

Starter

Get out your "Quadrilaterals Review" from last class, make sure it's ready to turn in, we'll turn it in just after the bell rings. If you have questions, make sure you ask, we'll go over questions after attendance is taken.

*Grab a book from the front and tear out chapter 8, pg. 565-648

(14) $360^\circ = 15^\circ \cdot n$

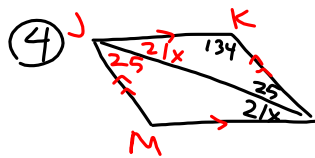
$$\frac{360}{15} = \frac{15n}{15}$$

$$24 = n$$

sides

sum of exterior
Ls in any polygon
is 360°

(15) para - 2 pair of ll
lines
rectangle must have
4 right angles

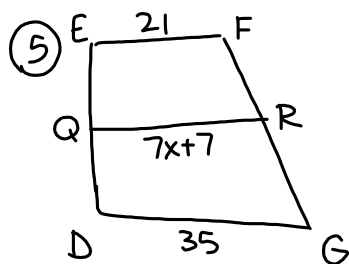


$$180 = 21x + 134 + 25$$

$$\begin{array}{r} 180 = 21x + 159 \\ -159 \quad -159 \\ \hline \end{array}$$

$$\frac{21}{21} = \frac{21x}{21}$$

$$1 = x$$



$$\frac{21 + 35}{2} = 7x + 7$$

$$\frac{56}{2} = 7x + 7$$

$$\begin{array}{r} 28 = 7x + 7 \\ -7 \quad -7 \\ \hline \end{array}$$

$$\frac{21}{7} = \frac{7x}{7}$$

$$3 = x$$

8.1

Three Angle Measure

Introduction to Trigonometry

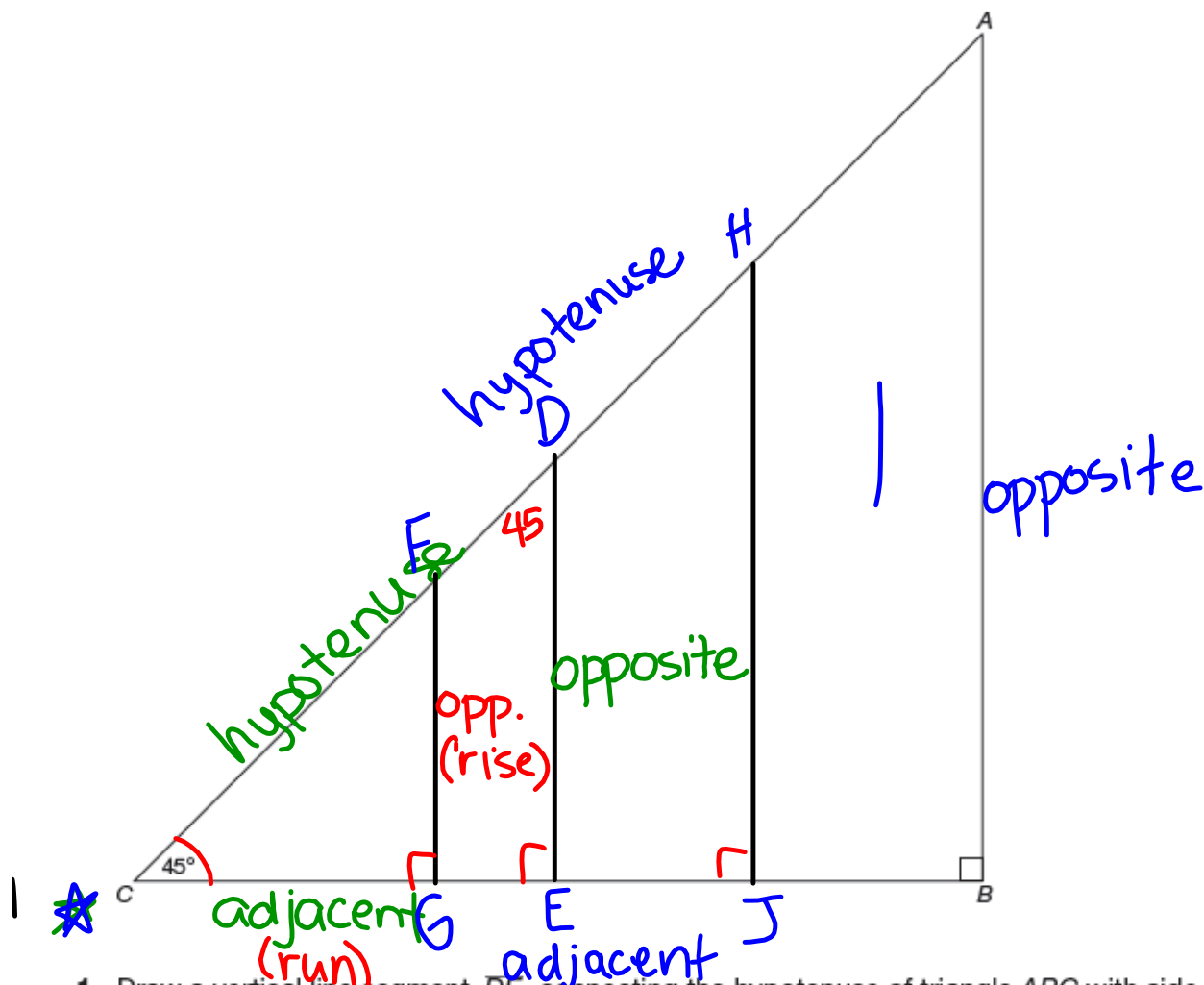
PG.567-568 IN YOUR BOOK

You know that to convert between measurements you can multiply by a conversion ratio. For example, to determine the number of centimeters that is equivalent to 30 millimeters, you can multiply by $\frac{1 \text{ cm}}{10 \text{ mm}}$ because there are 10 millimeters in each centimeter:

$$\begin{aligned} \cancel{30 \text{ mm}} \times \frac{1 \text{ cm}}{\cancel{10 \text{ mm}}} &= \frac{30 \text{ cm}}{10} \\ &= 3 \text{ cm} \end{aligned}$$

In trigonometry, you use conversion ratios too. These ratios apply to right triangles.

Triangle ABC shown is a 45° - 45° - 90° triangle.



1. Draw a vertical line segment, DE , connecting the hypotenuse of triangle ABC with side BC . Label the endpoint of the vertical line segment along the hypotenuse as point D . Label the other endpoint as point E .

PG.569 IN YOUR BOOK

2. Explain how you know that triangle ABC is similar to triangle DEC .

$\triangle ABC \sim \triangle DEC$ by AA similarity.

3. Measure each of the sides of triangles ABC and DEC in millimeters. Record the approximate measurements.

$\triangle ABC$

$75\sqrt{2} \rightarrow AC = 106\text{mm}$
 $BC = 75\text{mm}$
 $AB = 75\text{mm}$

$\triangle DEC$

you will
all have
different
measurements.

I know some things about $45^\circ-45^\circ-90^\circ$ right triangles I can use to verify that these are the right measurements.



PG.569 IN YOUR BOOK

You know that the hypotenuse of a right triangle is the side that is opposite the right angle. In trigonometry, the legs of a right triangle are often referred to as the *opposite side* and the *adjacent side*. These references are based on the angle of the triangle that you are looking at, which is called the *reference angle*. The *opposite side* is the side opposite the reference angle. The *adjacent side* is the side adjacent to the reference angle that is *not* the hypotenuse.

4. For triangles ABC and DEC , identify the opposite side, adjacent side, and hypotenuse, using angle C as the reference angle.

$\triangle ABC$
 \overline{AB} is opposite
 \overline{BC} is adjacent
 \overline{CA} is hypotenuse

$\triangle DEC$
 \overline{DE} is opposite
 \overline{EC} is adjacent
 \overline{CD} is hypotenuse

PG.570 IN YOUR BOOK

5. Determine each side length ratio for triangles ABC and DEC , using angle C as the reference angle. Write your answers as decimals rounded to the nearest thousandth.

\sin
sine

a. $\frac{\text{side opposite } \angle C}{\text{hypotenuse}}$

$\triangle ABC$
 $\frac{AB}{CA} = \frac{75}{106} = 0.708$

$\triangle DEC$
 $\frac{DE}{CD} = \frac{\quad}{\quad} = \quad$

\cos
cosine

b. $\frac{\text{side adjacent to } \angle C}{\text{hypotenuse}}$

$\frac{BC}{CA} = \frac{75}{106} = 0.708$

$\frac{EC}{CD} = \frac{\quad}{\quad} = \quad$

\tan
tangent

c. $\frac{\text{side opposite } \angle C}{\text{side adjacent to } \angle C}$

$\frac{AB}{BC} = \frac{75}{75} = 1.000$

$\frac{DE}{EC} = \frac{\quad}{\quad} = 1.000$

PG.571 IN YOUR BOOK

6. Draw two more vertical line segments, \overline{FG} and \overline{HJ} , connecting the hypotenuse of triangle ABC with side \overline{BC} . Label the endpoints of the vertical line segments along the hypotenuse as points F and H . Label the other endpoints as points G and J .
- a. Explain how you know that triangles ABC , DEC , FGC , and HJC are all similar.

AA ~

- b. Measure each of the sides of the two new triangles you created. Record the side length measurements for all four triangles in the table.

Triangle Name	Length of Side Opposite Angle C	Length of Side Adjacent to Angle C	Length of Hypotenuse
Triangle ABC	75	75	106
Triangle DEC			
Triangle FGC			
Triangle HJC			

- c. Determine each side length ratio for all four triangles using angle C as the reference angle.

Triangle Name	$\frac{\text{side opposite } \angle C}{\text{hypotenuse}}$	$\frac{\text{side adjacent to } \angle C}{\text{hypotenuse}}$	$\frac{\text{side opposite } \angle C}{\text{side adjacent to } \angle C}$
Triangle ABC	$\frac{75}{106} = 0.708$	0.708	1.000
Triangle DEC			
Triangle FGC			
Triangle HJC			

PG.572 IN YOUR BOOK

7. Compare the side length ratios of all four triangles in the table.

What do you notice? all tangents are the same (1)
all sine are same (≈ 0.708)
all cosine are same (≈ 0.708)

8. Compare your measurements and ratios with those of your classmates.
What do you notice?

9. Calculate the slope of the hypotenuse in each of the four triangles. Explain how you determined your answers.

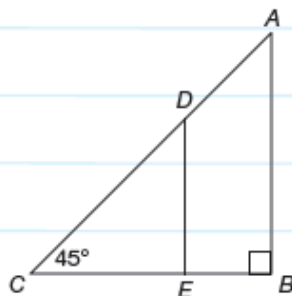
Slope is tangent and is 1.000 for all
4 triangles ($\frac{\text{opposite}}{\text{adjacent}}$).

PG.573-574 IN YOUR BOOK



Given the same reference angle measure, are each of the ratios you studied constant in similar right triangles? You can investigate this question by analyzing similar right triangles without side measurements.

Consider triangles ABC and DEC shown. They are both 45° - 45° - 90° triangles.



Triangle ABC is similar to triangle DEC by the AA Similarity Theorem. This means that the ratios of the corresponding sides of the two triangles are equal.

$$\frac{CE}{CB} = \frac{CD}{CA}$$

Rewrite the proportion.

$$\begin{array}{ccc} \text{side adjacent to } \angle C & \longrightarrow & \frac{CE}{CD} = \frac{CB}{CA} & \longleftarrow & \text{side adjacent to } \angle C \\ & & \text{hypotenuse} & & \text{hypotenuse} \end{array}$$

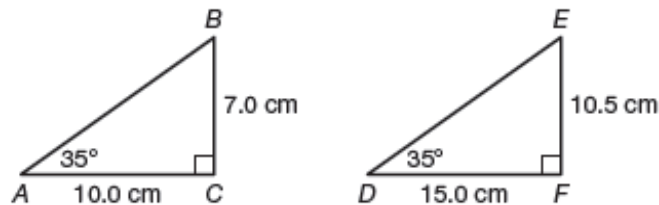
So, the ratio $\frac{\text{side adjacent to reference angle}}{\text{hypotenuse}}$ is constant in similar right triangles given the same reference angle measure.

10. Use triangle ABC in the worked example with reference angle C to verify that the ratios $\frac{\text{side opposite reference angle}}{\text{hypotenuse}}$ and $\frac{\text{side opposite reference angle}}{\text{side adjacent to reference angle}}$ are constant in similar right triangles. Show your work.

$$\frac{DE}{AB} = \frac{CD}{CA} \quad \text{and} \quad \frac{DE}{CD} = \frac{AB}{CA}$$

Finish pg.574-577 for homework!
What is below is not in your book

1. Analyze triangle ABC and triangle DEF . Use $\angle A$ and $\angle D$ as the reference angles.



- Identify the leg opposite $\angle A$, the leg adjacent to $\angle A$, and the hypotenuse in $\triangle ABC$.
- Calculate the length of the hypotenuse of triangle ABC . Round your answer to the nearest tenth.
- Calculate the ratios $\frac{\text{opposite}}{\text{hypotenuse}}$, $\frac{\text{adjacent}}{\text{hypotenuse}}$, and $\frac{\text{opposite}}{\text{adjacent}}$ for the reference angle in triangle ABC . Round your answers to the nearest thousandth if necessary.
- Describe the relationship between $\triangle ABC$ and $\triangle DEF$. Explain your reasoning.
- Calculate the length of the hypotenuse in $\triangle DEF$ without using the Pythagorean Theorem. Explain your reasoning.
- Calculate the ratios $\frac{\text{opposite}}{\text{hypotenuse}}$, $\frac{\text{adjacent}}{\text{hypotenuse}}$, and $\frac{\text{opposite}}{\text{adjacent}}$ for the reference angle in $\triangle DEF$. Round your answers to the nearest thousandth if necessary.
- Compare the values of the three ratios for $\triangle ABC$ and $\triangle DEF$. What do you observe? Why do you think this is true?

Homework

Finish Lesson 8.1