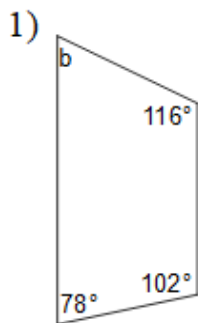


Warm Up Gr. 6

Date: _____



Show work and find the missing angle

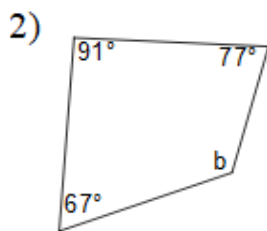


$$\begin{array}{r} \text{Given} = 116^\circ \\ + 102^\circ \\ + 78^\circ \\ \hline 296^\circ \end{array}$$

Missing Angle
 $b = 64^\circ$

Missing Angle
 $360^\circ - \text{Given}$

$$\begin{array}{r} 360 \\ - 296 \\ \hline 64 \end{array}$$



$$\begin{array}{r} \text{Given} \\ 91^\circ \\ + 77^\circ \\ + 67^\circ \\ \hline 235^\circ \end{array}$$

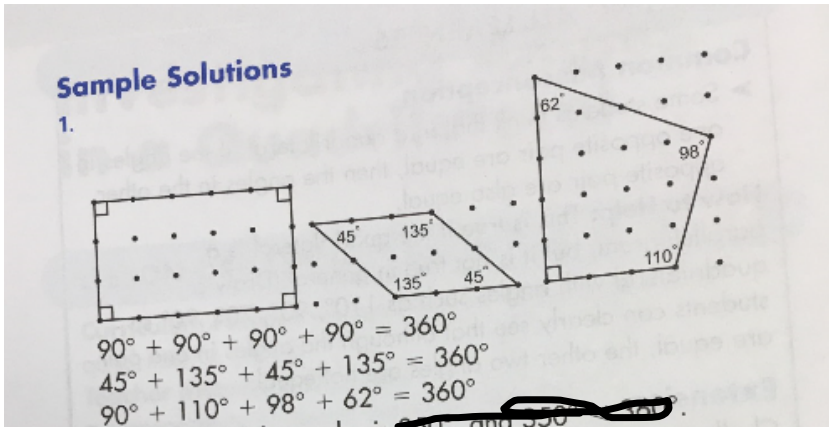
Missing Angle
 $b = 125^\circ$

Missing angle
 $= 360^\circ - \text{Given}$

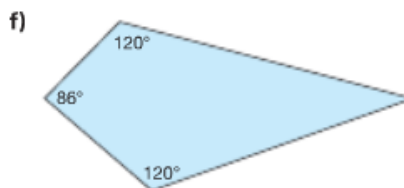
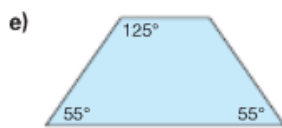
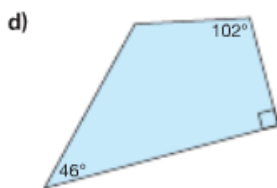
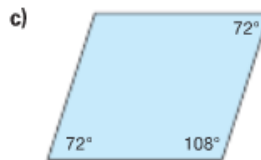
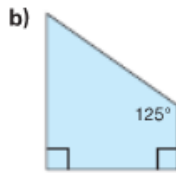
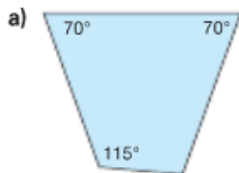
$$\begin{array}{r} 360^\circ \\ - 235^\circ \\ \hline 125^\circ \end{array}$$

Practice

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



2. Find the unknown angle measure in each quadrilateral.



a) $360 - 70 - 70 - 115$
 $= 105$

b) $360 - 90 - 90 - 125$
 $= 55$

c) $360 - 72 - 108 - 72$
 $= 108$

d) $360 - 102 - 90 - 46$
 $= 122$

e) $360 - 55 - 125 - 55$
 $= 125$

f) $360 - 120 - 86 - 120$
 $= 34$

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°	no
b)	81°	99°	81°	99°	yes
c)	90°	45°	120°	105°	yes
d)	123°	66°	108°	73°	no

$$225 + 36 + 47 + 42 = 350^\circ$$

$$123 + 66 + 108 + 73 = 370^\circ$$

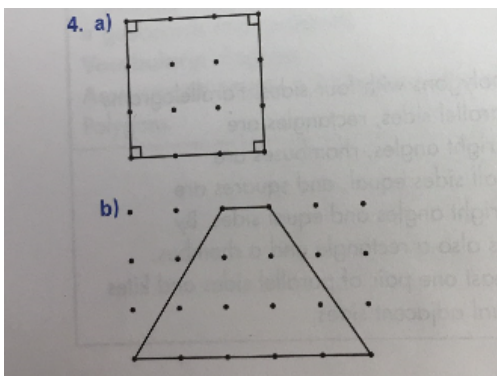
Did the student measure the angles in each quadrilateral correctly? How do you know?

3. a) The sum of the angles is 350° , and $350^\circ < 360^\circ$.
 b) The sum of the angles is 360° .
 c) The sum of the angles is 360° .
 d) The sum of the angles is 370° , and $370^\circ > 360^\circ$.

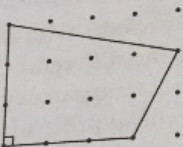


4. Use a geoboard and geobands and/or dot paper. Try to make each quadrilateral below. If you can make the quadrilateral, record your work on dot paper. If you cannot make the quadrilateral, use what you know about the sum of the angles in a quadrilateral to explain why.

- a) a quadrilateral with 4 right angles
- b) a quadrilateral with 2 acute angles and 2 obtuse angles
- c) a quadrilateral with only one right angle
- d) a quadrilateral with 4 acute angles
- e) a quadrilateral with 4 obtuse angles



(Sample Solutions, continued)

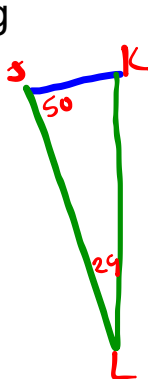
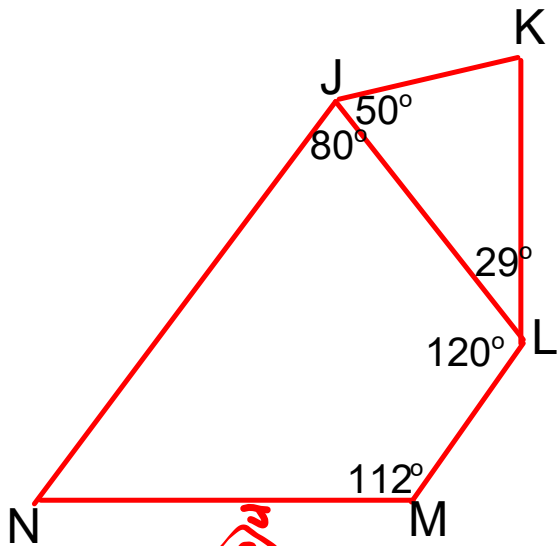
c) 

d) It is not possible to construct a quadrilateral with 4 acute angles. An acute angle is less than 90° . So, the greatest the sum could be is $4 \times 89^\circ = 356^\circ$.

e) It is not possible to construct a quadrilateral with 4 obtuse angles. An obtuse angle is greater than 90° . So, the least the sum could be is $4 \times 91^\circ = 364^\circ$.

SHOW WORK (Diagram is not drawn to scale)

Explain your thinking



JKL make a Δ

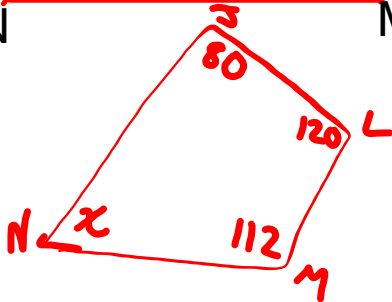
a) Find $\angle K$

$$\begin{aligned} \text{Given} &= J + L \\ &= 50 + 29 \\ &= 79 \end{aligned}$$

$$\begin{aligned} \angle K &= 180 - \text{Given} \\ &= 180 - 79^\circ \\ \angle K &= 101^\circ \end{aligned}$$

$\angle JNM$

b) Find $\angle JNM$



Because JLMN is Quadrilateral

Missing $\angle JNM$

$$\begin{aligned} &= 360^\circ - \text{Given} \\ &= 360^\circ \\ &\quad - 312^\circ \\ &\hline &48 \end{aligned}$$

$$\begin{aligned} \text{Given} &= 112 \\ &120 \\ &+ 80 \\ &\hline &312 \end{aligned}$$

$$\angle JNM = 48^\circ$$

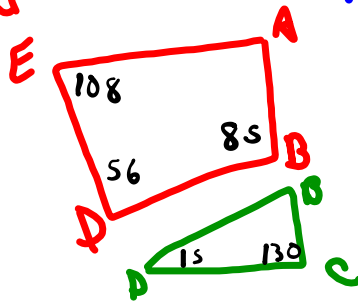
Class/Homework

Page 152-153

#5,6,7,9

Must show work

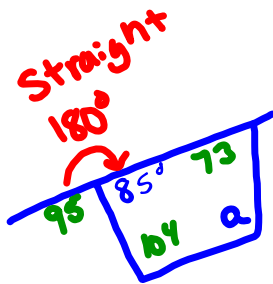
quadrilateral
triangle



Missing $\angle A B$

Missing $\angle D B C$

6a)



#5,6,7,9

$$95^\circ + \boxed{85^\circ} = 180^\circ$$

$$\angle a = 360^\circ - \text{Given}$$

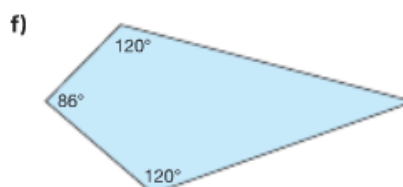
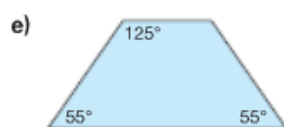
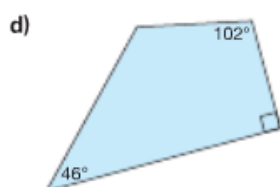
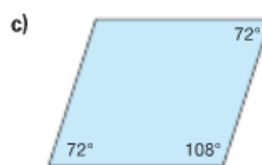
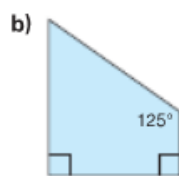
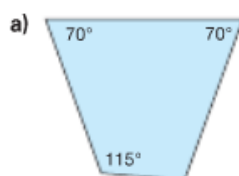
$$\begin{array}{r} 360 \\ - 262 \\ \hline 98^\circ \end{array}$$

$$\begin{array}{r} \text{Given} = 104^\circ \\ 73^\circ \\ 85^\circ \rightarrow \\ \hline 262^\circ \end{array}$$

Practice

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

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°

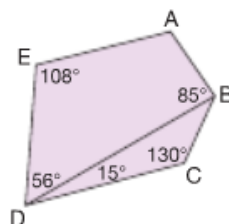
Did the student measure the angles in each quadrilateral correctly?
How do you know?



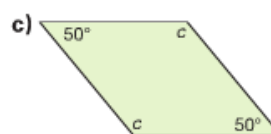
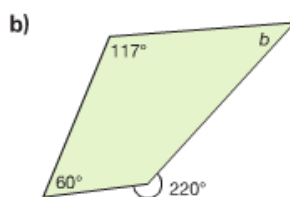
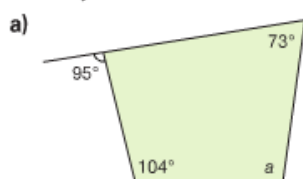
4. Use a geoboard and geobands and/or dot paper.
Try to make each quadrilateral below.
If you can make the quadrilateral, record your work on dot paper.
If you cannot make the quadrilateral, use what you know about
the sum of the angles in a quadrilateral to explain why.
- a) a quadrilateral with 4 right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

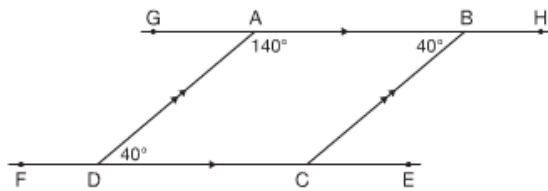
this is a quadrilateral
↓ add to 360°
Given = $100^\circ + 102^\circ + 50^\circ$
= 252°
Missing angle of Quad
 $360 - \text{Given}$
 $360^\circ - 252^\circ$
 108°

Straight angle add to 180
 $180^\circ - 130^\circ$
 $= 50$

Straight
 $\angle ABC = \frac{180}{-108}$
72°

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° .

Sample Solutions

1.

$90^\circ + 90^\circ + 90^\circ + 90^\circ = 360^\circ$
 $45^\circ + 135^\circ + 45^\circ + 135^\circ = 360^\circ$
 $90^\circ + 110^\circ + 98^\circ + 62^\circ = 360^\circ$

3. a) The sum of the angles is 350° , and $350^\circ < 360^\circ$.
 b) The sum of the angles is 360° .
 c) The sum of the angles is 360° .
 d) The sum of the angles is 370° , and $370^\circ > 360^\circ$.

4. a)

b)

2. Find the unknown angle measure in each quadrilateral.

a) b) c) d) e) f)

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°

a) No b) Yes
c) Yes d) No

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.

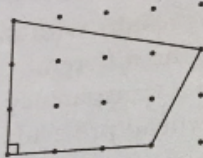
- a quadrilateral with 4 right angles
- a quadrilateral with 2 acute angles and 2 obtuse angles
- a quadrilateral with only one right angle
- a quadrilateral with 4 acute angles
- a quadrilateral with 4 obtuse angles

5. Look at this pentagon.

a) Find the measure of $\angle A$. 111°
 b) Find the measure of $\angle DBC$. 35°
 Show your work. Explain your thinking.

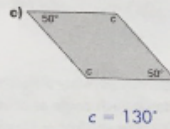
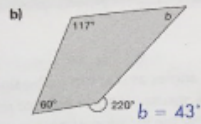
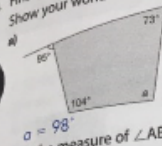
(Sample Solutions, continued)

c)

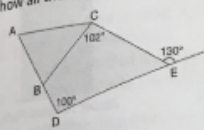


- d) It is not possible to construct a quadrilateral with 4 acute angles. An acute angle is less than 90° . So, the greatest the sum could be is $4 \times 89^\circ = 356^\circ$.
- e) It is not possible to construct a quadrilateral with 4 obtuse angles. An obtuse angle is greater than 90° . So, the least the sum could be is $4 \times 91^\circ = 364^\circ$.
5. a) The sum of the angles in quadrilateral ABDE is 360° .
 $360^\circ - 56^\circ - 108^\circ - 85^\circ = 111^\circ$
- b) The sum of the angles in $\triangle DBC$ is 180° .
 $180^\circ - 15^\circ - 130^\circ = 35^\circ$
6. a) $180^\circ - 95^\circ = 85^\circ$; the 2 angles make a straight angle. The sum of the angles in a quadrilateral is 360° . So, subtract to find a :
 $360^\circ - 85^\circ - 104^\circ - 73^\circ = 98^\circ$
- b) To find the inside angle, subtract:
 $360^\circ - 220^\circ = 140^\circ$. The sum of the angles in a quadrilateral is 360° . So, subtract to find b :
 $360^\circ - 140^\circ - 60^\circ - 117^\circ = 43^\circ$

6. Find the measure of $\angle a$.
Show your work.



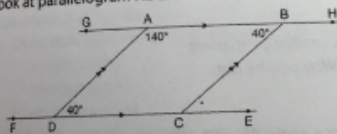
7. Find the measure of $\angle ABC$.
Show all the steps you took to find its measure.



$\angle ABC = 72^\circ$

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?

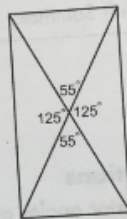
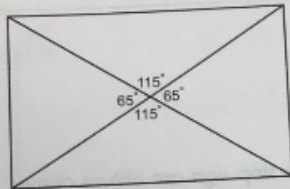
9. Look at parallelogram ABCD.



- a) Without using a protractor, find the measure of $\angle BCD$. $\angle BCD = 140^\circ$
- b) Find the measure of $\angle BCE$, $\angle CBH$, $\angle ADF$, and $\angle DAG$. $\angle BCE = 40^\circ$, $\angle CBH = 140^\circ$,
 $\angle ADF = 140^\circ$, $\angle DAG = 40^\circ$
What strategy did you use?
- c) List pairs of angles that have the same measure. $\angle DAG$, $\angle BCE$, $\angle ABC$, $\angle ADC$ all measure 40° .
- d) List pairs of angles that add to 180° .
 $\angle CBH$, $\angle ADF$, $\angle DAB$, $\angle BCD$ all measure 140° .

- c) $360^\circ - 100^\circ = 260^\circ$; since the 2 unknown angles are equal, divide by 2 to find c: $260^\circ \div 2 = 130^\circ$
7. $\angle DEC = 180^\circ - 130^\circ = 50^\circ$ (straight angle)
 The sum of the angles in quadrilateral CBDE is 360° .
 So, $\angle CBD = 360^\circ - 102^\circ - 50^\circ - 100^\circ = 108^\circ$
 $\angle ABC$ and $\angle CBD$ make a straight angle.
 So, $\angle ABC = 180^\circ - 108^\circ = 72^\circ$

8.



I know that a straight angle is 180° , so I subtracted 65° from 180° to find one of the other measures. I used the same process to find the other 2 angles.
 Each time, the angles formed by the diagonals add to 360° .
 For example, $55^\circ + 125^\circ + 55^\circ + 125^\circ = 360^\circ$ and $65^\circ + 115^\circ + 65^\circ + 115^\circ = 360^\circ$

9. b) I used the fact that a straight angle measures 180° .
 d) $\angle FDA$ and $\angle ADC$; $\angle DCB$ and $\angle BCE$; $\angle HBC$ and $\angle CBA$;
 $\angle BAD$ and $\angle DAG$; $\angle DAB$ and $\angle ABC$; $\angle ABC$ and $\angle BCD$;
 $\angle BCD$ and $\angle CDA$; $\angle CDA$ and $\angle DAB$

REFLECT: I know the sum of the angles in a triangle is 180° .
 I can draw a diagonal to divide a quadrilateral into 2 triangles. So, the sum of the angles in a quadrilateral is:
 $180^\circ + 180^\circ = 360^\circ$

Attachments

Worksheet Maeasuring Angles with Protractors.pdf