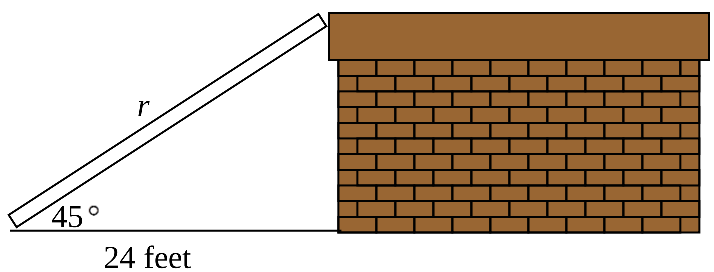
5. Carlos walked 10 miles at an angle of 20° north of due east. To the nearest tenth of a mile, how far east, x, is Carlos from his starting point?



6. Students are trying to determine the height of the flagpole at Arlington High. They have measured out a horizontal distance of 40 feet from the flagpole and site the top of it at an angle of elevation of 52°. What is the height, h, of the flagpole? Round your answer to the nearest *tenth* of a foot.



7. The picture below illustrates a ramp leaning against a wall. If the ramp makes an angle of $45°$ with the ground and the ramp is 24 feet from the wall, find the length of the ramp, *r*, to the *nearest tenth*.

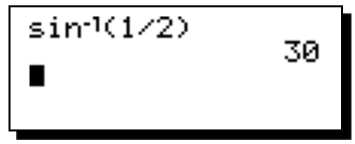


Lesson 6: The Inverse Trigonometry Function

<u>The Inverse Trig Functions</u> - Thus far, we have been evaluating the sine, cosine, and tangent of angles. By doing so, we have been finding the ratio of two sides in a right triangle given an angle. Using the calculator, we can reverse this process and find the angle when given a ratio of sides.

***Exercise* #1:** Consider the following:

(a) Evaluate $\sin^{-1}\left(\frac{1}{2}\right)$ using your calculator. The screen shot is shown at the below.



(b) How do you interpret this answer?

***Exercise* #2:** Find each angle that has the trigonometric ratio given below. Round all answers to the nearest tenth of a degree, if they are not whole numbers.

(a) $\tan A = \frac{5}{2}$ (b) $\cos B = \frac{1}{2}$ (c) $\sin E = \frac{2}{3}$

(d) $\sin A = \frac{3}{4}$ (e) $\tan C = \frac{3}{7}$ (f) $\cos F = \frac{5}{11}$

(g) $\tan A = 2.384$ (h) $\sin E = 0.238$ (i) $\cos B = 0.754$

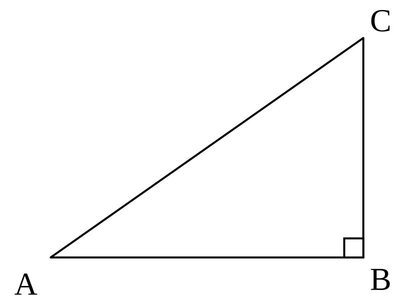
Exercise # 3: An inverse trigonometric function gives the angle measurement that corresponds to the ratio of two sides of a right triangle.

(a) Find $m\angle A$ if $\sin A = \frac{3}{2}$.

What happened when you tried to inverse sine $\frac{3}{2}$? Why do you think that happened?

Using the right triangle provided, use SOH CAH TOA to put the values onto the triangle.

$\sin A = \frac{3}{2}$



What is wrong with where the values are placed?

General rule for **sine** and **cosine** : The values of the ratios for sine and cosine will always be less than or equal to 1. (note: the tangent values do not follow this rule – see Exercise # 3 (g))

Exercise # 4: Which of the following ratios is not possible?

(1) $\cos A = \frac{7}{8}$ (2) $\sin A = 1$ (3) $\tan A = \frac{5}{4}$ (4) $\sin A = 1.00001$

Trigonometry and the Calculator

Intro to Geometry Homework

Skills

For problems 1 through 6, evaluate each trigonometric function. Round your answers to the nearest *thousandth*. Note – these are NOT inverse questions!!

1. $\sin\left(35^\circ\right)$
2. $\cos\left(60^\circ\right)$
3. $\tan\left(30^\circ\right)$
4. $\sin\left(45^\circ\right)$
5. $\tan\left(50^\circ\right)$
6. $\sin\left(33^\circ\right)$

For problems 7 through 15, find the angle that has the given trigonometric ratio. Round all non-exact answers to the nearest *tenth* of a degree.

7. $\sin A = \dfrac{1}{3}$
8. $\cos G = \dfrac{4}{9}$
9. $\tan K = 1$
10. $\cos B = \dfrac{8}{11}$
11. $\tan R = \dfrac{8}{5}$
12. $\sin T = \dfrac{1}{2}$
13. $\tan A = 3.127$
14. $\sin B = 0.724$
15. $\cos L = 0.876$

16. If $\sin A = \dfrac{2}{5}$ then $m\angle A$ is closest to which of the following? __________

(1) 32° (3) 24°

(2) 76° (4) 56°

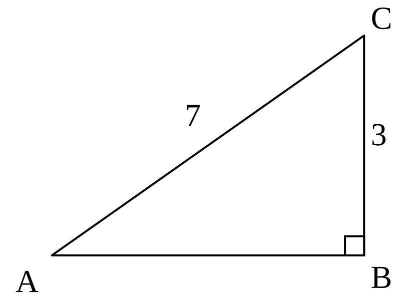
17. If $\tan A = 3.5$ then $m\angle A$, to the nearest degree, is __________

(1) 74° (3) 24°

(2) 18° (4) 55°

Reasoning

18. Consider the following right triangle.



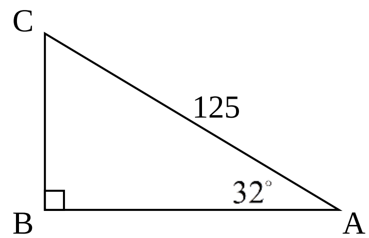
(a) Express $\sin A$ as a ratio.

(b) Using your answer from part (a), find the $m\angle A$ to the nearest degree.

Lesson 7: Solving For Missing Angles

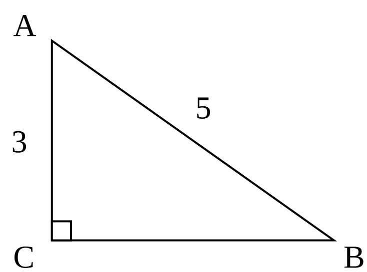
Today we will learn how to use right triangle trigonometry to find missing angles of a right triangle. In the first exercise, though, we will review how to solve for a missing side using trigonometry.

***Exercise* #1:** Find the length of $\overline{AB}$ to the nearest *tenth*.



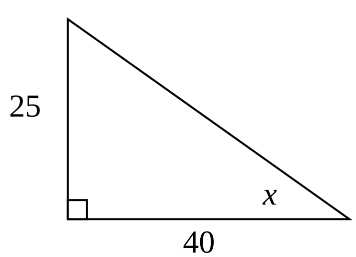
Solving for a Missing Angle – The process for finding a missing angle in a right triangle is very similar to that of finding a missing side. The key is to identify a trigonometric ratio that can be set up and then use the inverse trigonometric functions to solve for that angle.

***Exercise* #2:** Solve for $m\angle B$ to the *nearest degree*.

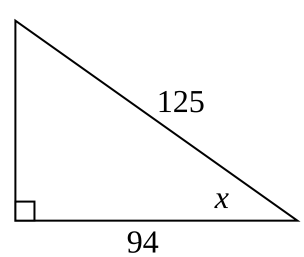


***Exercise* #3:** Find the value of x, in the diagrams below, to the *nearest degree*.

(a)

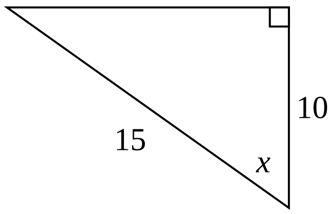


(b)

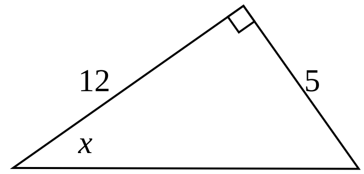


***Exercise* #4:** Find the value of *x* in the diagrams below. Round your answers to the nearest degree.

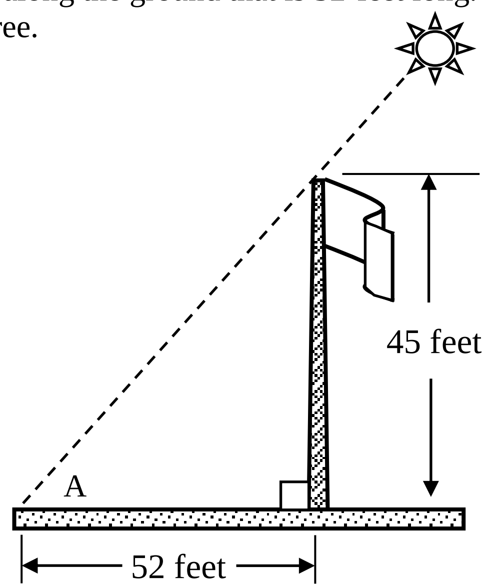
(a)



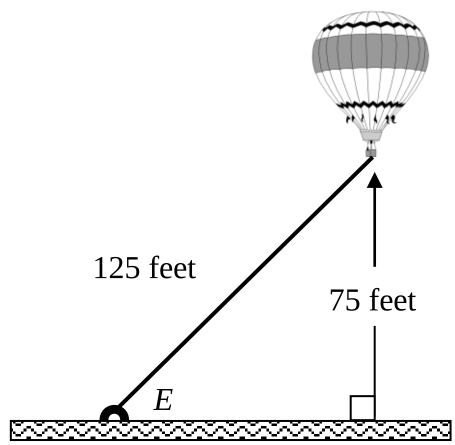
(b)



***Exercise* #5:** A flagpole that is 45-feet high casts a shadow along the ground that is 52-feet long. What is the measure of angle *A*? Round your answer to the nearest degree.



***Exercise* #6:** A hot air balloon hovers 75 feet above the ground. The balloon is tethered to the ground with a rope that is 125 feet long. At what angle *E*, is the rope attached to the ground? Round your answer to the nearest degree.

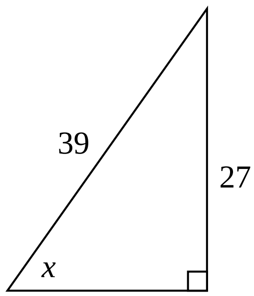


Solving For Missing Angles
Intro to Geometry Homework

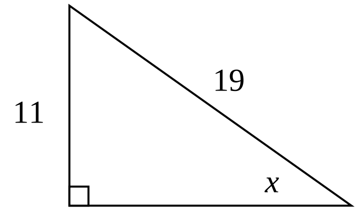
Skills

1. For the following right triangles, find the measure of each angle, x, to the nearest degree:

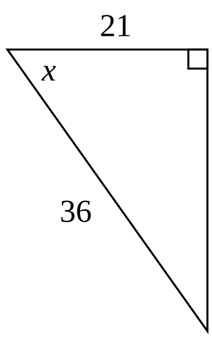
(a)



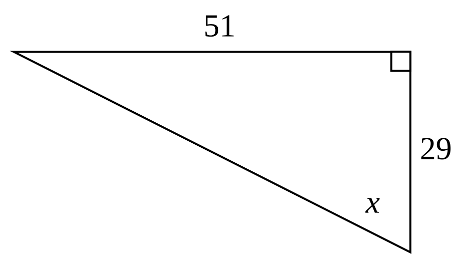
(b)



(c)



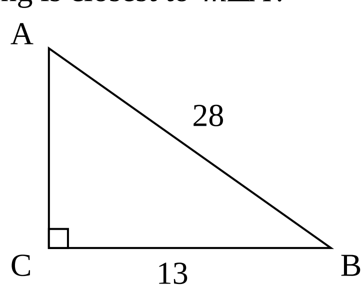
(d)



2. Given the following right triangle, which of the following is closest to $m\angle A$?

(1) 28° (3) 62°

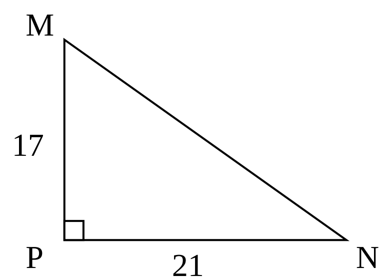
(2) 25° (4) 65°



3. In the diagram shown, $m\angle N$ is closest to

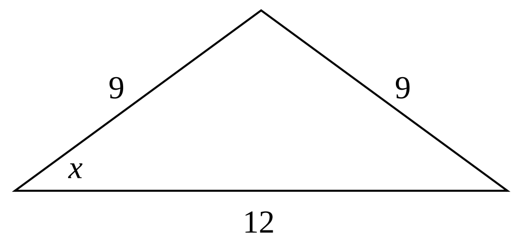
(1) 51° (3) 17°

(2) 54° (4) 39°

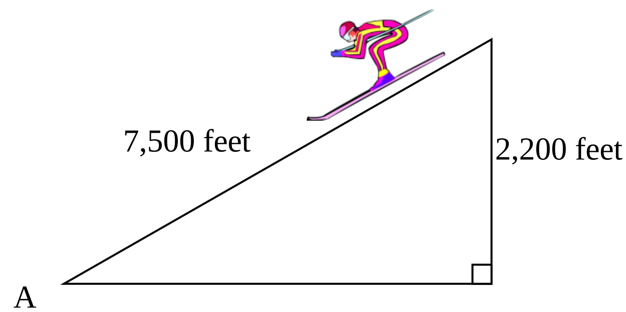


Applications

4. An isosceles triangle has legs measuring 9 feet and a base of 12 feet. Find the measure of the base angle, *x*, to the *nearest degree*. (Remember: Right triangle trigonometry can only be used in right triangles.)

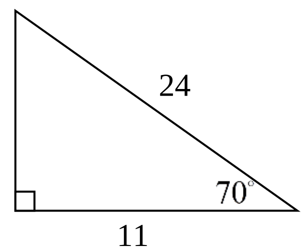


5. A skier is going down a slope that measures 7,500 feet long. By the end of the slope, the skier has dropped 2,200 vertical feet. To the nearest degree, what is the angle, A, of the slope?



Reasoning

6. Could the following triangle exist with the given measurements? Justify your answer.

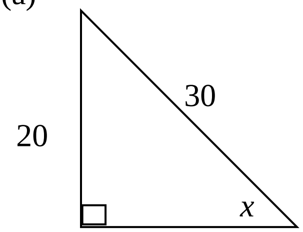


Lesson 8: A Mixture of Right Triangle Trigonometry Problems
Class work/Homework

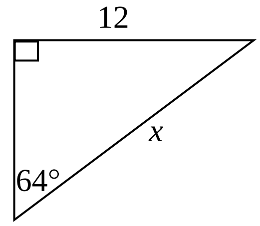
Skills

1. Find ***x*** to the nearest ***tenth*** or ***degree.***

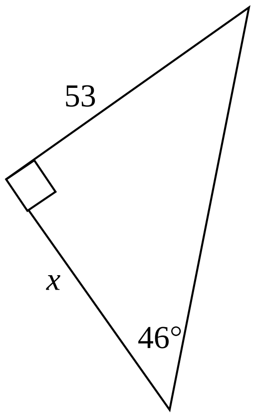
(a)



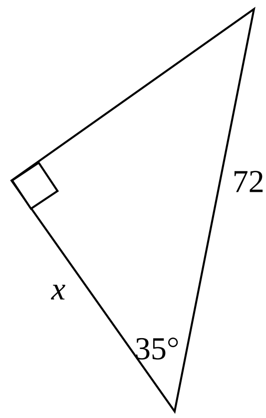
(b)



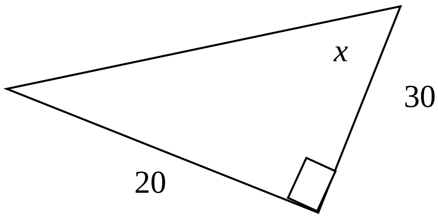
(c)



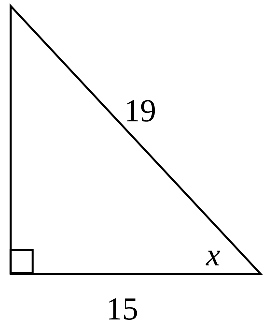
(d)



(e)

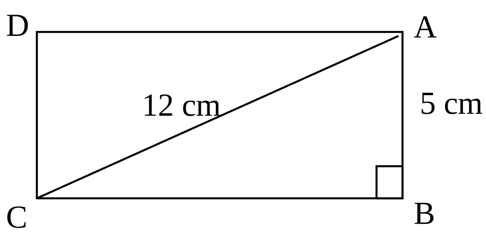


(f)



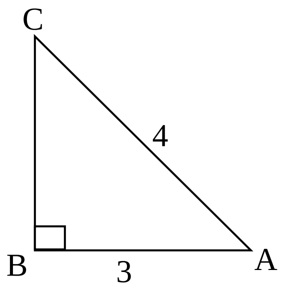
Application

2. In rectangle ABCD, diagonal $\overline{AC}$ measures 12 centimeters and side $\overline{AB}$ measures 5 centimeters. Find to the ***nearest degree*** the measure of $\angle$CAB.

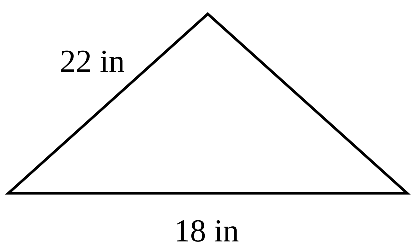


3. A captive balloon, fastened by a cable 800 feet long, was blown by a wind so that the cable made an angle of 64° with the ground. Find, to the ***nearest foot***, the height of the balloon.

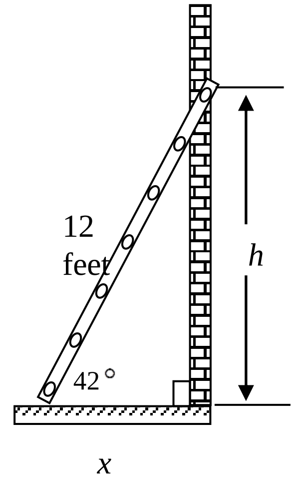
4. The legs of a right triangle measure 3 and 4. Find to the ***nearest degree*** the measure of the smallest angle of this triangle.



5. The legs of an isosceles triangle measure 22 inches and the base is 18. Find the measure of one of the base angles to the ***nearest tenth***.



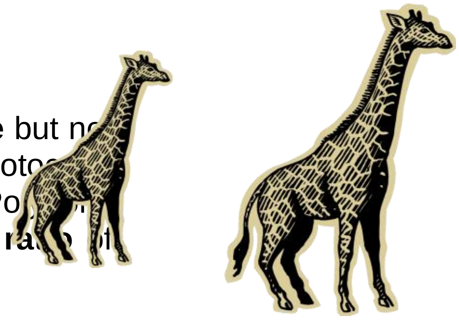
6. A ladder is leaning against a building. The length of the ladder is 12 feet long. If the ladder makes an angle of 42° with the ground, find how far away the foot of the ladder is from the foot of the building to the ***nearest foot.***



7. An isosceles triangle has a base of 24 cm and each base angle has a measure of 54°. Find the measure of the altitude of the isosceles triangle to the ***nearest tenth***.

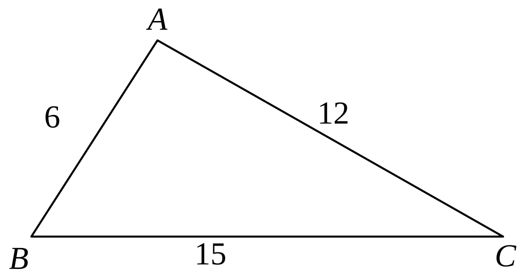
Lesson 9: Similar Polygons Day 1
Introduction to Geometry

AIM: → *To review the properties of similar polygons*
→ *To use proportions to find missing sides of similar polygons*



We say that two figures are **similar** if they have the **same shape** but n **necessarily** the same size. When we enlarge a figure on a photo machine we are making an image that is similar to the original. Po are similar (~) if their corresponding angles are **equal** and the **ra** o their corresponding sides are in proportion.

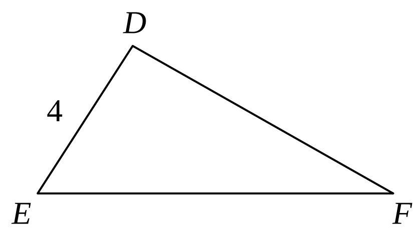
***Exercise* #1:** Triangles ΔABC and ΔDEF shown below are similar. We say $\Delta ABC \sim \Delta DEF$.



(a) Find the lengths of $\overline{EF}$.

(b) Find the length of $\overline{DF}$.

(c) What is the common ratio among the sides?

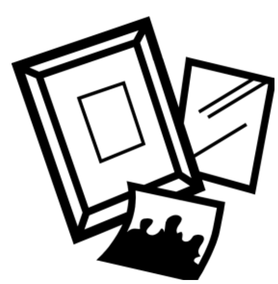


(d) Find the perimeter of ΔABC and the perimeter of ΔDEF.

(e) Find the ratio of the perimeters. How does it compare to the ratio of the sides?

(f) If $m\angle A = 108$, what is $m\angle D$?

***Exercise* #2:** A picture 15 cm long and 9 cm wide is to be enlarged so that its length will be 24 cm. How wide will the enlarged picture be?



***Exercise* #3:** At the same time that a tree casts a shadow 24 feet long, a man that is 6 feet tall casts a shadow 4 feet long. Find the height of the tree.

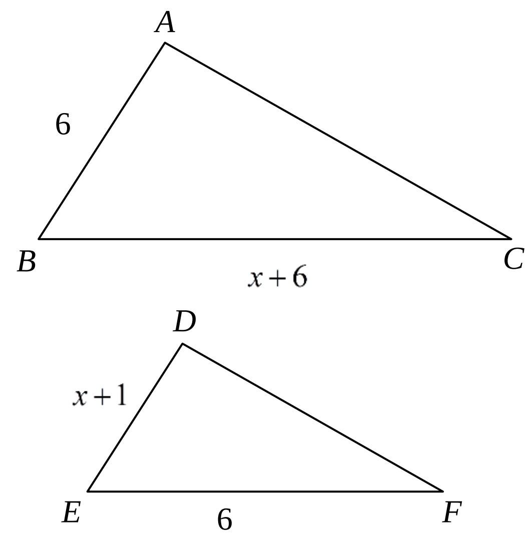
***Exercise* #4:** The measures of the sides of a triangle are 4, 7, and 10 inches long. If the longest side of a similar triangle is 25 inches, find the length of the shortest side of that triangle.

***Exercise* #5:** The longest sides of two similar triangles have lengths of 10 inches and 25 inches, respectively. If the perimeter of the smaller triangle is 22 inches long, which of the following is the perimeter of the larger triangle?

(1) 55 inches (3) 44 inches

(2) 36 inches (4) 12 inches

***Exercise* #6:** In the following diagram $\Delta ABC \sim \Delta DEF$. The sides have measures as indicated in terms of *x*. Find the value of *x*.



Similar Polygons Day 1 Homework

1. The lengths of the sides of a triangle are 6, 7, and 8. Which of the following represents the length of the longest side of a similar triangle whose shortest side has a length of 9?

(1) 10 (3) 12

(2) 11 (4) 15

____

2. The longest side lengths of two similar triangles are 20 and 24, respectively. Which of the following represents the perimeter of the smaller triangle if the perimeter of the larger triangle is 54?

(1) 45 (3) 50

(2) 52 (4) 60

____

3. The ratio of corresponding sides of two similar triangles is $2:3$. If two corresponding sides can be expressed as $x \text{ and } x+6$, then which of the following is the value of *x*?

(1) 6 (3) 10

(2) 14 (4) 12

____

4. Which of the following represents the height of a vertical pole that casts a shadow 8 feet long if a 12 foot tall tree, standing nearby, casts a shadow 3 feet long?

(1) 8 feet (3) 32 feet

(2) 2 feet (4) 17 feet

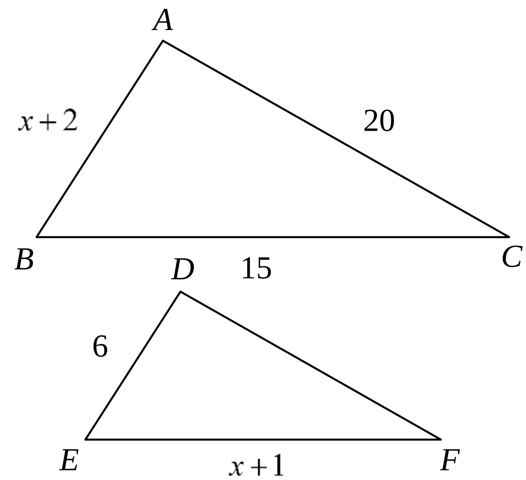
____

5. At the same time that a vertical flagpole casts a shadow 15 feet long, a vertical pole that is 6 feet high casts a shadow 5 feet long. Find the height of the flagpole.

6. A certain tree casts a shadow 12 feet long. At the same time, a nearby boy 3 feet tall casts a shadow 4 feet long. Find the height of the tree.

7. In the following diagram, $\Delta ABC \sim \Delta DEF$. The sides have measures as indicated in terms of *x*.

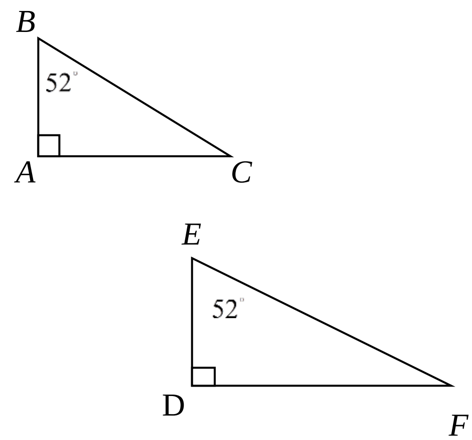
(a) Find the value of *x*.



(b) Find the length of side $\overline{DF}$.

We know from geometry that two triangles will be similar if all three corresponding angles have the same measures.

8. Consider two **right triangles** ΔABC and ΔDEF in which $m\angle A = 90^\circ$ and $m\angle D = 90^\circ$. It is also known that $m\angle B = m\angle E = 52^\circ$. Are these two right triangles similar? Justify your answer.

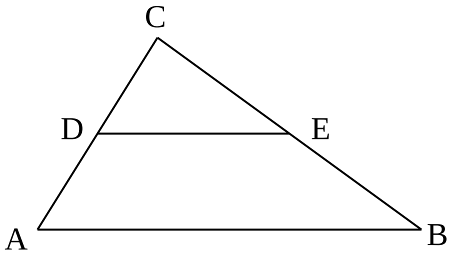


Lesson 10: Triangle Proportionality Theorem
Intro to Geometry

AIM: → *To recognize similar triangles within overlapping triangles*
→ *To apply the Triangle Proportionality Theorem to overlapping similar triangles*

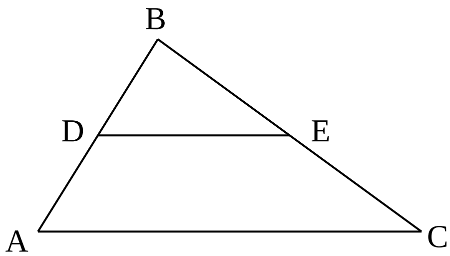
Recall from the last lesson that triangles, or polygons, are similar if their corresponding (matching) angles are congruent and the ratio of their corresponding sides are in proportion. Keep an open mind! Remember there is more than one way to arrive at an answer.

Triangle Proportionality Theorem **–** If a line parallel to one side of a triangle intersects the other two sides, then it divides them proportionally. In other words, we create two similar triangles.

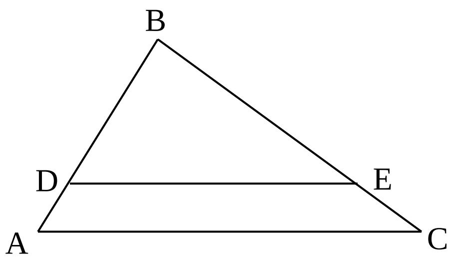


$\Delta ABC \sim \Delta DEC$

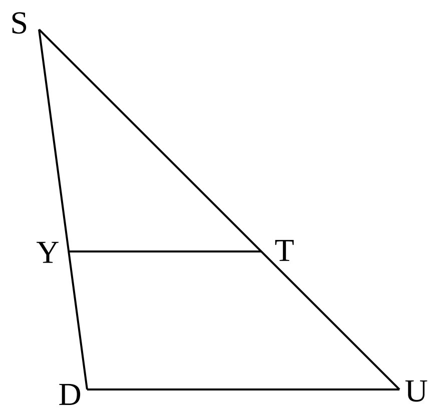
Exercise #1: In the accompanying diagram of ΔABC, $\overline{DE} \parallel \overline{AC}$, $BD = 8$, $BA = 18$, $BC = 27$. Find the length of $\overline{BE}$.



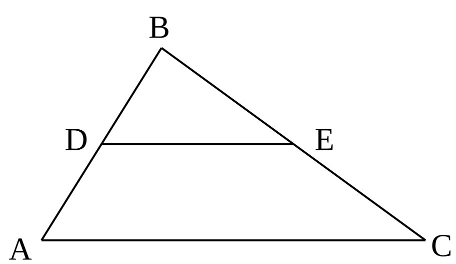
Exercise #2: In the accompanying diagram, $\overline{DE} \parallel \overline{AC}$, $AB = 10$, $BC = 15$, $BD = 8$. What is the length of $\overline{EC}$?



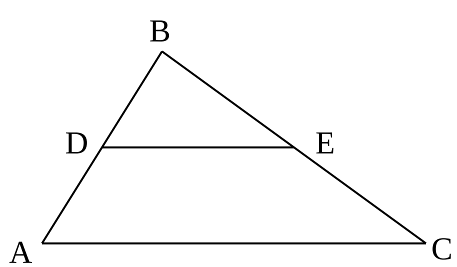
***Exercise* #3:** In the accompanying diagram of ΔSUD, Y is a point on $\overline{SD}$ and T is a point on $\overline{SU}$ such that $\overline{YT} \parallel \overline{DU}$, $YT = 4$, $TU = 4$, *and* $DU = 6$. Find ST.



***Exercise* #4:** In the accompanying diagram of ΔABC, D is a point on $\overline{AB}$ and E is a point on $\overline{AC}$ such that $\overline{DE} \parallel \overline{BC}$, $DE = 2$, $AC = 6$, *and* $BE = 4$. Find EC.

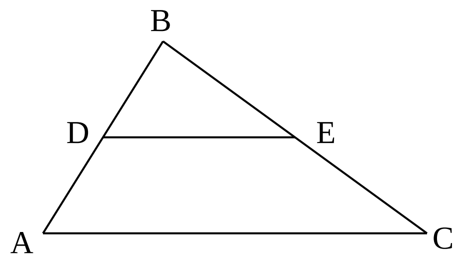


***Exercise* #5:** In the accompanying diagram of ΔABC, D is a point on $\overline{AB}$ and E is a point on $\overline{AC}$ such that $\overline{DE} \parallel \overline{BC}$, $AD = 8$, $BD = 4$, *and* $EC = 10$. Find BE.

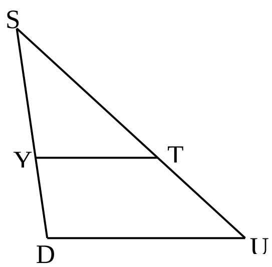


Triangle Proportionality Theorem Homework

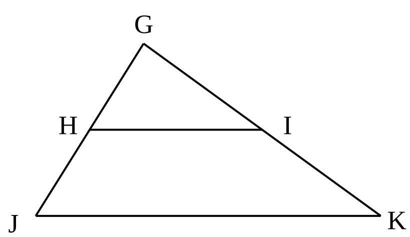
1. In the accompanying diagram of ΔABC, $\overline{DE} \parallel \overline{AC}$, $BD = 6$, $BA = 18$, $BC = 15$. Find the length of $\overline{BE}$.



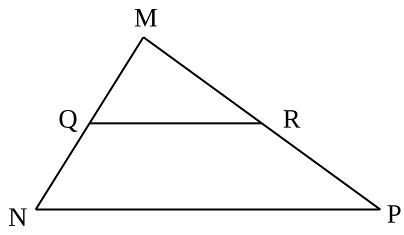
2. In the accompanying diagram of ΔSUD, Y is a point on $\overline{SD}$ and T is a point on $\overline{SU}$ such that $\overline{YT} \parallel \overline{DU}$, $SY = 3$, $YD = 2$, *and* $ST = 6$. Find TU.



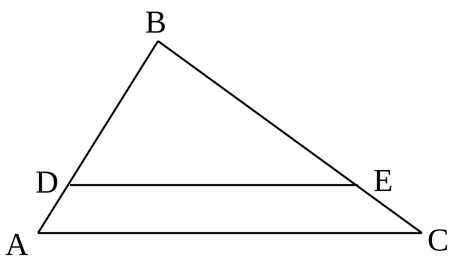
3. In the accompanying diagram of ΔGJK, $\overline{HI} \parallel \overline{JK}$, $GH = 5$, $HJ = 5$, $HI = 6$. Find the length of $\overline{JK}$.



4. In the accompanying diagram of ΔMNP , $\overline{QR} \parallel \overline{NP}$, $MR = 8$, $MP = 10$, $MQ = 4$. Find the length of $\overline{QN}$.



5. In the accompanying diagram, $\overline{DE} \parallel \overline{AC}$, $AB = 10$, $BC = 20$, $BD = 7$. What is the length of $\overline{EC}$?



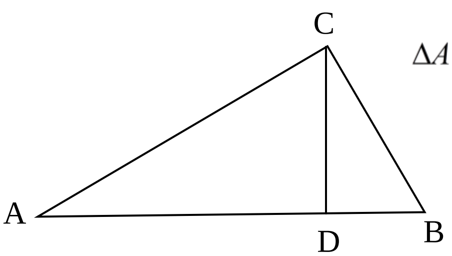
Lesson 11: Similar Triangles – Geometric Mean in Right Triangles

AIM: → ***To recognize similar triangles within a right triangle with an altitude drawn to the hypotenuse.***

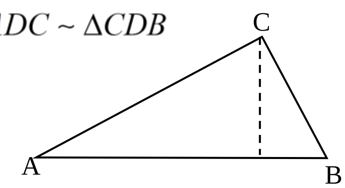
→ ***To apply*** proportionality to similar triangles formed by an altitudes two triangles that are similar to each other and to the original triangle.

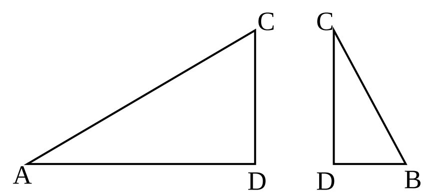
We will now look at one more relationship for similar triangles.

- The altitude to the hypotenuse of a right triangle forms two triangles that are similar to each other and to the original triangle.

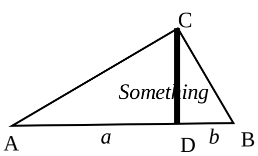


$\Delta ACB \sim \Delta ADC \sim \Delta CDB$

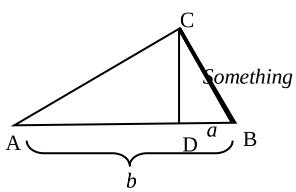




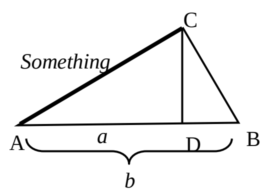
Case 1



Case 2



Case 3

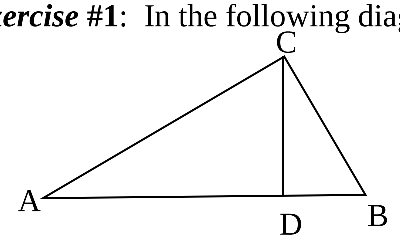


Helpful Hint

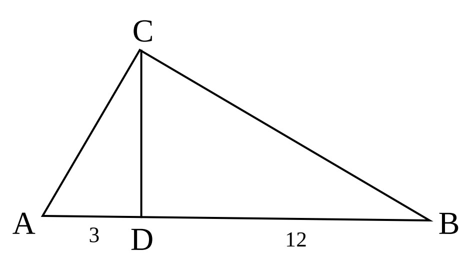
$$\frac{a}{something} = \frac{something}{b}$$

*the something's are the same value

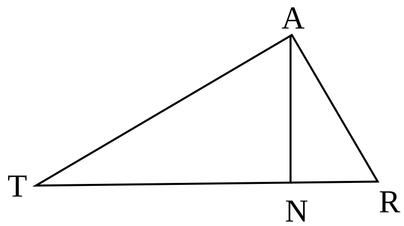
Exercise #1: In the following diagram $CD = 8$ and $DB = 4$. Find $\overline{AD}$.



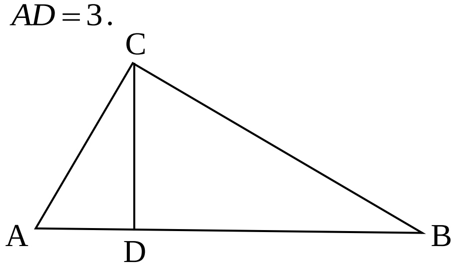
Exercise #2: In the diagram below of right triangle ACB, altitude $\overline{CD}$ intersects $\overline{AB}$ at D. If $AD = 3$, $DB = 12$, find the length of $\overline{CD}$ in simplest radical form.



***Exercise* #3:** In the accompanying diagram of right triangle *RAT*, altitude *AN* divides hypotenuse $\overline{RT}$ into two segments with lengths of 15 and 5. Find the length of leg *RA*.



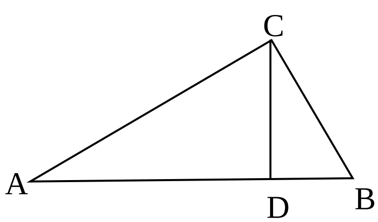
***Exercise* #4**: In the accompanying diagram of right triangle *ABC*, altitude *CD* is drawn to hypotenuse *AB*, $CA = 6$, $AD = 3$.



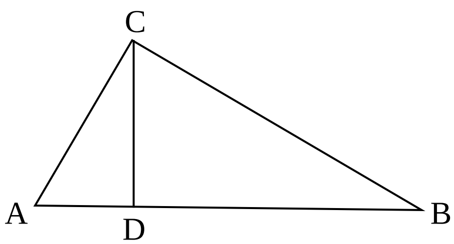
a) Find *AB*.

b) Using the results from part *a*, find the length of altitude *CD* to the *nearest tenth*.

Exercise # 5: In the following diagram $AD = 5$ and $DB = 4$. Find $\overline{CB}$.



Exercise # 6: In the following diagram $AC = 12$ and $AD = 8$. Find $\overline{DB}$.

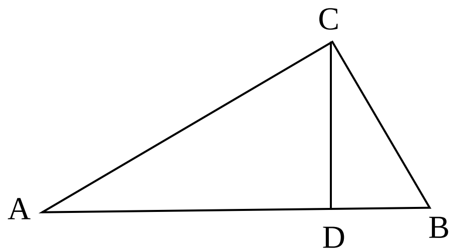


Geometric Mean Homework

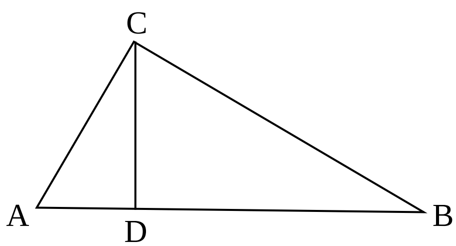
Helpful Hint

$$\frac{a}{something} = \frac{something}{b}$$

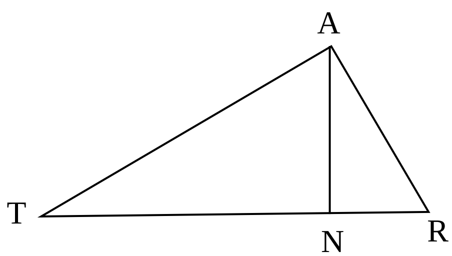
1. In the following diagram $CD = 6$ and $AD = 9$. Find $\overline{DB}$.



2. In the following diagram $DB = 6$ and $AD = 2$. Find $\overline{AC}$.

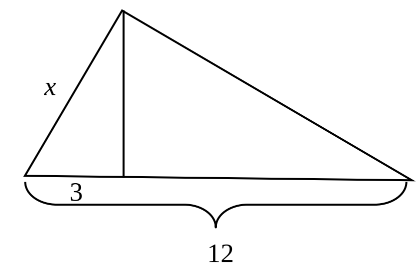


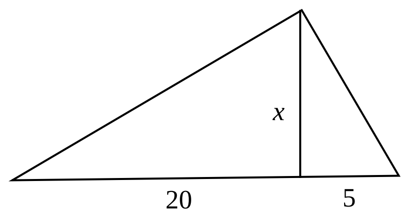
3. In the accompanying diagram of right triangle *RAT*, altitude *AN* divides hypotenuse $\overline{RT}$ into two segments with lengths of 9 and 4. Find the length of leg *AN*.

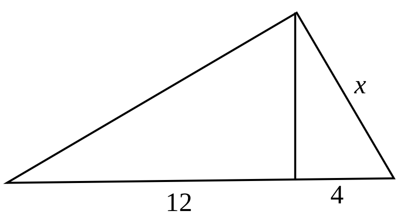


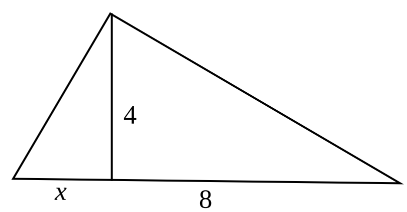
4. In right triangle *ABC*, $\overline{CD}$ is the altitude to the hypotenuse, $\overline{AB}$. The segments of the hypotenuse, $\overline{AB}$, are in the ratio of 1:4. The altitude is 6. Find the two segments of the hypotenuse

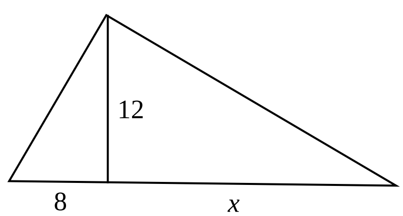
5. Find x in each case.

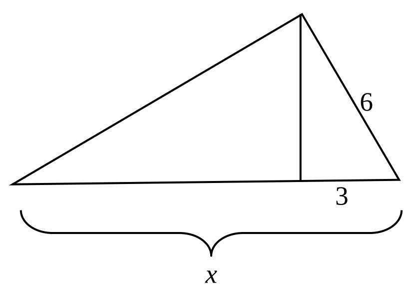












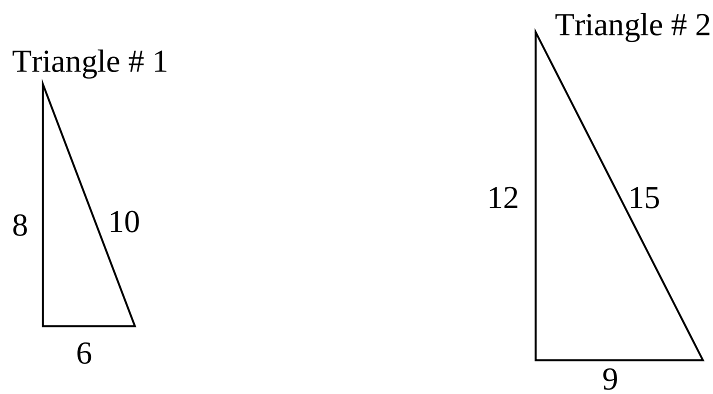
Lesson 12: Similar Triangles and Areas

AIM: → ***To define a relationship between the ratio of triangle areas and the triangle similarity ratio***
→ ***To solve problems regarding the areas of similar triangles***

As of right now, we know that the ratios of corresponding sides and the ratio of the perimeters for similar polygons are equal.

Look at the following relationship:

The similarity ratio from Triangle #1 to Triangle #2 is $\frac{2}{3}$.



We can use the formula for the area of a triangle to find that

Area of Triangle #1 $= \frac{1}{2}(8 \bullet 6) = 24$

Area of Triangle #2 $= \frac{1}{2}(12 \bullet 9) = 54$

Using what we know about the formula, we can see that the ratio of the areas is $\frac{24}{54} \Rightarrow \frac{4}{9} \Rightarrow \frac{2^2}{3^2}$.

Similarity Ratio		Ratio of Areas
$\frac{\#1}{\#2} \Rightarrow \frac{2}{3}$	$\Rightarrow$	$\frac{2^2}{3^2} \Rightarrow \frac{4}{9}$

- If two triangles are ***similar***, then the ratio of their areas equals the square of the lengths of any two corresponding sides.

Ex. 1 The following are the ratios of the lengths of a pair of corresponding sides of two similar polygons. State the ratio of the areas of the polygons.

a) $\frac{1}{2}$ b) $\frac{3}{5}$ c) $3:2$

Ex. 2 The perimeters of two similar polygons are 12 and 16.

a) What is the ratio of the lengths of two corresponding sides?

b) What is the ratio of their areas?

c) If the area of the smaller polygon is 54, what is the area of the larger?

Ex. 3 The areas of two similar triangles are 49 and 25.

a) What is the ratio of the lengths of two corresponding sides?

b) If the perimeter of the smaller triangle is 40, what is the perimeter of the larger triangle?

Similar Triangles and Area Homework

1. Given the ratios of the sides of two similar triangles, find the ratios of the areas.

a.) $\frac{5}{6}$ b.) $\frac{10}{3}$ c.) $\frac{1}{8}$ d.) 12:13

2. Given the ratios of the areas of two similar triangles, find the ratios of the sides.

a.) $\frac{49}{36}$ b.) $\frac{1}{16}$ c.) $\frac{4}{169}$ d.) $\frac{18}{8}$

(*hint: reduce first*)

3. The perimeters of two similar polygons are 24 and 36.

a.) What is the ratio of the lengths of two corresponding sides?

b.) What is the ratio of their areas?

c.) If the area of the larger polygon is 108, what is the area of the smaller?

4. The areas of two similar triangles are 162 and 50.

a.) What is the ratio of the lengths of two corresponding sides?

b.) If the perimeter of the smaller triangle is 45, what is the perimeter of the larger triangle?