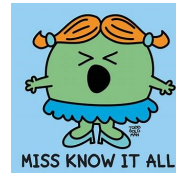




Warm Up Gr. 6
Lesson 4



a) Willow drew a triangle and said the angles were 104° , 64° and 20° . Is this possible? Why or why not?

Angle sum of triangle is 180° .

BUT

$$104 + 64 + 20 = 188^\circ$$

This cannot be a triangle since the angles does NOT add up to 180.

b) if 2 angles of a triangle are 64° , 73° then what is the final angle?

$$\text{Missing angle} = 180^\circ - (\text{given angles})$$

$$= 180^\circ - (64^\circ + 73^\circ)$$

$$= 180^\circ - 137^\circ$$

$$= 43^\circ$$

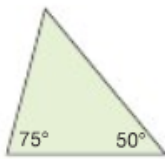
Practice

1. Draw 3 different triangles on dot paper. Measure and record each angle.
Find the sum of the measures of the angles for each triangle.

Many solutions

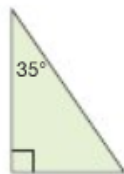
2. Determine the measure of the third angle without measuring.

a)

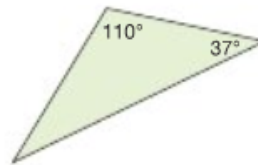


$$\begin{aligned} \text{a) Missing angle} &= 180^\circ - 50^\circ - 75^\circ \\ &= 180^\circ - 125^\circ \\ &= 55^\circ \end{aligned}$$

b)



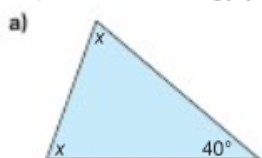
c)



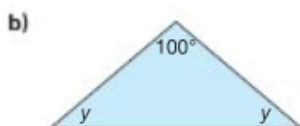
$$\begin{aligned} \text{b) Missing angle} &= 180^\circ - 35^\circ - 90^\circ \\ &= 180^\circ - 125^\circ \\ &= 55^\circ \end{aligned}$$

$$\begin{aligned} \text{c) Missing angle} &= 180^\circ - 37^\circ - 110^\circ \\ &= 180^\circ - 147^\circ \\ &= 33^\circ \end{aligned}$$

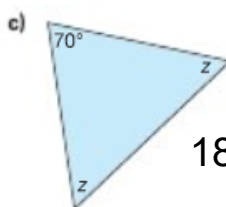
3. The two unknown angles in each triangle below are equal.
Determine the measure of each unknown angle without measuring.
Explain the strategy you used.



$$\begin{aligned} 180^\circ - 140^\circ \\ = 40^\circ \\ \text{Sum of } x + x = 40^\circ \\ \\ 40^\circ \div 2 = 20^\circ \\ \text{so } x = 20^\circ \end{aligned}$$



$$\begin{aligned} 180^\circ - 100^\circ \\ = 80^\circ \\ \text{Sum of } y + y = 80^\circ \\ \\ 80^\circ \div 2 = 40^\circ \\ \text{so } y = 40^\circ \end{aligned}$$



$$\begin{aligned} 180^\circ - 70^\circ \\ = 110^\circ \\ \text{Sum of } z + z = 110^\circ \\ \\ 110^\circ \div 2 = 55^\circ \\ \text{so } z = 55^\circ \end{aligned}$$

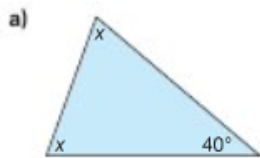
4. Two angles of a triangle are given.
Find the measure of the third angle.

- a) $55^\circ, 105^\circ$ b) $45^\circ, 90^\circ$
c) $30^\circ, 60^\circ$ d) $25^\circ, 125^\circ$

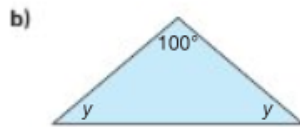
a) Missing angle = $180^\circ - 55^\circ - 105^\circ$ b) Missing angle = $180^\circ - 45^\circ - 90^\circ$
 $= 180^\circ - 160^\circ$ $= 180^\circ - 135^\circ$
 $= 20^\circ$ $= 45^\circ$

c) Missing angle = $180^\circ - 30^\circ - 60^\circ$ d) Missing angle = $180^\circ - 25^\circ - 125^\circ$
 $= 180^\circ - 90^\circ$ $= 180^\circ - 150^\circ$
 $= 90^\circ$ $= 30^\circ$

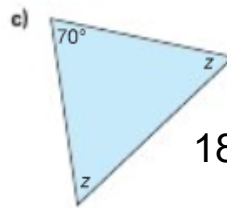
3. The two unknown angles in each triangle below are equal.
Determine the measure of each unknown angle without measuring.
Explain the strategy you used.



$$\begin{aligned} 180^\circ - 140^\circ \\ = 40^\circ \\ \text{Sum of } x + x = 40^\circ \\ \\ 40^\circ \div 2 = 20^\circ \\ \text{so } x = 20^\circ \end{aligned}$$



$$\begin{aligned} 180^\circ - 100^\circ \\ = 80^\circ \\ \text{Sum of } y + y = 80^\circ \\ \\ 80^\circ \div 2 = 40^\circ \\ \text{so } y = 40^\circ \end{aligned}$$



$$\begin{aligned} 180^\circ - 70^\circ \\ = 110^\circ \\ \text{Sum of } z + z = 110^\circ \\ \\ 110^\circ \div 2 = 55^\circ \\ \text{so } z = 55^\circ \end{aligned}$$

4. Two angles of a triangle are given.
Find the measure of the third angle.

- a) $55^\circ, 105^\circ$ b) $45^\circ, 90^\circ$
c) $30^\circ, 60^\circ$ d) $25^\circ, 125^\circ$

$$\begin{aligned} \text{a) Missing angle} &= 180^\circ - 55^\circ - 105^\circ & \text{b) Missing angle} &= 180^\circ - 45^\circ - 90^\circ \\ &= 180^\circ - 160^\circ & &= 180^\circ - 135^\circ \\ &= 20^\circ & &= 45^\circ \\ \\ \text{c) Missing angle} &= 180^\circ - 30^\circ - 60^\circ & \text{d) Missing angle} &= 180^\circ - 25^\circ - 125^\circ \\ &= 180^\circ - 90^\circ & &= 180^\circ - 150^\circ \\ &= 90^\circ & &= 30^\circ \end{aligned}$$

5. Vegreville, Alberta, is home to the world's largest known Ukrainian egg. It has 1108 triangular pieces with three angles of equal measure. Find the measure of each angle. Explain your strategy.

$$180^\circ \div 3 = 60^\circ$$



6. Is it possible for a triangle to have:
- a) more than 1 obtuse angle?
 - b) 2 right angles?
 - c) 3 acute angles?
- Explain your thinking.
Use pictures and words.

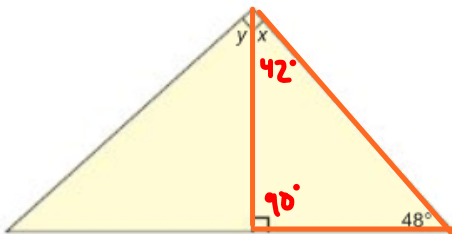
a)no since obtuse means bigger than 90 degrees and $91 + 91 = 182$ degrees (angles must add to 180 degrees)

b)no since right means 90 degrees and $90 + 90 = 180$ degrees (angles must add to 180 degrees) and there is no third angle.

a)You can have 3 acute angles since $(60 + 70 + 50)$ (angles must add to 180 degrees)

9. Find the measures of the angles labelled x and y.
Show your work. Explain the strategy you used.

a)



angle sum of triangle

$$x = 180^\circ - 48^\circ - 90^\circ$$

$$= 180^\circ - 138^\circ$$

$$= 42^\circ$$

y is gotten by sum of right angle

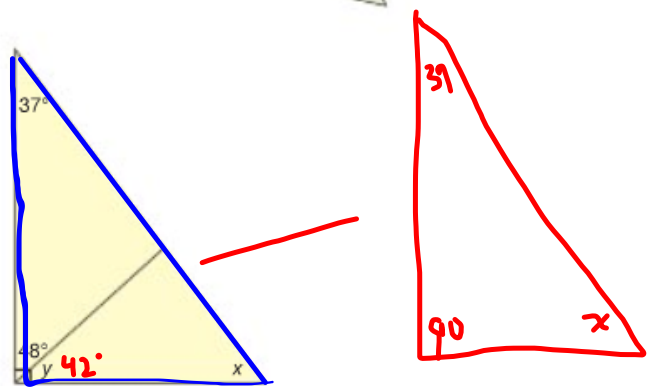
$$x + y = 90^\circ$$

$$y = 90^\circ - x$$

$$= 90^\circ - 42^\circ$$

$$= 48^\circ$$

b)



y is gotten by sum of right angle

$$48^\circ + y = 90^\circ$$

$$y = 90^\circ - 48^\circ$$

$$y = 42^\circ$$

angle sum of triangle

$$x = 180^\circ - 90^\circ - 37^\circ$$

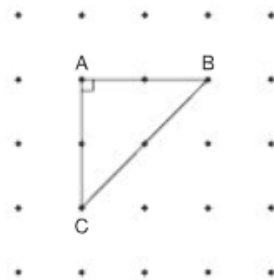
$$= 180^\circ - 127^\circ$$

$$= 54^\circ$$

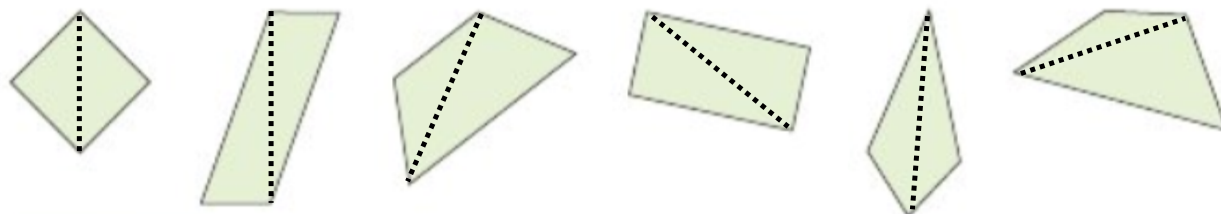
10. Use a geoboard and geobands or square dot paper.

Construct $\triangle ABC$.

- Find the unknown angle measures.
Check your answers by measuring with a protractor.
- Extend AB 1 unit right to D.
Extend AC 1 unit down to E. Join DE.
- Predict the measure of each angle in the new triangle.
Use a protractor to check. Record your work.
- Repeat steps b and c two more times.
- What do you notice about all the triangles you created? Explain.



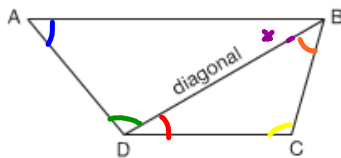
I want you to draw a diagonal line in each of the following quadrilaterals.



What do you notice?

Each quadrilaterals is made up of 2 triangles

Since any quadrilateral can be cut to form 2 triangles , then the sum of the interior angles of any quadrilateral will add to 360° .



study

We can use 3 letters to name an angle. The middle letter tells the vertex of the angle.



The sum of the angles in each triangle formed is 180° .

In $\triangle ABD$, $\angle ABD + \angle BDA + \angle DAB = 180^\circ$

In $\triangle DBC$, $\angle DBC + \angle BCD + \angle CDB = 180^\circ$

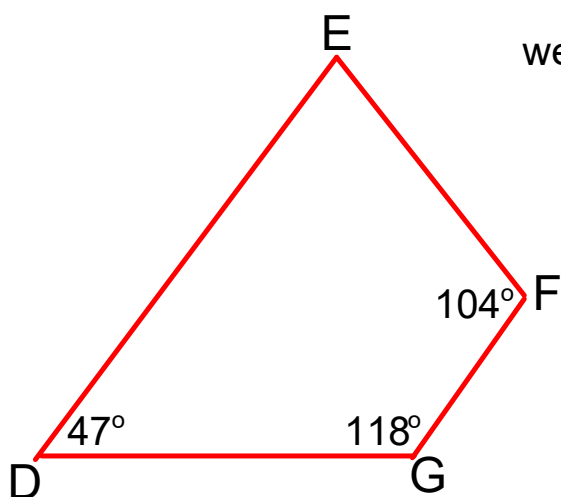
So, the sum of the angles in quadrilateral ABCD is $2 \times 180^\circ = 360^\circ$.

Study

\times $\angle_{\text{missing angle of quad}} = 360^\circ - (\text{sum of given angles})$

SHOW WORK (Diagram is not drawn to scale)

Find the angle measure of $\angle E$ in the quadrilateral



we know the sum of all angles add to 360°

$$\angle E + \angle F + \angle G + \angle D = 360^\circ$$

$$\angle E + 104^\circ + 118^\circ + 47^\circ = 360^\circ$$

or

$$360^\circ - (\text{given angle sum})$$

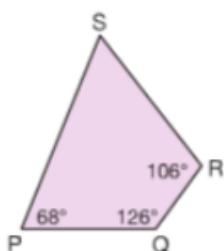
$$\angle E = 360^\circ - (\text{given angle sum})$$

$$\angle E = 360^\circ - (47^\circ + 118^\circ + 104^\circ)$$

$$\angle E = 360^\circ - (269^\circ)$$

$$\angle E = 91^\circ$$

You try



Show work
Find the angle measure of $\angle S$

$$\angle S = 360^\circ - (\text{given angle sum})$$

$$\angle S = 360^\circ - (68^\circ + 126^\circ + 106^\circ)$$

$$\angle S = 360^\circ - (300^\circ)$$

$$\angle S = 60^\circ$$

Class/Homework

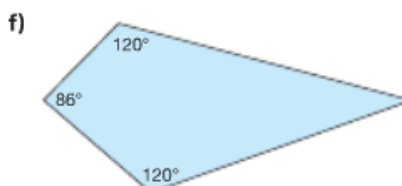
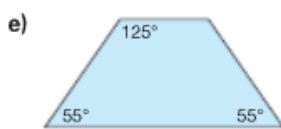
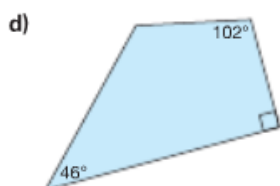
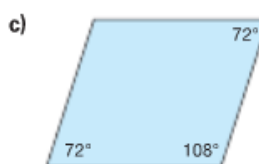
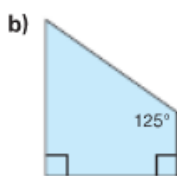
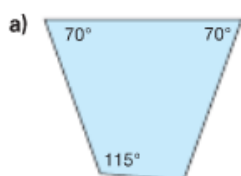
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#2,3

Must show work

Practice

2. Find the unknown angle measure in each quadrilateral.



3. A student drew 4 different quadrilaterals.
She recorded the angle measures in a table.

Quadrilateral	$\angle A$	$\angle B$	$\angle C$	$\angle D$
a)	225°	36°	47°	42°
b)	81°	99°	81°	99°
c)	90°	45°	120°	105°
d)	123°	66°	108°	73°

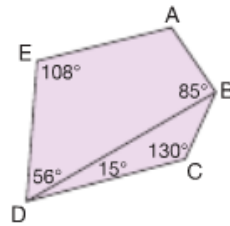
Did the student measure the angles in each quadrilateral correctly?
How do you know?



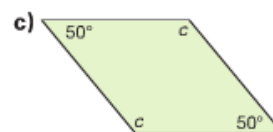
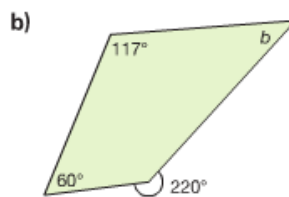
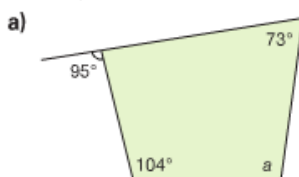
4. Use a geoboard and geobands and/or dot paper.
Try to make each quadrilateral below.
If you can make the quadrilateral, record your work on dot paper.
If you cannot make the quadrilateral, use what you know about
the sum of the angles in a quadrilateral to explain why.
- a quadrilateral with 4 right angles
 - a quadrilateral with 2 acute angles and 2 obtuse angles
 - a quadrilateral with only one right angle
 - a quadrilateral with 4 acute angles
 - a quadrilateral with 4 obtuse angles



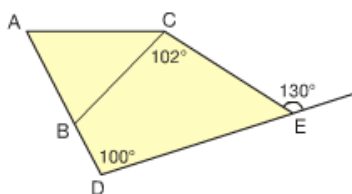
5. Look at this pentagon.
- Find the measure of $\angle A$.
 - Find the measure of $\angle DBC$.
- Show your work. Explain your thinking.



6. Find the measure of the angles labelled a , b , and c . Show your work.

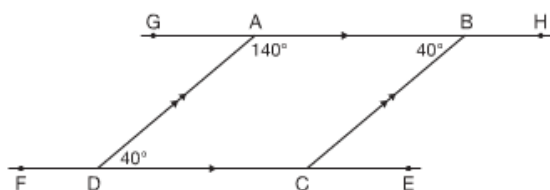


7. Find the measure of $\angle ABC$.
Show all the steps you took to find its measure.



8. Draw a rectangle. Draw its diagonals.
Measure one of the angles formed where the diagonals intersect.
Without using a protractor, find the measures of the other 3 angles.
Explain your strategy.
Repeat for 2 different quadrilaterals.
What do you notice?

9. Look at parallelogram ABCD.



- Without using a protractor, find the measure of $\angle BCD$.
- Find the measure of $\angle BCE$, $\angle CBH$, $\angle ADF$, and $\angle DAG$.
What strategy did you use?
- List pairs of angles that have the same measure.
- List pairs of angles that add to 180° .

Attachments

Worksheet Maeasuring Angles with Protractors.pdf