

Measuring Angles

Objectives

- 1 Name angles and identify their parts.
- 2 Measure angles using a protractor.
- 3 Work with congruent angles.
- 4 Solve problems using the Angle Addition Postulate

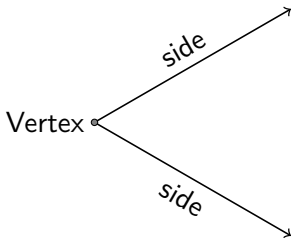
Angles

Angles are formed by 2 rays with the same endpoint.

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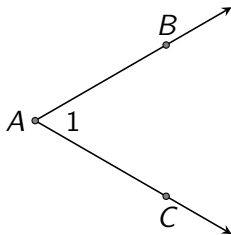
The rays are the **sides** and the endpoint is the **vertex**.



Naming Angles

You can name an angle by

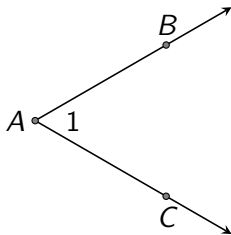
- its vertex, $\angle A$



Naming Angles

You can name an angle by

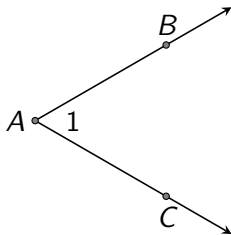
- its vertex, $\angle A$
- a point on each ray and the vertex, $\angle BAC$ or $\angle CAB$



Naming Angles

You can name an angle by

- its vertex, $\angle A$
- a point on each ray and the vertex, $\angle BAC$ or $\angle CAB$
- a number, $\angle 1$



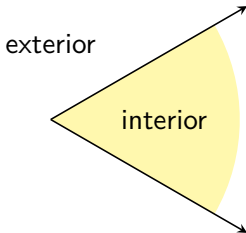
Parts of an Angle

The **interior** of an angle is the region containing all of the points between the rays.

Parts of an Angle

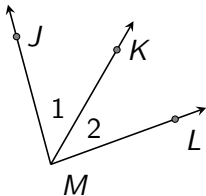
The **interior** of an angle is the region containing all of the points between the rays.

The **exterior** of an angle is all of the points outside the interior.



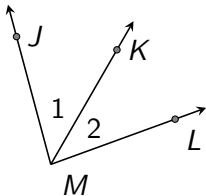
Example 1

- (a) What are two other names for $\angle 1$?



Example 1

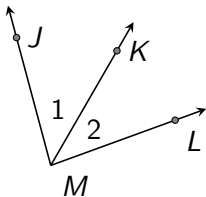
- (a) What are two other names for $\angle 1$?



$\angle JMK$ and $\angle KMJ$

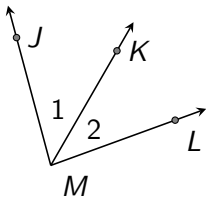
Example 1

- (b) What are two other names for $\angle KML$?



Example 1

- (b) What are two other names for $\angle KML$?



$\angle LMK$ and $\angle 2$

Objectives

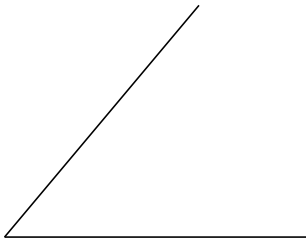
- 1 Name angles and identify their parts.
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Using a Protractor

When measuring angles using a protractor, place the middle of the protractor at the vertex of the angle and align the $180/0^\circ$ line along one of the angle's sides.

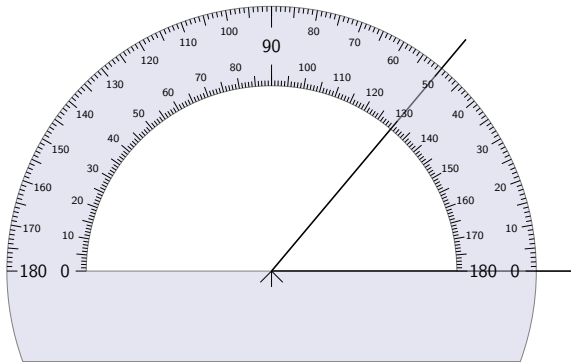
Using a Protractor

When measuring angles using a protractor, place the middle of the protractor at the vertex of the angle and align the $180/0^\circ$ line along one of the angle's sides.



Using a Protractor

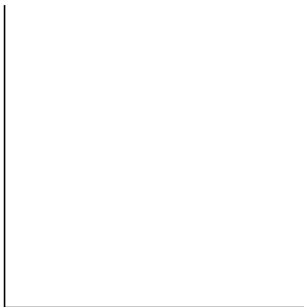
When measuring angles using a protractor, place the middle of the protractor at the vertex of the angle and align the $180/0^\circ$ line along one of the angle's sides.



Example 2

Find the measure of each angle.

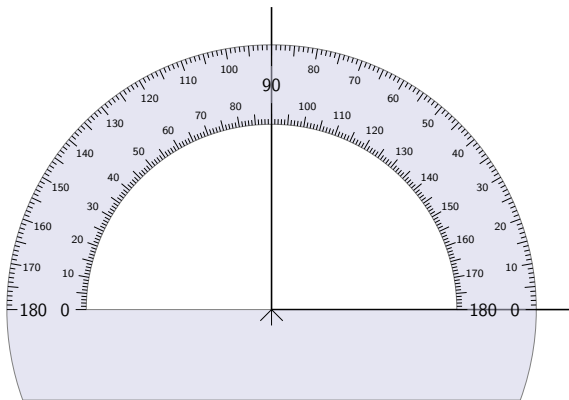
(a)



Example 2

Find the measure of each angle.

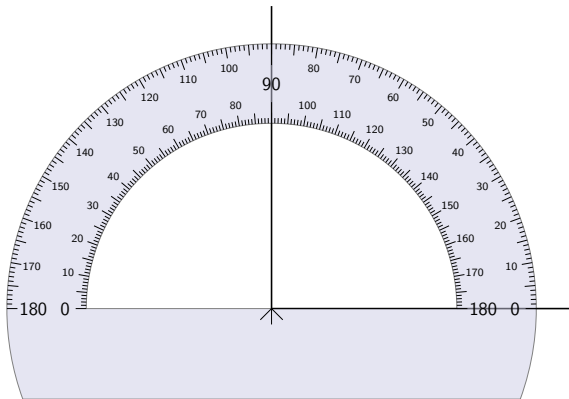
(a)



Example 2

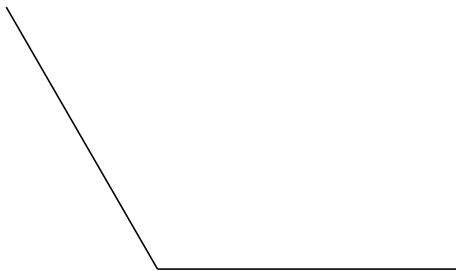
Find the measure of each angle.

(a) 90°



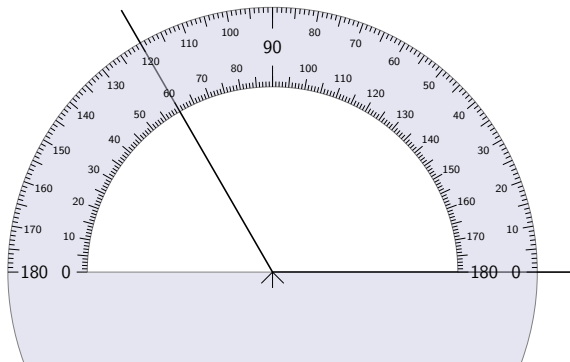
Example 2

(b)



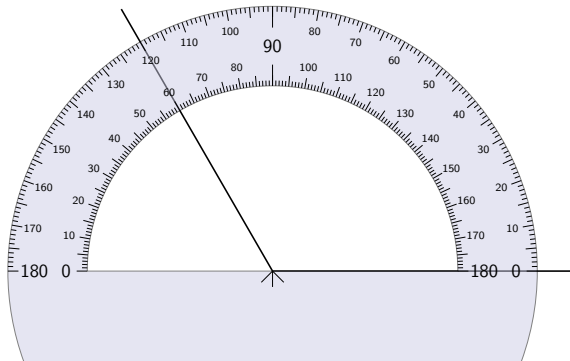
Example 2

(b)



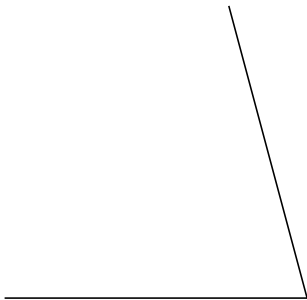
Example 2

(b) **120°**



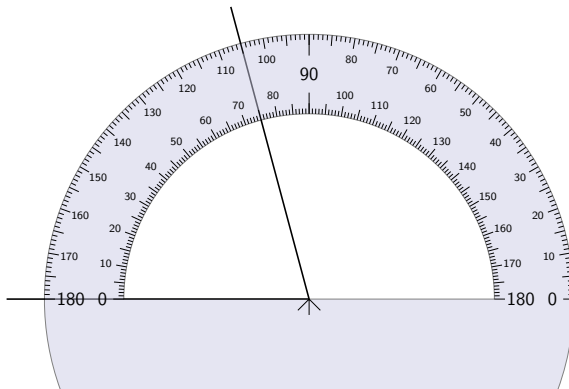
Example 2

(c)



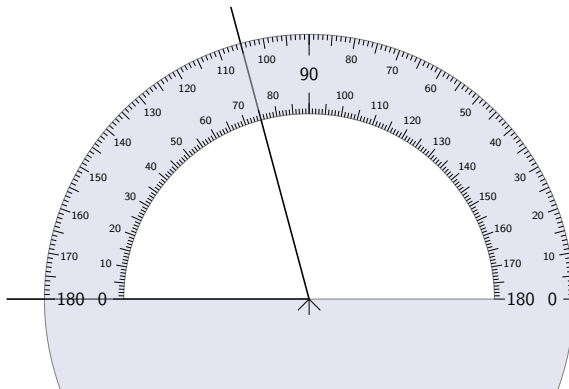
Example 2

(c)



Example 2

(c) **75°**



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Congruent Angles

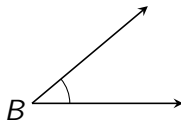
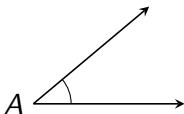
Congruent Angles

Congruent angles have the same degree measure.

Congruent Angles

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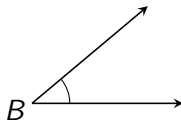
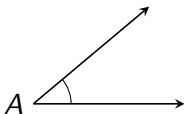
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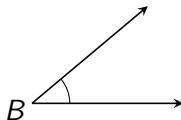
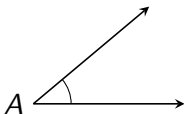


$$m\angle A = m\angle B$$

Congruent Angles

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Congruent angles have the same degree measure.



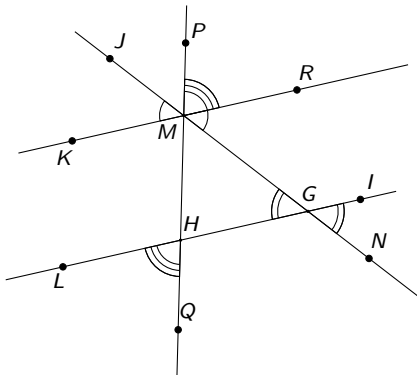
$$m\angle A = m\angle B$$

$$\angle A \cong \angle B$$

Example 3

Use the figure to find the missing value.

(a) $\angle JMK \cong ?$

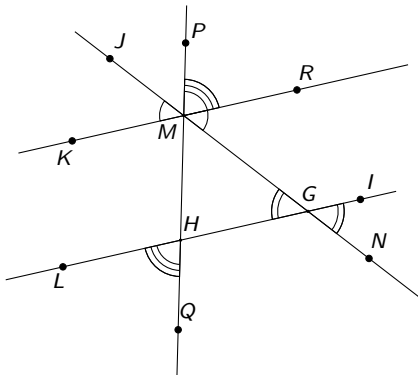


Example 3

Use the figure to find the missing value.

(a) $\angle JMK \cong ?$

$\angle RMG$



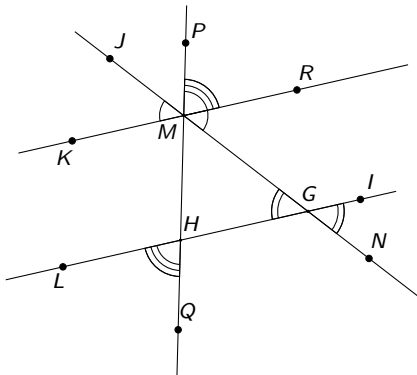
Example 3

Use the figure to find the missing value.

(a) $\angle JMK \cong ?$

$\angle RMG$

(b) $\angle IGN \cong ?$



Example 3

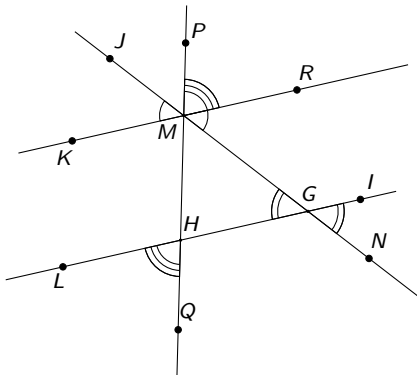
Use the figure to find the missing value.

(a) $\angle JMK \cong ?$

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(b) $\angle IGN \cong ?$

$\angle HGM$



Example 3

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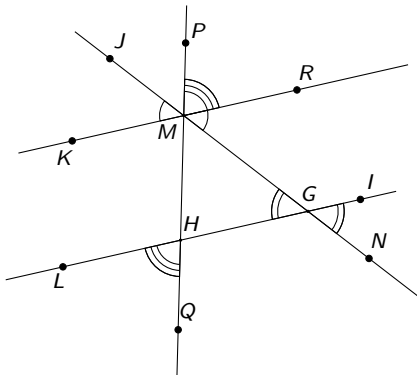
(a) $\angle JMK \cong ?$

$\angle RMG$

(b) $\angle IGN \cong ?$

$\angle HGM$

(c) $\angle RMP \cong ?$



Example 3

Use the figure to find the missing value.

(a) $\angle JMK \cong ?$

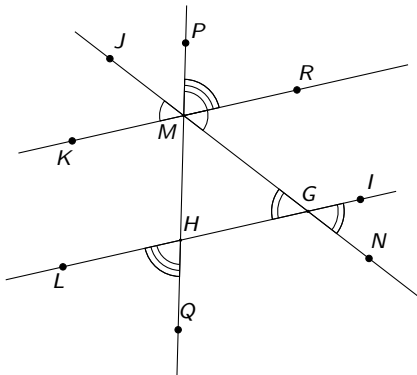
$\angle RMG$

(b) $\angle IGN \cong ?$

$\angle HGM$

(c) $\angle RMP \cong ?$

$\angle QHL$



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Angle Addition Postulate

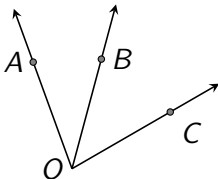
The **Angle Addition Postulate** is similar to the Segment Addition Postulate.

Angle Addition Postulate

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If B is in the interior of $\angle AOC$ then

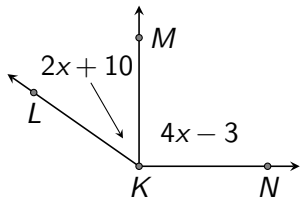
$$m\angle AOB + m\angle BOC = m\angle AOC$$



Example 4

Find the measure of each angle.

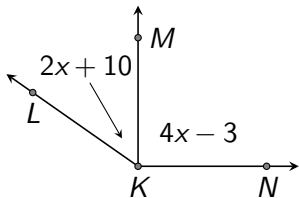
(a) $m\angle LKN = 145^\circ$



Example 4

Find the measure of each angle.

(a) $m\angle LKN = 145^\circ$

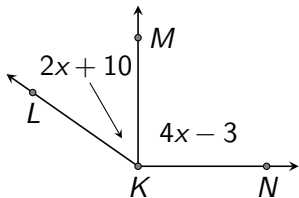


$$m\angle LKM + m\angle MKN = m\angle LKN$$

Example 4

Find the measure of each angle.

(a) $m\angle LKN = 145^\circ$



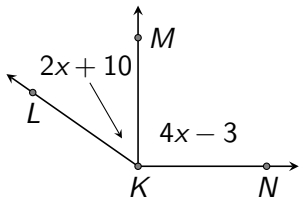
$$m\angle LKM + m\angle MKN = m\angle LKN$$

$$2x + 10 + 4x - 3 = 145$$

Example 4

Find the measure of each angle.

(a) $m\angle LKN = 145^\circ$



$$m\angle LKM + m\angle MKN = m\angle LKN$$

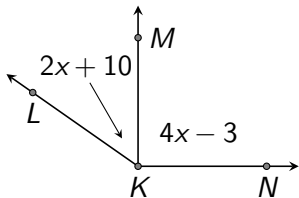
$$2x + 10 + 4x - 3 = 145$$

$$6x + 7 = 145$$

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Find the measure of each angle.

(a) $m\angle LKN = 145^\circ$



$$m\angle LKM + m\angle MKN = m\angle LKN$$

$$2x + 10 + 4x - 3 = 145$$

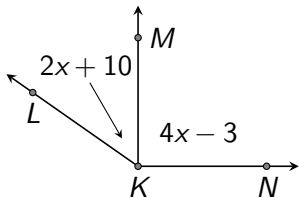
$$6x + 7 = 145$$

$$6x = 138$$

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Find the measure of each angle.

(a) $m\angle LKN = 145^\circ$



$$m\angle LKM + m\angle MKN = m\angle LKN$$

$$2x + 10 + 4x - 3 = 145$$

$$6x + 7 = 145$$

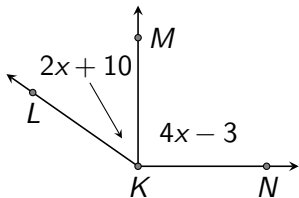
$$6x = 138$$

$$x = 23$$

Example 4

Find the measure of each angle.

(a) $m\angle LKN = 145^\circ$



$$m\angle LKM + m\angle MKN = m\angle LKN$$

$$2x + 10 + 4x - 3 = 145$$

$$6x + 7 = 145$$

$$6x = 138$$

$$x = 23$$

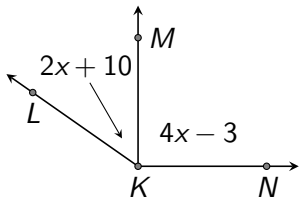
$$m\angle LKM = 2(23) + 10$$

$$m\angle MKN = 4(23) - 3$$

Example 4

Find the measure of each angle.

(a) $m\angle LKN = 145^\circ$



$$m\angle LKM + m\angle MKN = m\angle LKN$$

$$2x + 10 + 4x - 3 = 145$$

$$6x + 7 = 145$$

$$6x = 138$$

$$x = 23$$

$$m\angle LKM = 2(23) + 10$$

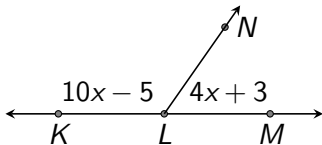
$$m\angle LKM = 56^\circ$$

$$m\angle MKN = 4(23) - 3$$

$$m\angle MKN = 89^\circ$$

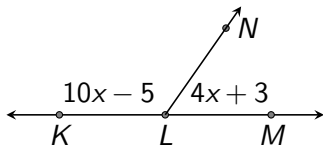
Example 4

(b) Given \overleftrightarrow{KM}



Example 4

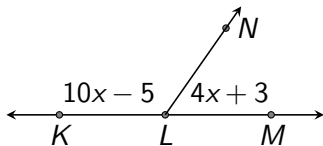
(b) Given \overleftrightarrow{KM}



$$m\angle KLN + m\angle MLN = m\angle KLM$$

Example 4

(b) Given \overleftrightarrow{KM}

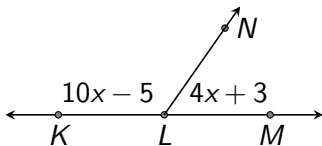


$$m\angle KLN + m\angle MLN = m\angle KLM$$

$$10x - 5 + 4x + 3 = 180$$

Example 4

(b) Given \overleftrightarrow{KM}



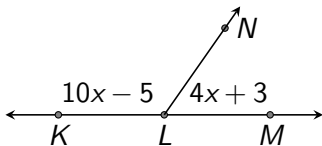
$$m\angle KLN + m\angle MLN = m\angle KLM$$

$$10x - 5 + 4x + 3 = 180$$

$$14x - 2 = 180$$

Example 4

(b) Given \overleftrightarrow{KM}



$$m\angle KLN + m\angle MLN = m\angle KLM$$

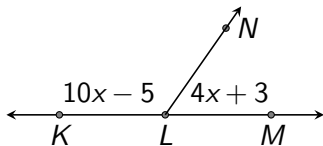
$$10x - 5 + 4x + 3 = 180$$

$$14x - 2 = 180$$

$$14x = 182$$

Example 4

(b) Given \overleftrightarrow{KM}



$$m\angle KLN + m\angle MLN = m\angle KLM$$

$$10x - 5 + 4x + 3 = 180$$

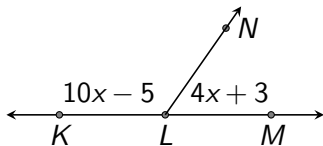
$$14x - 2 = 180$$

$$14x = 182$$

$$x = 13$$

Example 4

(b) Given \overleftrightarrow{KM}



$$m\angle KLN + m\angle MLN = m\angle KLM$$

$$10x - 5 + 4x + 3 = 180$$

$$14x - 2 = 180$$

$$14x = 182$$

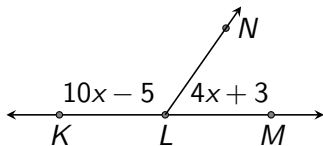
$$x = 13$$

$$m\angle KLN = 10(13) - 5$$

$$m\angle MLN = 4(13) + 3$$

Example 4

(b) Given \overleftrightarrow{KM}



$$m\angle KLN + m\angle MLN = m\angle KLM$$

$$10x - 5 + 4x + 3 = 180$$

$$14x - 2 = 180$$

$$14x = 182$$

$$x = 13$$

$$m\angle KLN = 10(13) - 5$$

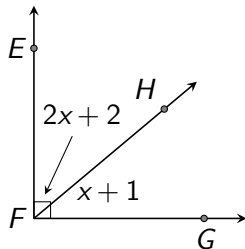
$$m\angle KLN = 125^\circ$$

$$m\angle MLN = 4(13) + 3$$

$$m\angle MLN = 55^\circ$$

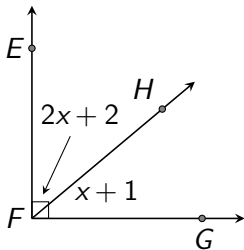
Example 4

(c)



Example 4

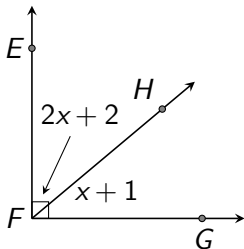
(c)



$$m\angle EFH + m\angle GFH = 90$$

Example 4

(c)

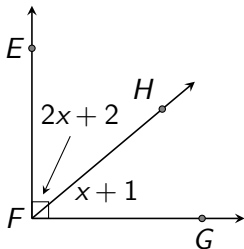


$$m\angle EFH + m\angle GFH = 90$$

$$2x + 2 + x + 1 = 90$$

Example 4

(c)



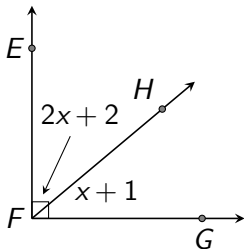
$$m\angle EFH + m\angle GFH = 90$$

$$2x + 2 + x + 1 = 90$$

$$3x + 3 = 90$$

Example 4

(c)



$$m\angle EFH + m\angle GFH = 90$$

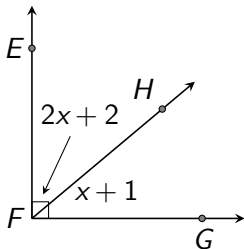
$$2x + 2 + x + 1 = 90$$

$$3x + 3 = 90$$

$$3x = 87$$

Example 4

(c)



$$m\angle EFH + m\angle GFH = 90$$

$$2x + 2 + x + 1 = 90$$

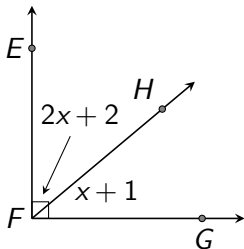
$$3x + 3 = 90$$

$$3x = 87$$

$$x = 29$$

Example 4

(c)



$$m\angle EFH + m\angle GFH = 90$$

$$2x + 2 + x + 1 = 90$$

$$3x + 3 = 90$$

$$3x = 87$$

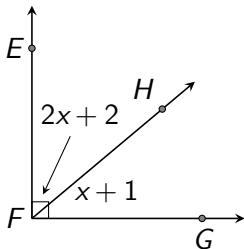
$$x = 29$$

$$m\angle EFH = 2(29) + 2$$

$$m\angle GFH = 29 + 1$$

Example 4

(c)



$$m\angle EFH + m\angle GFH = 90$$

$$2x + 2 + x + 1 = 90$$

$$3x + 3 = 90$$

$$3x = 87$$

$$x = 29$$

$$m\angle EFH = 2(29) + 2$$

$$m\angle EFH = 60^\circ$$

$$m\angle GFH = 29 + 1$$

$$m\angle GFH = 30^\circ$$