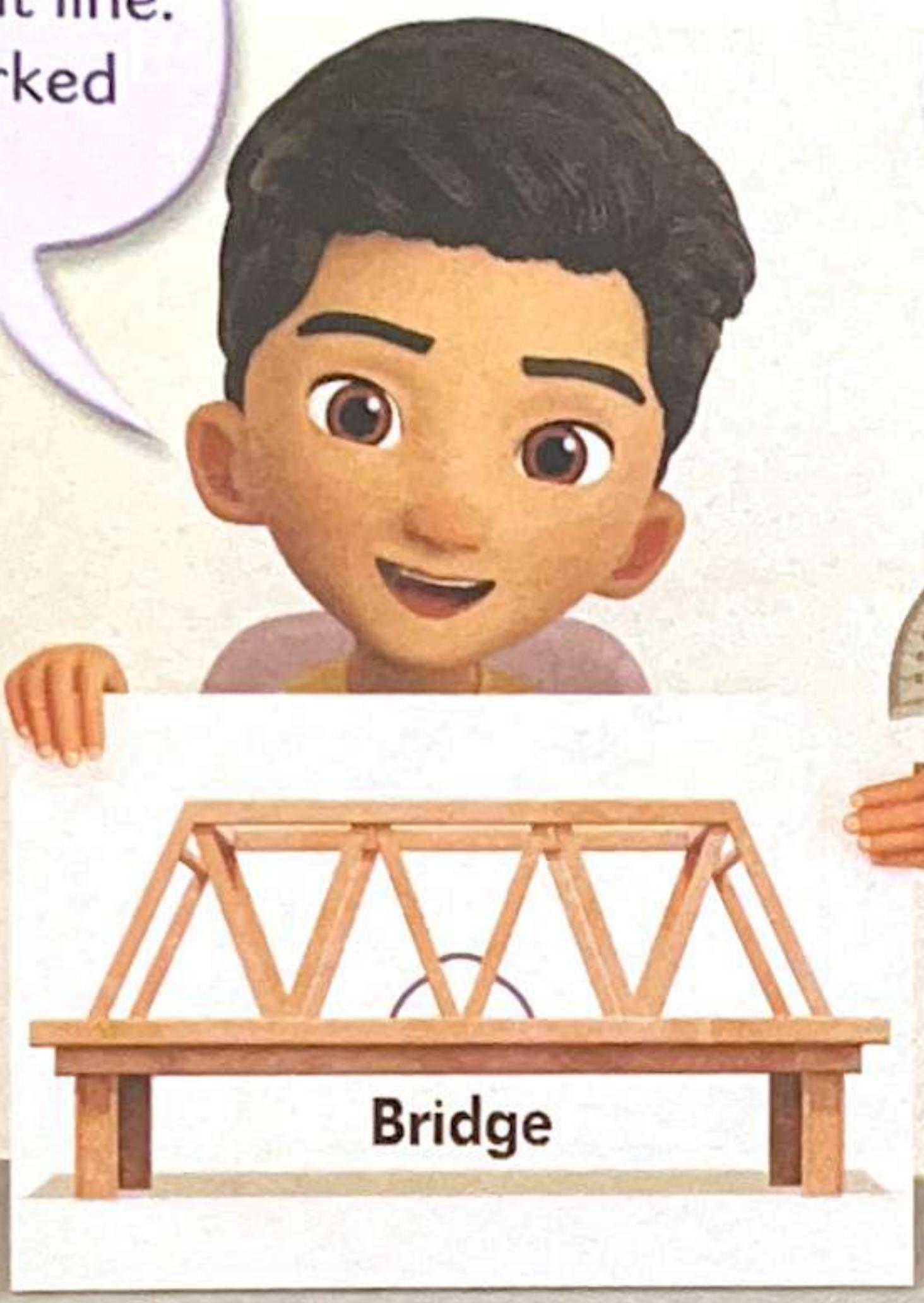


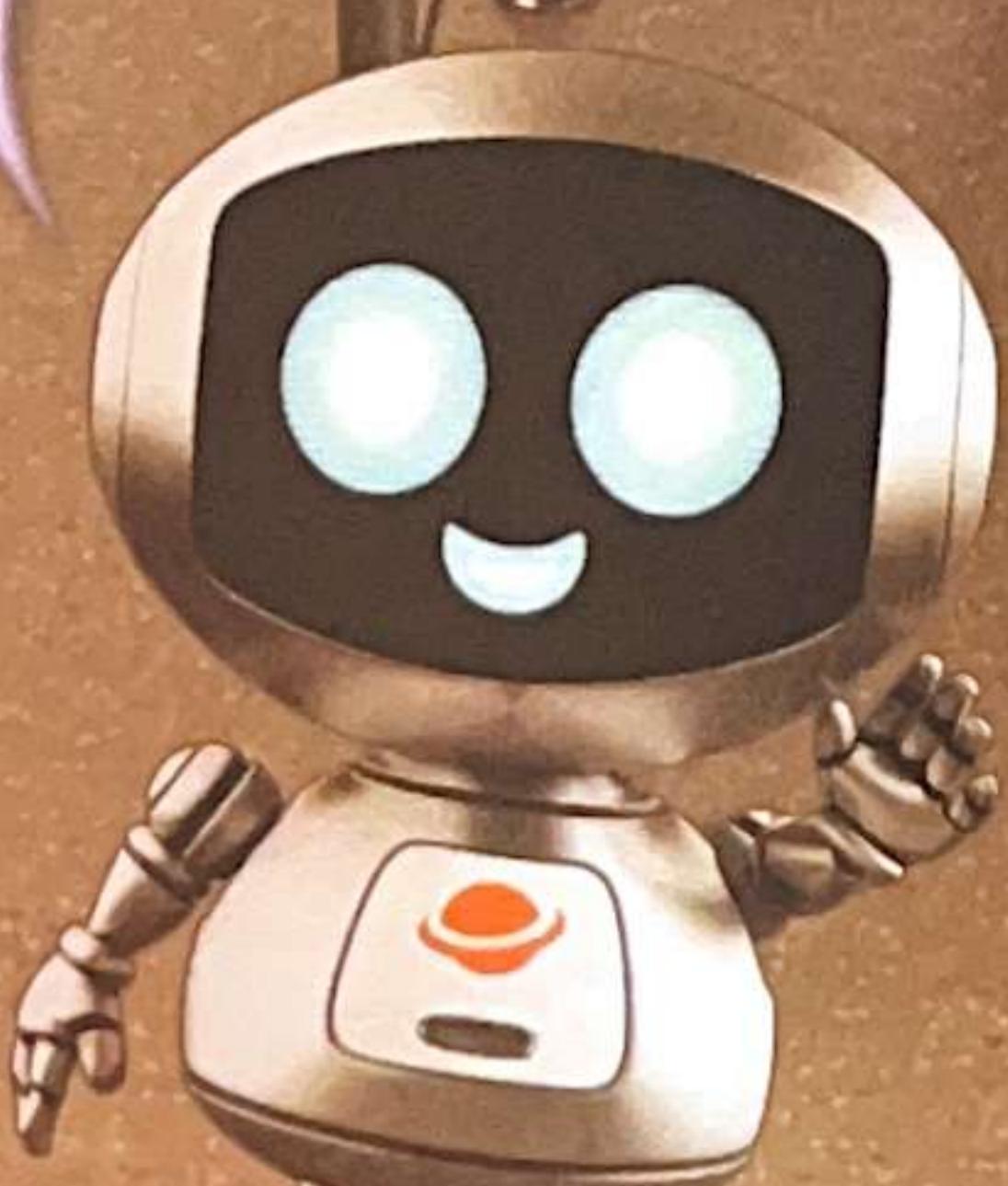
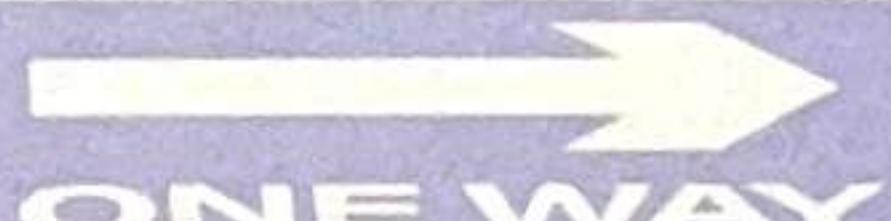


There are 3 marked angles on the straight line.
The sum of the marked angles is 180° .

What is this tool
that I am holding?



What are the types
of angles we can
find in this yellow
box junction?



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Do you know what
angle properties
are?

Learn more at
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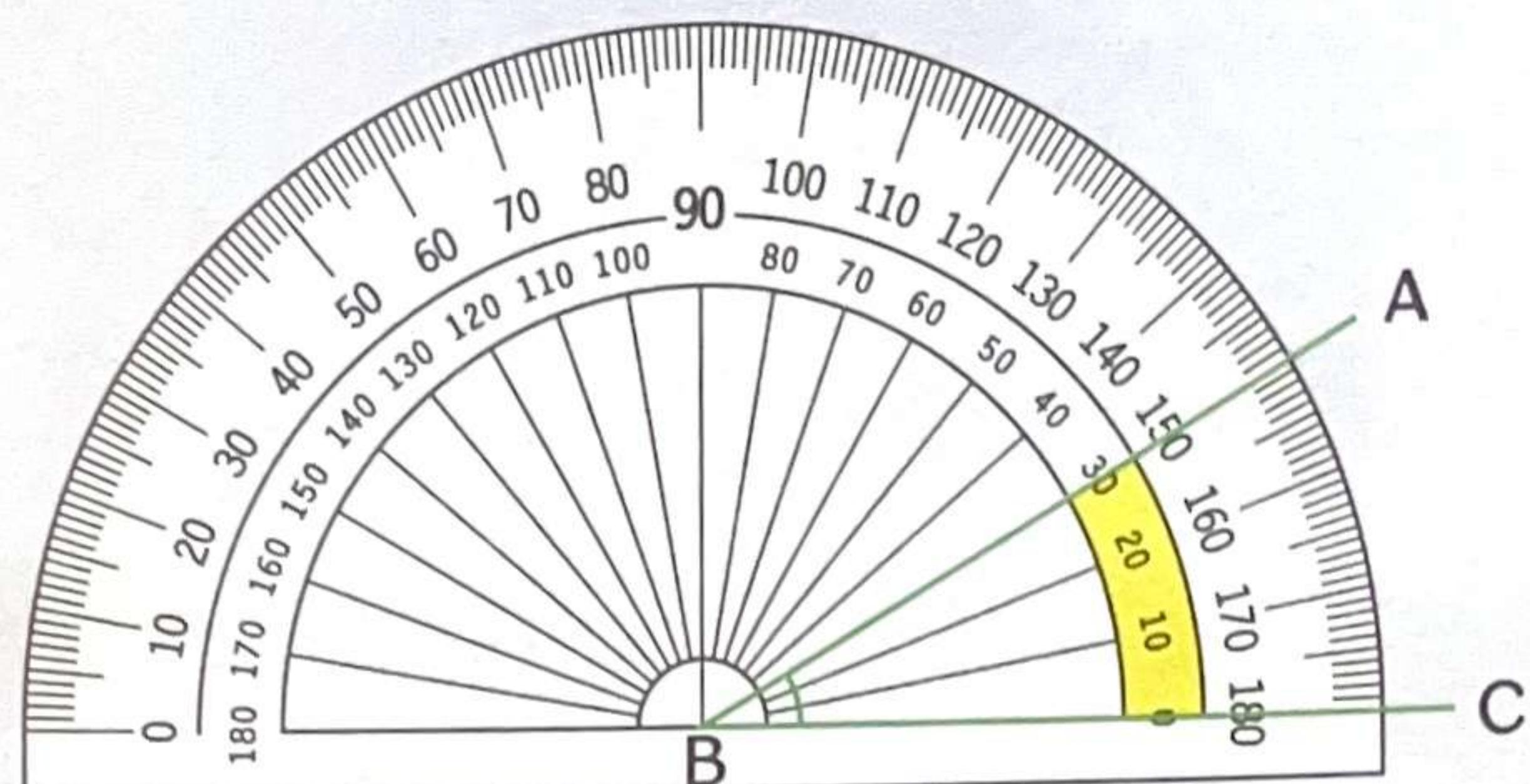


Angles on a Straight Line



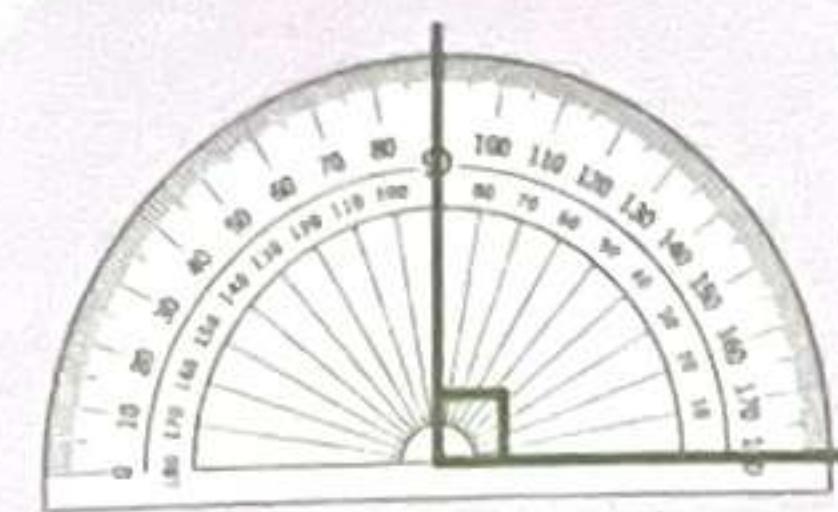
Recall

1



(a) $\angle ABC = \boxed{\hspace{1cm}}$ °

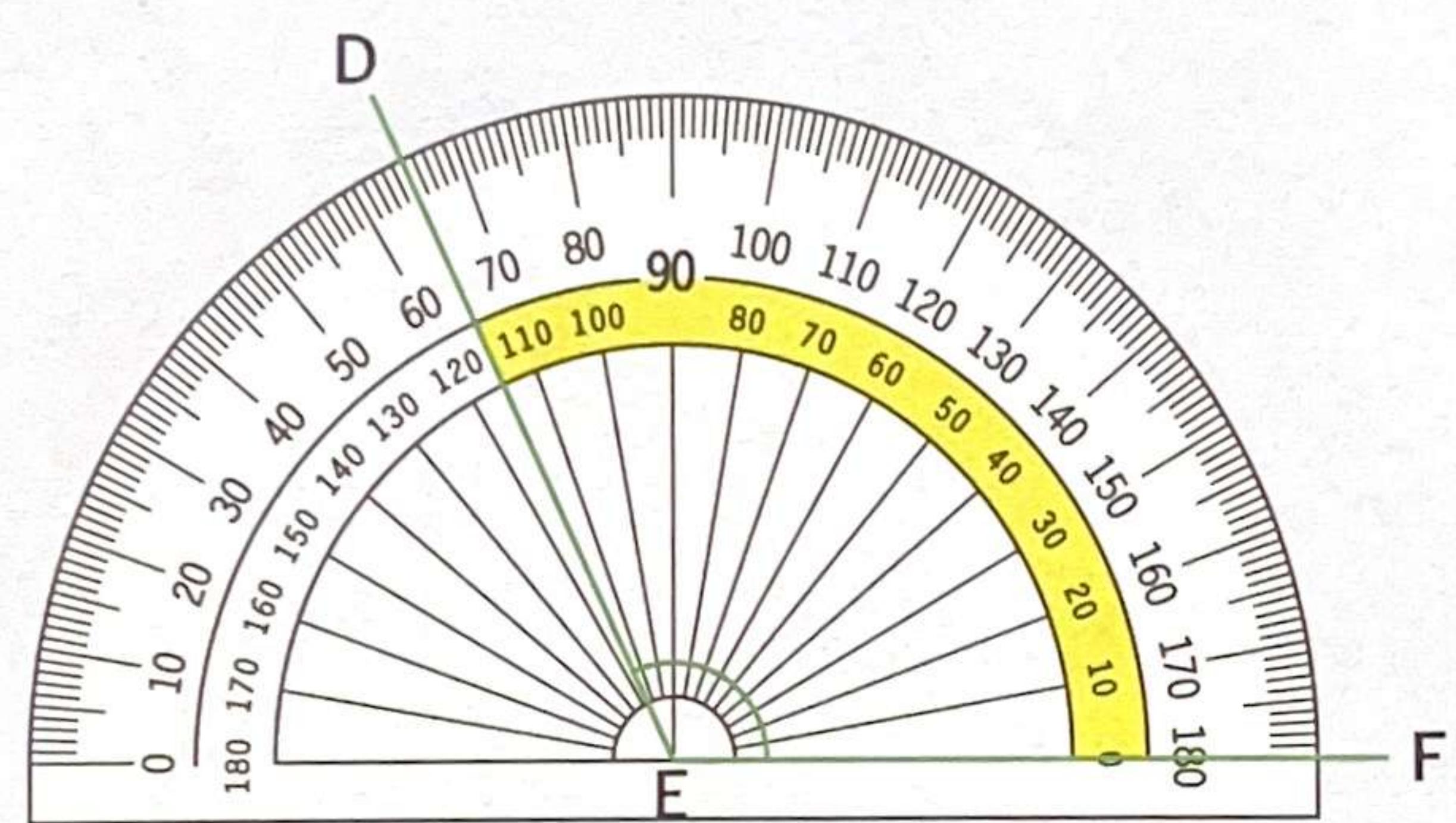
(b) $\angle ABC$ is less than $\boxed{\hspace{1cm}}$ °. It is an $\boxed{\hspace{1cm}}$ angle.



Right angle = 90° .



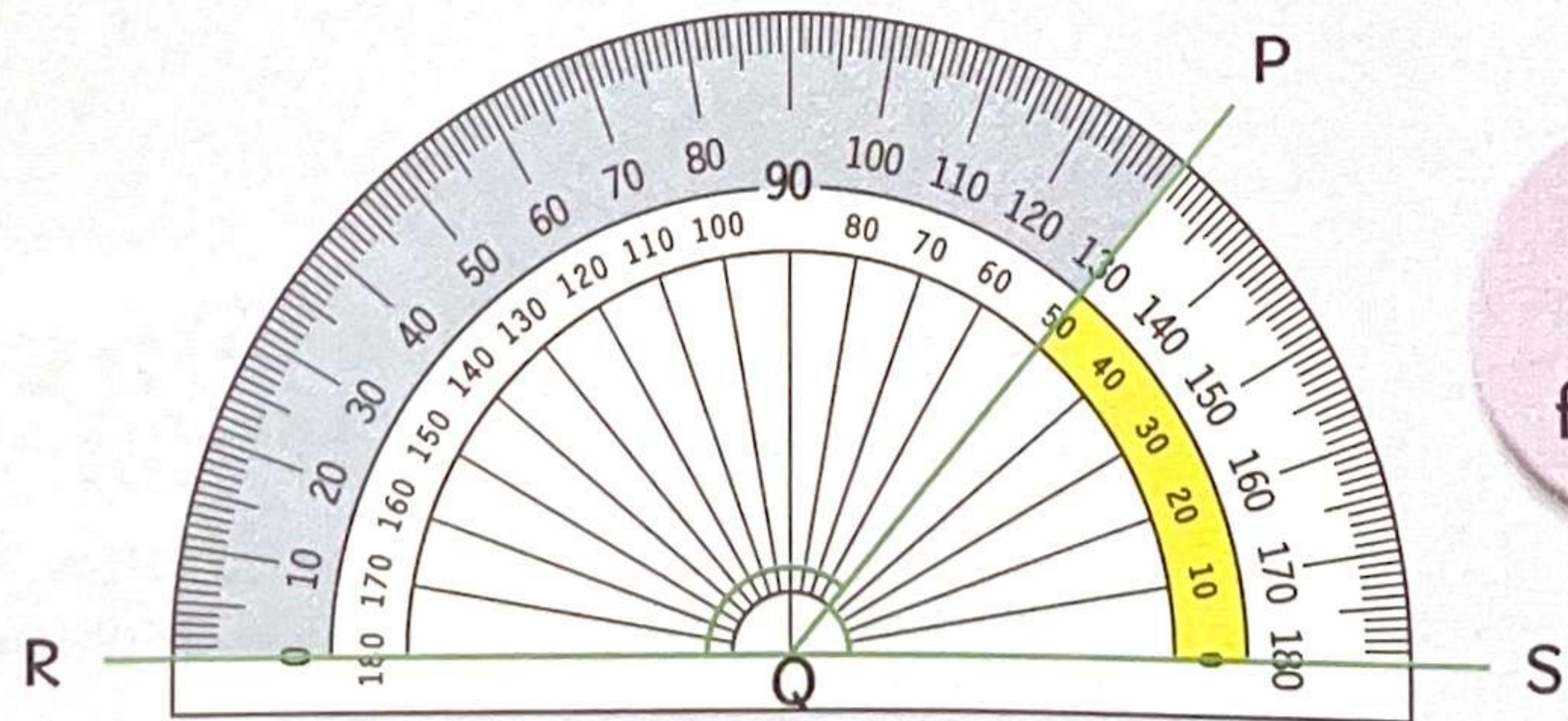
2



(a) $\angle DEF = \boxed{\hspace{1cm}}$ °

(b) $\angle DEF$ is more than $\boxed{\hspace{1cm}}$ °. It is an $\boxed{\hspace{1cm}}$ angle.

3



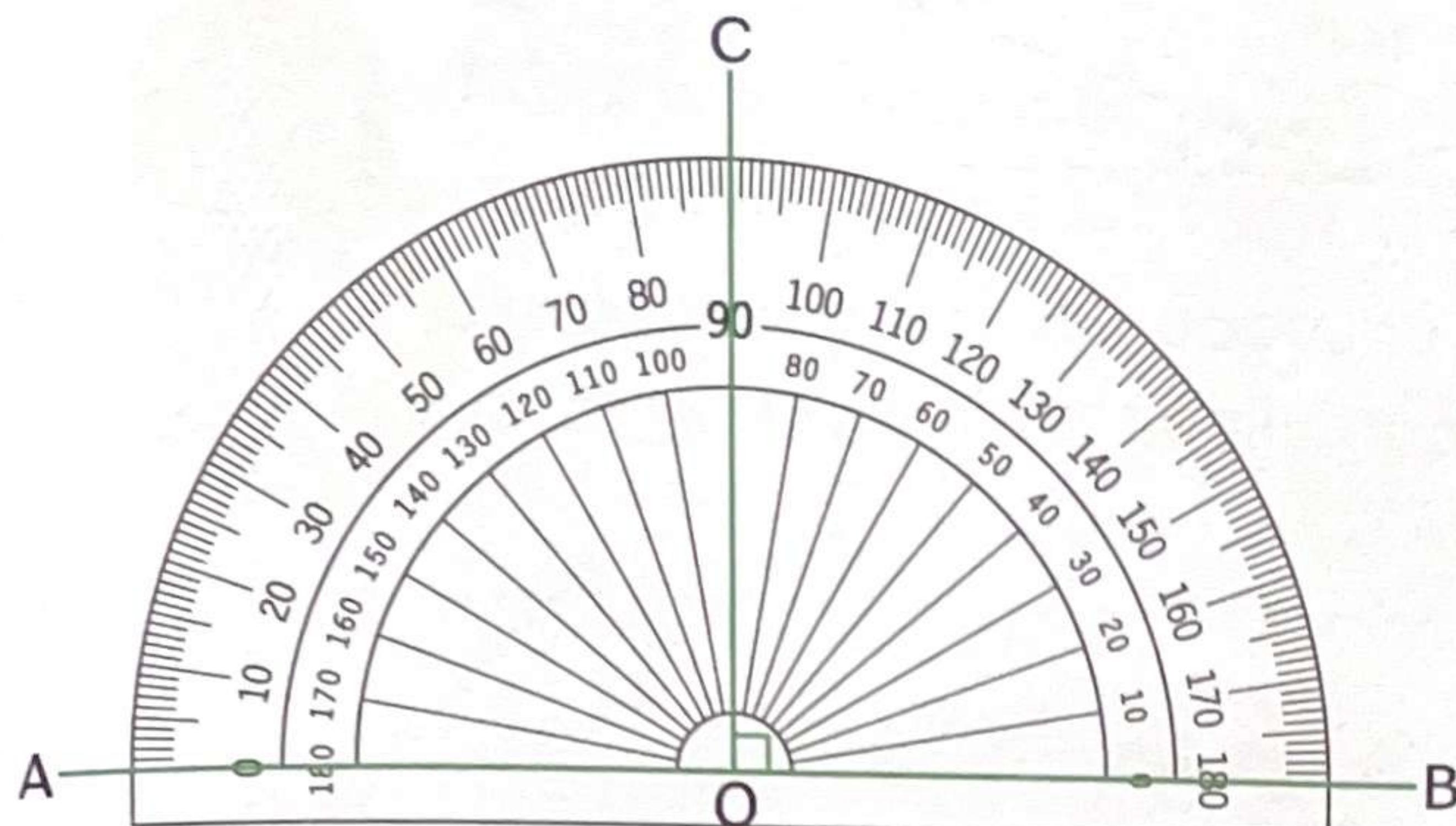
(a) $\angle PQR = \boxed{\hspace{1cm}}$ °

(b) $\angle PQS = \boxed{\hspace{1cm}}$ °

We read angles using a protractor, starting from 0° at the base line.



$\angle AOB$ is a **straight line**.

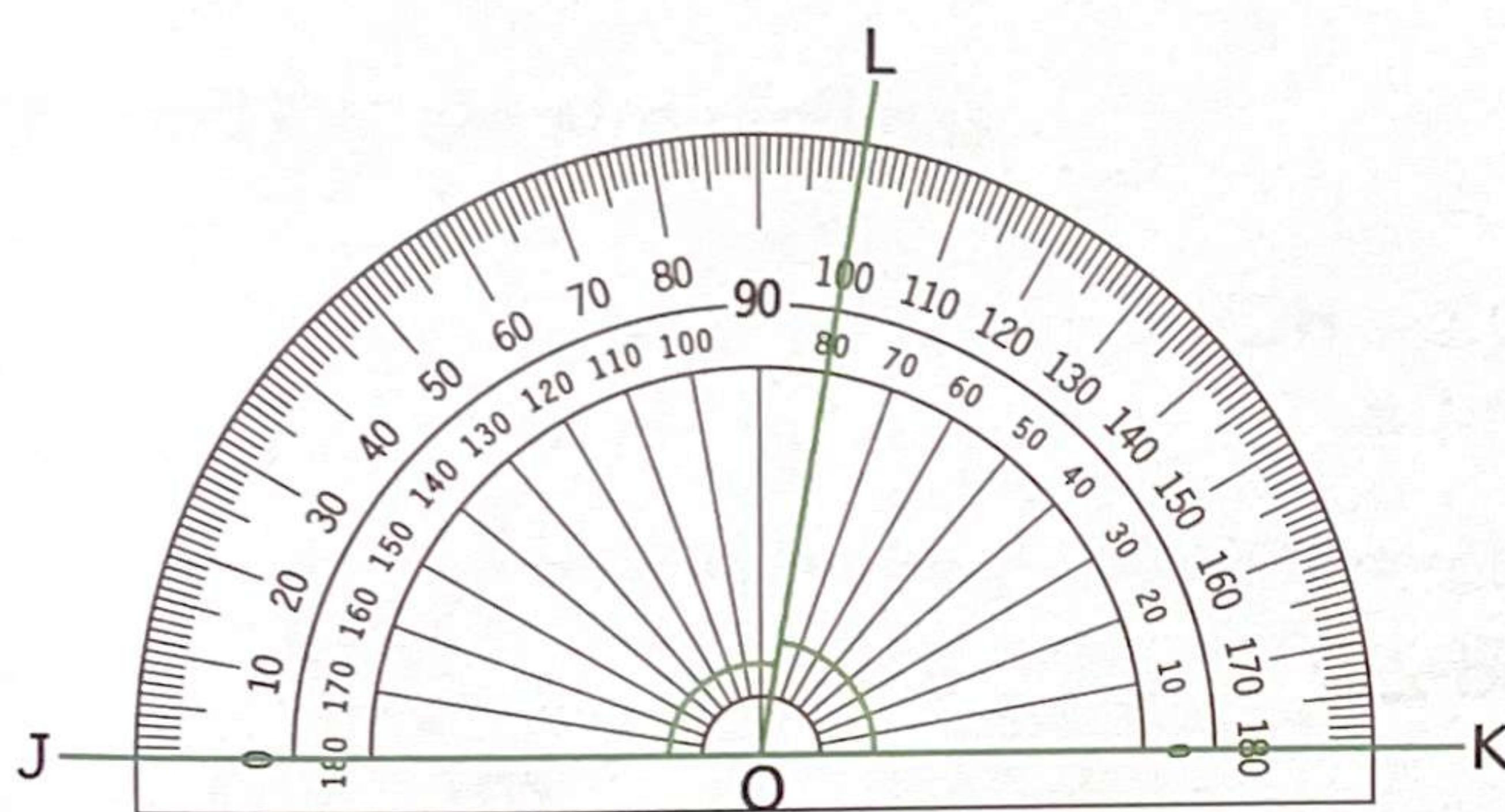


$$\angle AOC = 90^\circ$$

$$\angle BOC = 90^\circ$$

$$\begin{aligned}\angle AOC + \angle BOC &= 90^\circ + 90^\circ \\ &= 180^\circ\end{aligned}$$

$\angle JOK$ is a **straight line**.

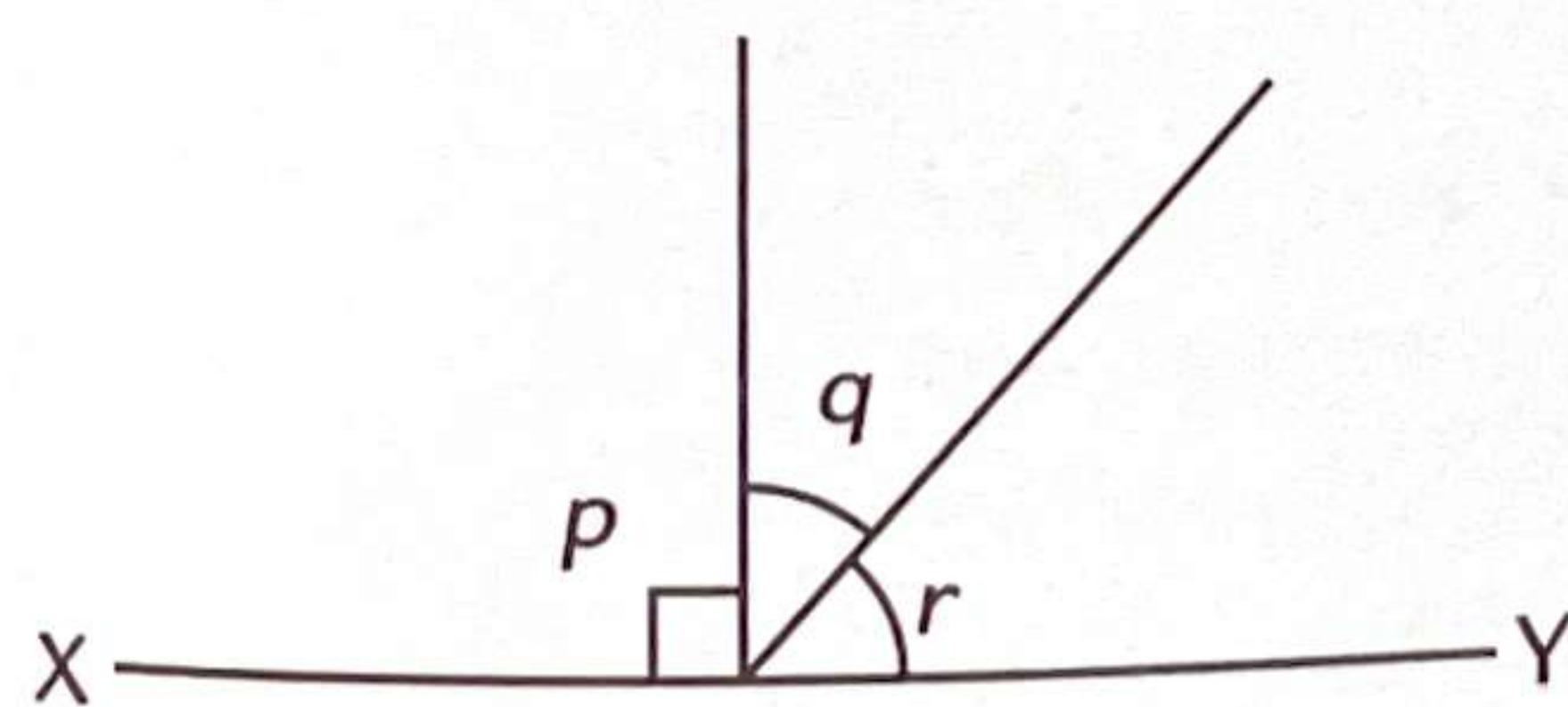


$$\angle JOL = 100^\circ$$

$$\angle KOL = 80^\circ$$

$$\begin{aligned}\angle JOL + \angle KOL &= 100^\circ + 80^\circ \\ &= 180^\circ\end{aligned}$$

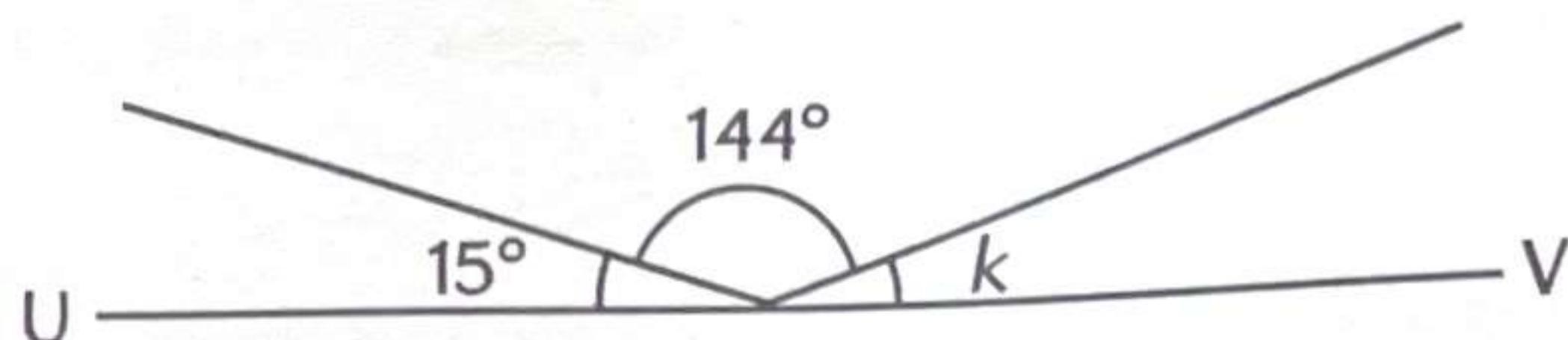
$\angle XY$ is a **straight line**. $\angle p = 90^\circ$, $\angle q = 42^\circ$ and $\angle r = 48^\circ$.



$$\begin{aligned}\angle p + \angle q + \angle r &= 90^\circ + 42^\circ + 48^\circ \\ &= 180^\circ\end{aligned}$$

The **sum of angles on a straight line is 180°** .

In the figure, UV is a straight line. Find angle k .

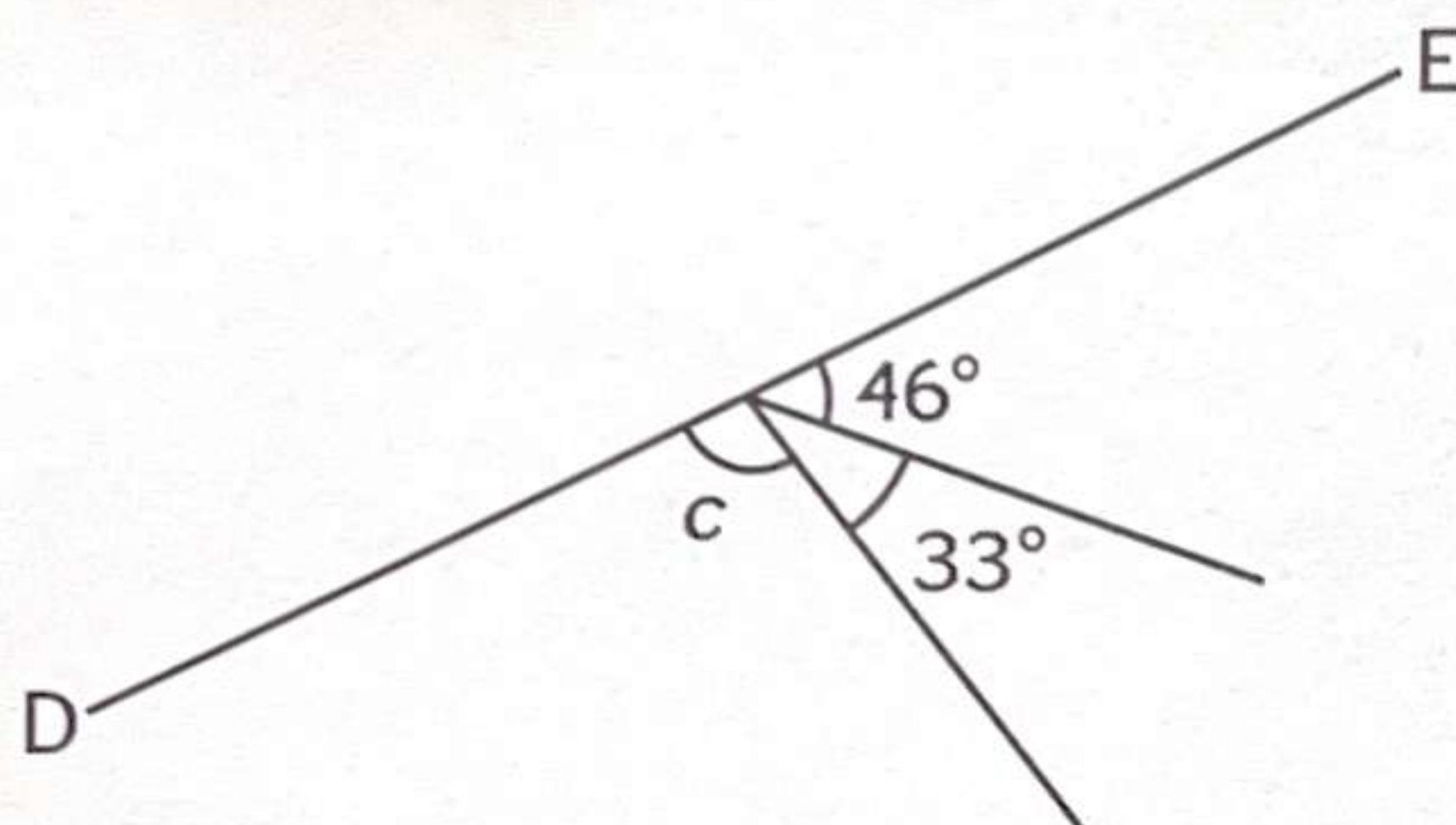


$$15^\circ + 144^\circ + \angle k = 180^\circ$$



$$\begin{aligned}\angle k &= 180^\circ - 15^\circ - 144^\circ \\ &= 21^\circ\end{aligned}$$

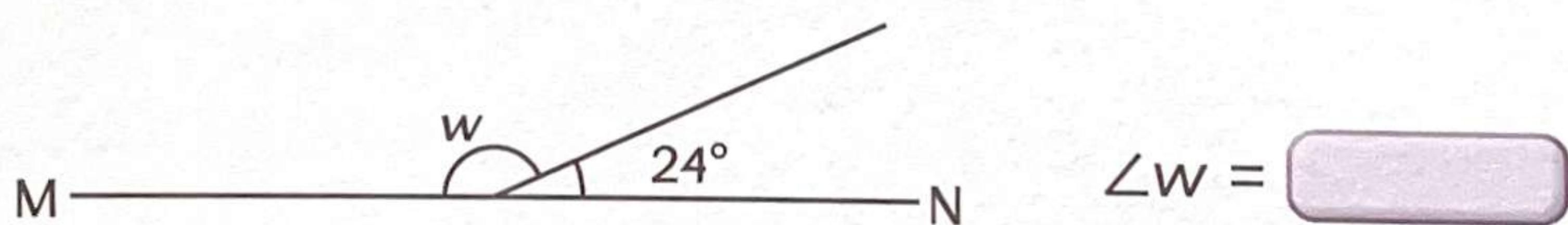
In the figure, DE is a straight line. Find $\angle c$.



$$\begin{aligned}\angle c &= 180^\circ - 33^\circ - 46^\circ \\ &= 101^\circ\end{aligned}$$

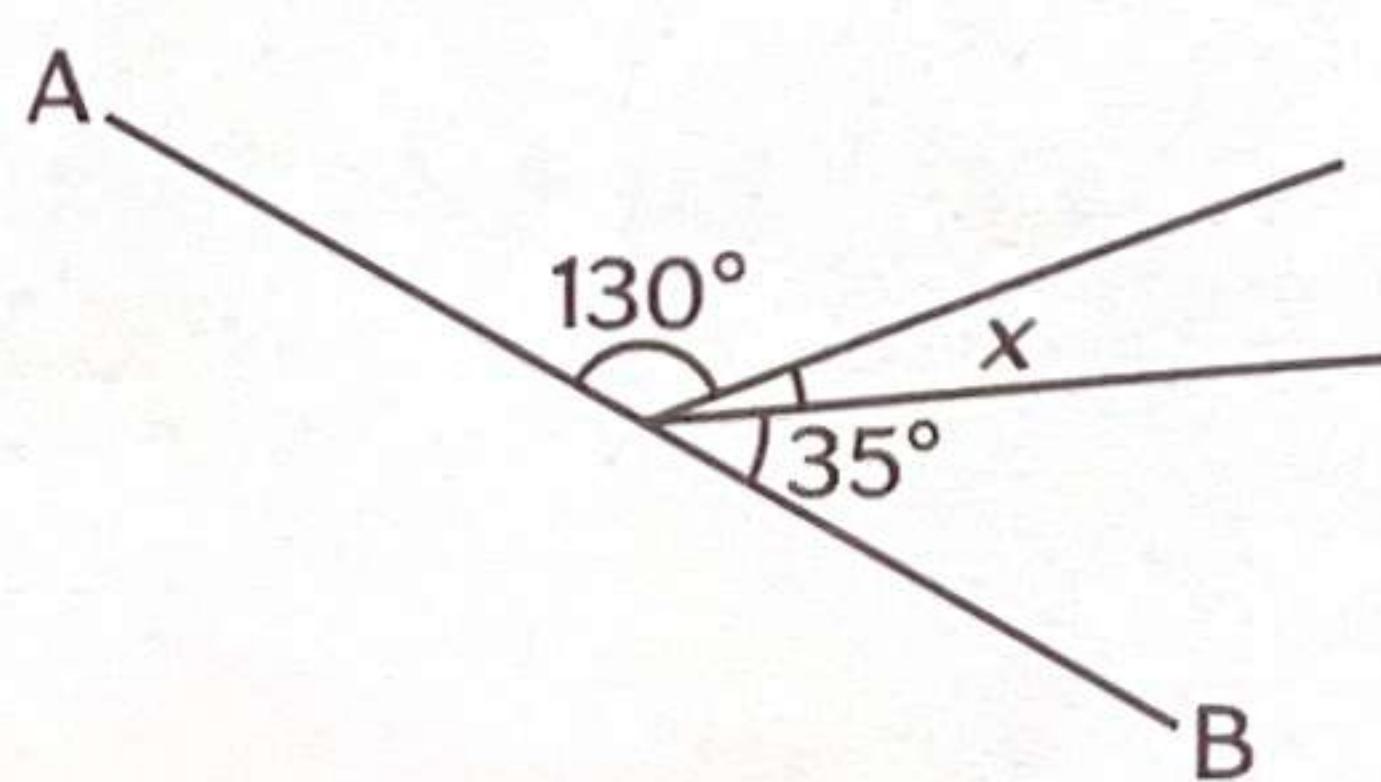
Let's Try!
1

(a) MN is a straight line. Find $\angle w$.



$$\angle w = \boxed{\quad}$$

(b) AB is a straight line. Find $\angle x$.



$$\angle x = \boxed{\quad}$$



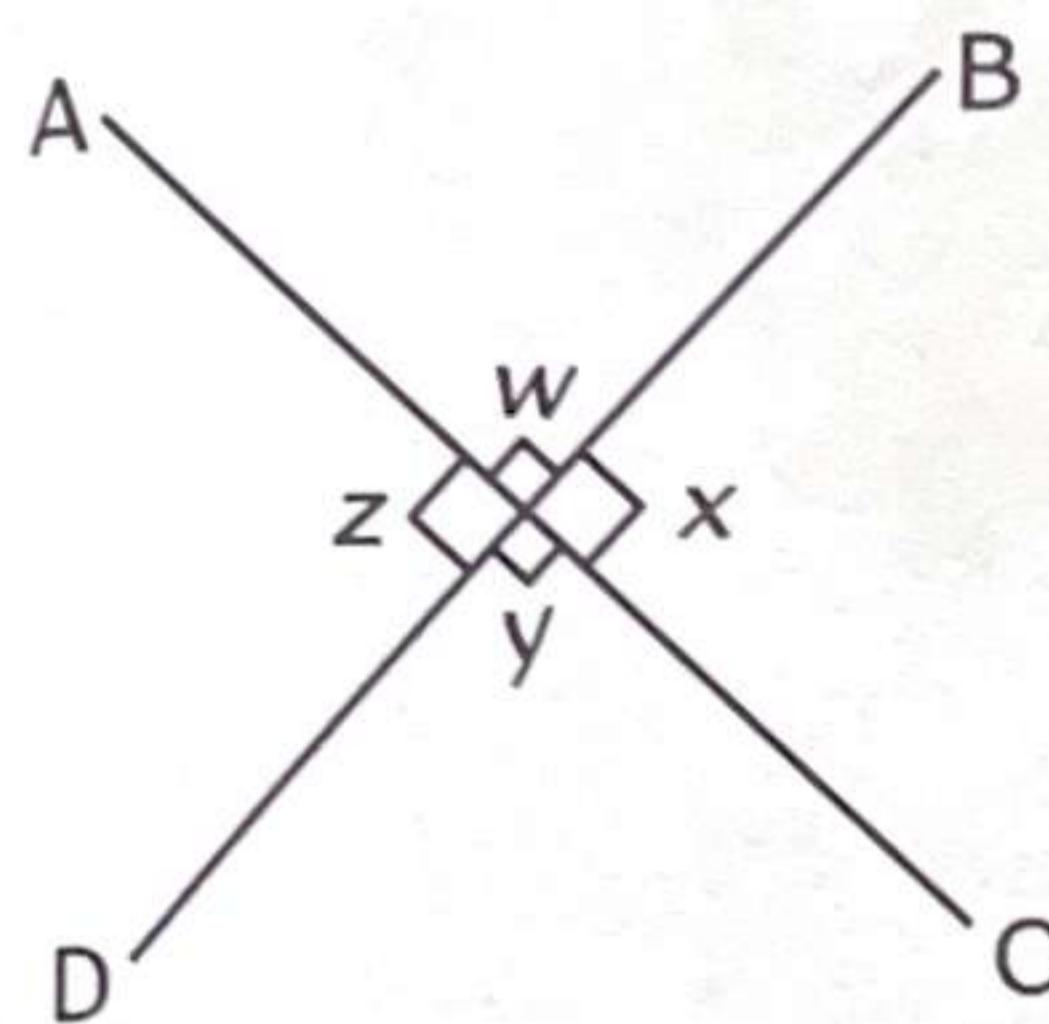
Vertically Opposite Angles

In the figure, AC is **perpendicular to** BD.

These two straight lines **intersect** each other.

$\angle w$ and $\angle y$ is a pair of vertically opposite angles.

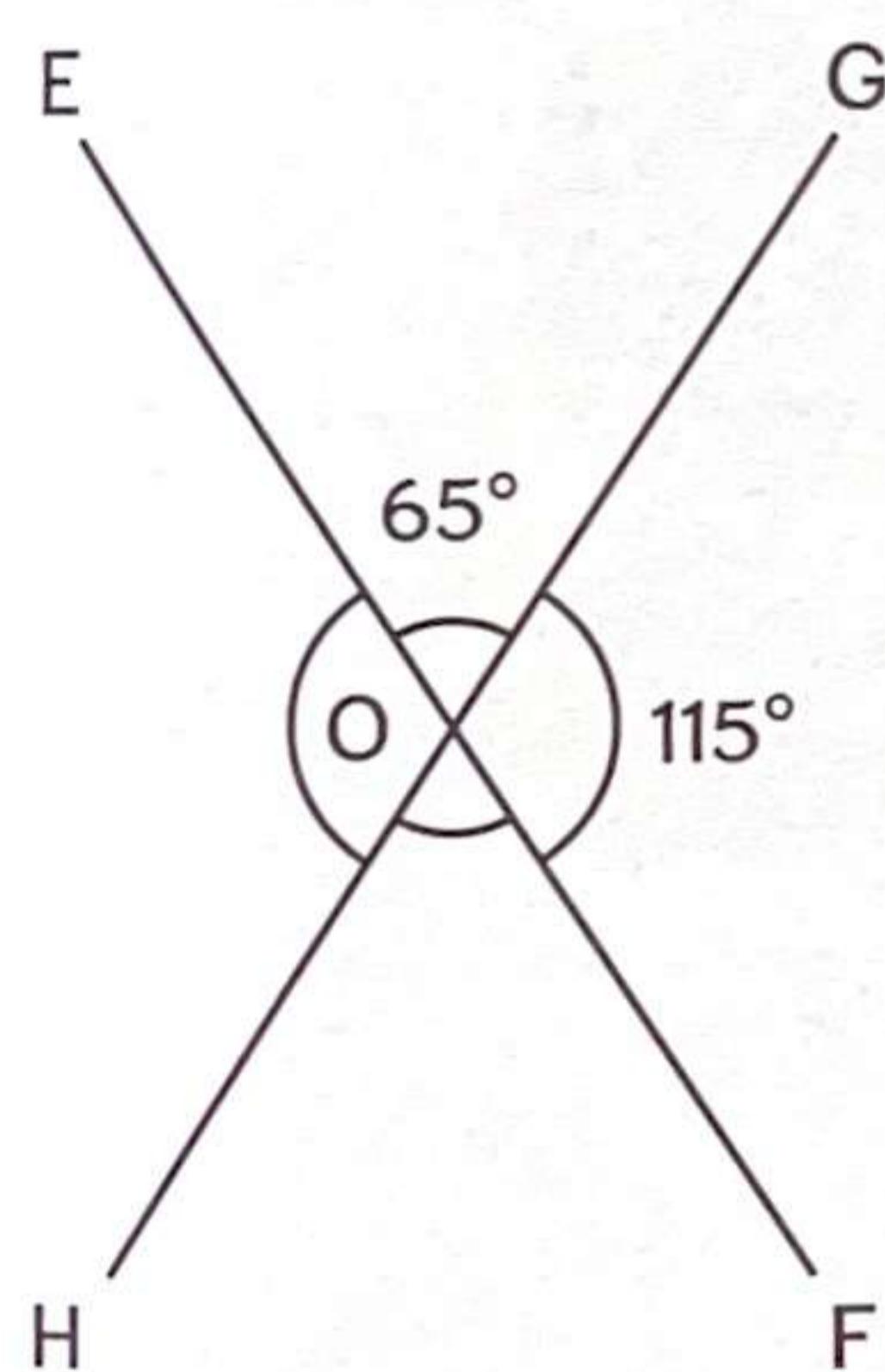
$\angle x$ and $\angle z$ is another pair of vertically opposite angles.



$$\angle w = \angle y = 90^\circ$$

$$\angle x = \angle z = 90^\circ$$

EF and GH are straight lines.



$$\begin{aligned}\angle EOH &= \angle GOF \\ &= 115^\circ\end{aligned}$$

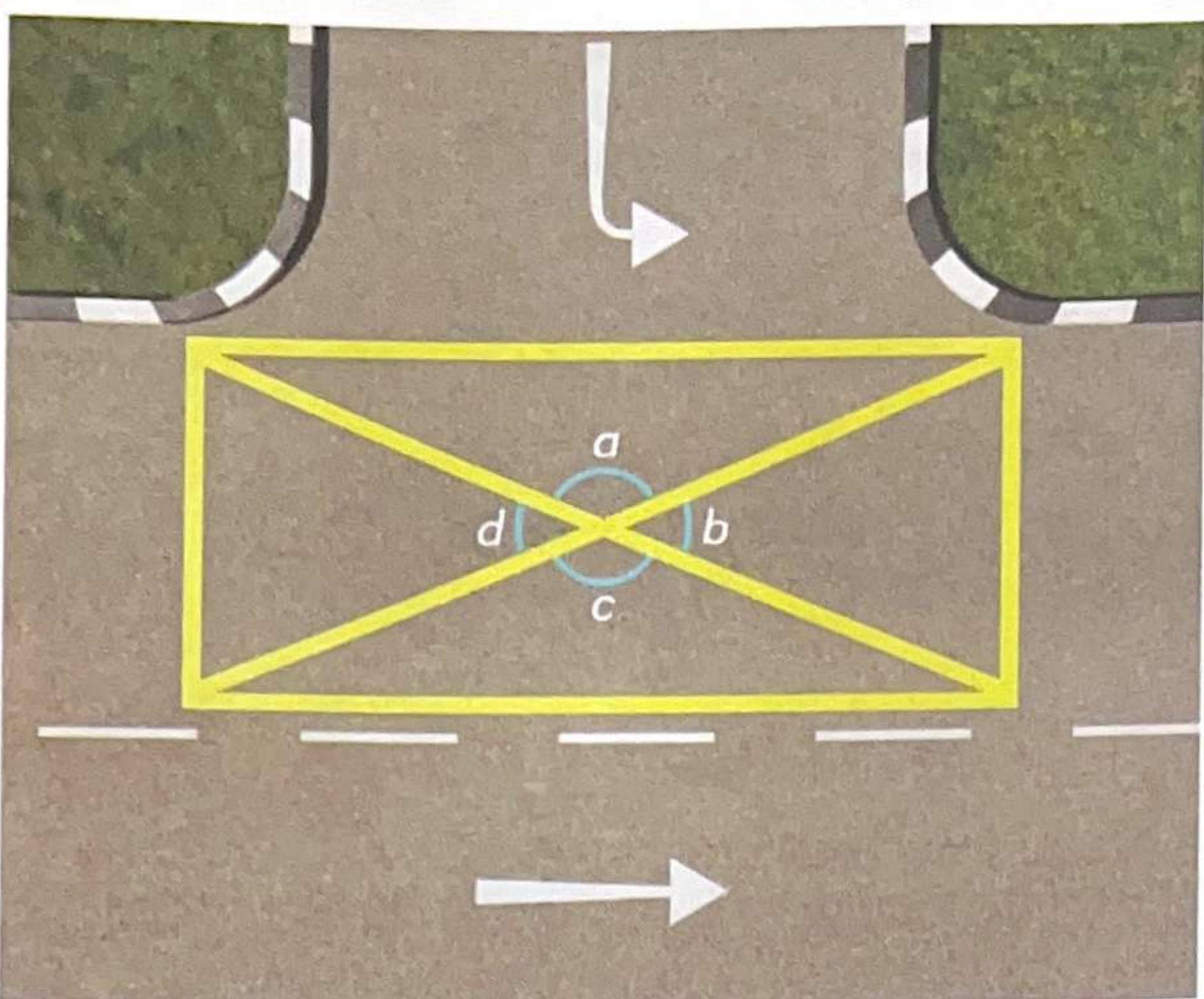
$$\begin{aligned}\angle HOF &= \angle EOG \\ &= 65^\circ\end{aligned}$$

$\angle GOF$ and $\angle EOH$ is a pair of vertically opposite angles.

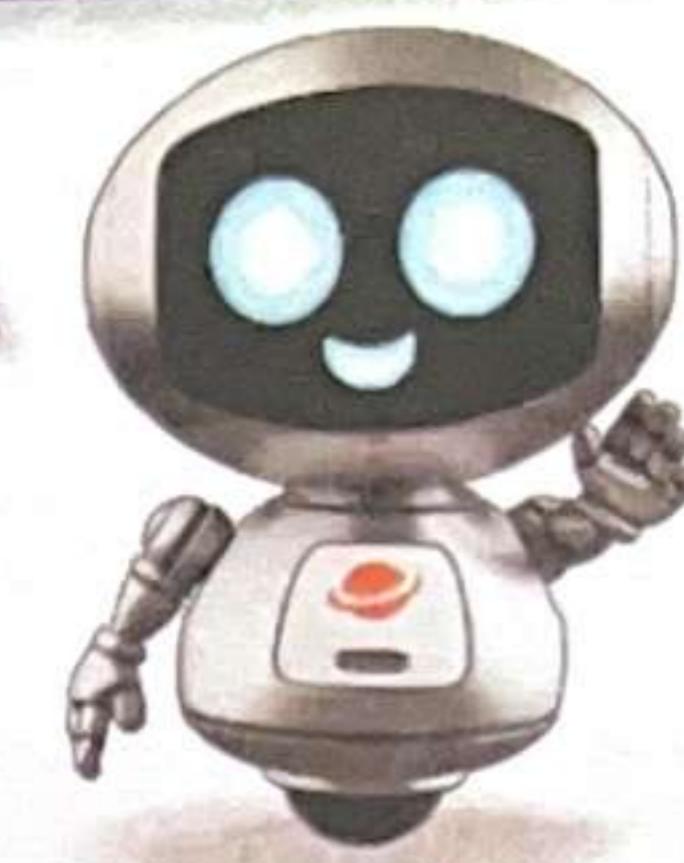
$\angle HOF$ and $\angle EOG$ is another pair of vertically opposite angles.

When two straight lines intersect, they form two pairs of vertically opposite angles. **Vertically opposite angles are equal.**

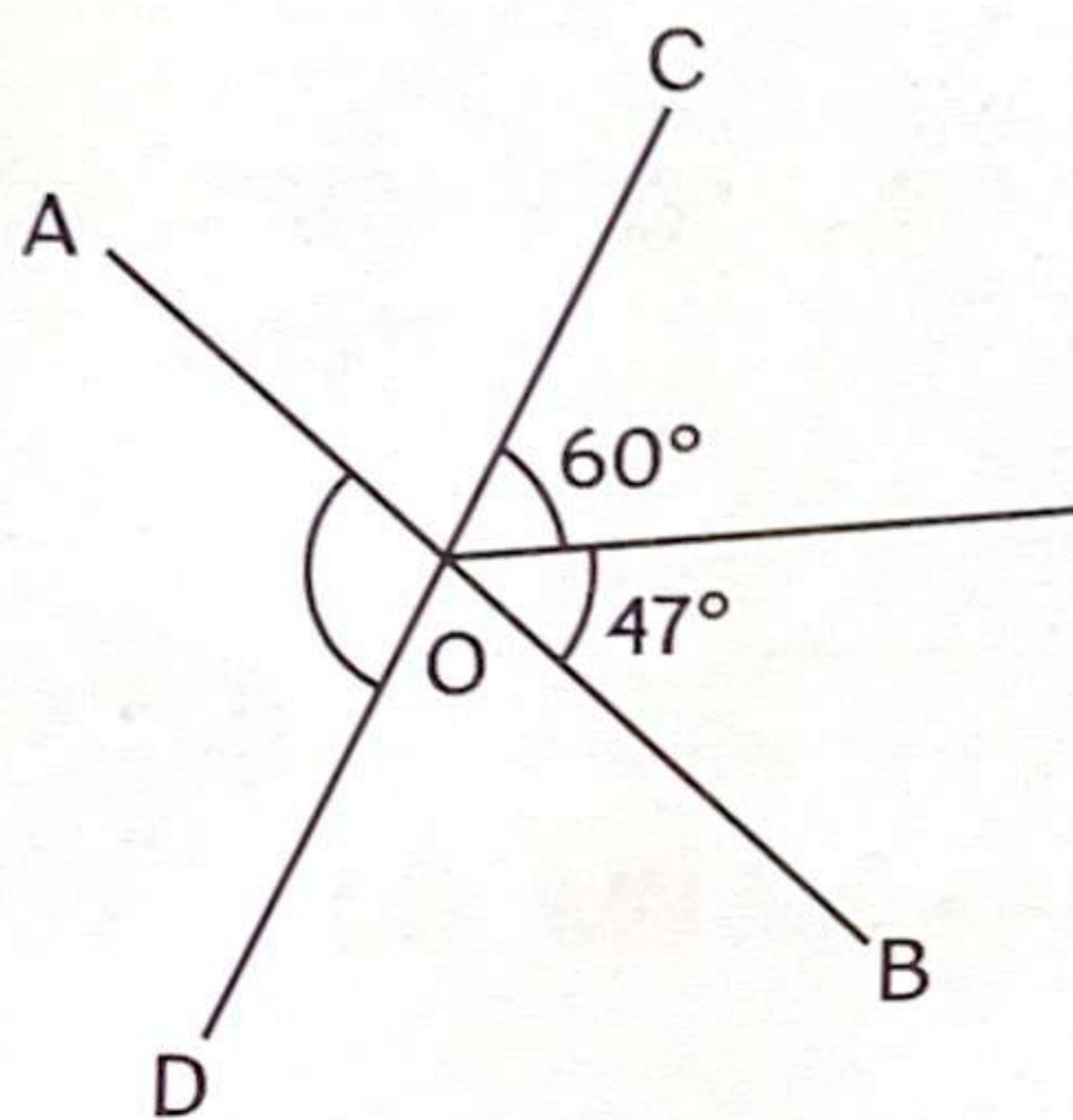
The yellow box junction is commonly seen on the roads in Singapore.



Can you identify and name the pairs of vertically opposite angles that are equal?



AB and CD are straight lines. Find $\angle AOD$.

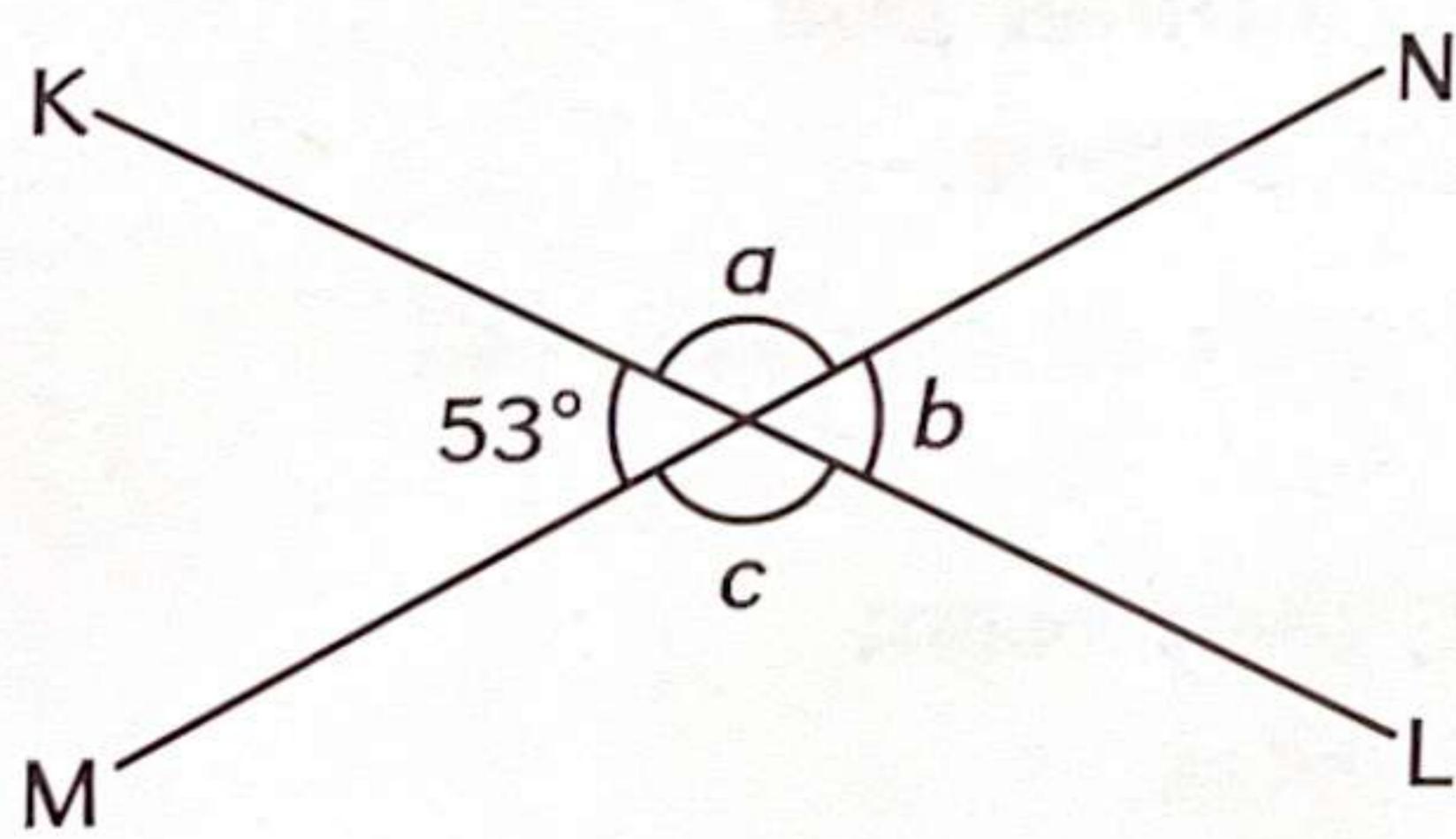


$$\begin{aligned}\angle AOD &= \angle COB \\ &= 60^\circ + 47^\circ \\ &= 107^\circ\end{aligned}$$

$\angle AOD$ and $\angle COB$
are vertically
opposite angles.



KL and MN are straight lines. Find the unknown angles.



$$\angle a = 180^\circ - 53^\circ$$

$$= 127^\circ$$

$$\angle b = 53^\circ$$

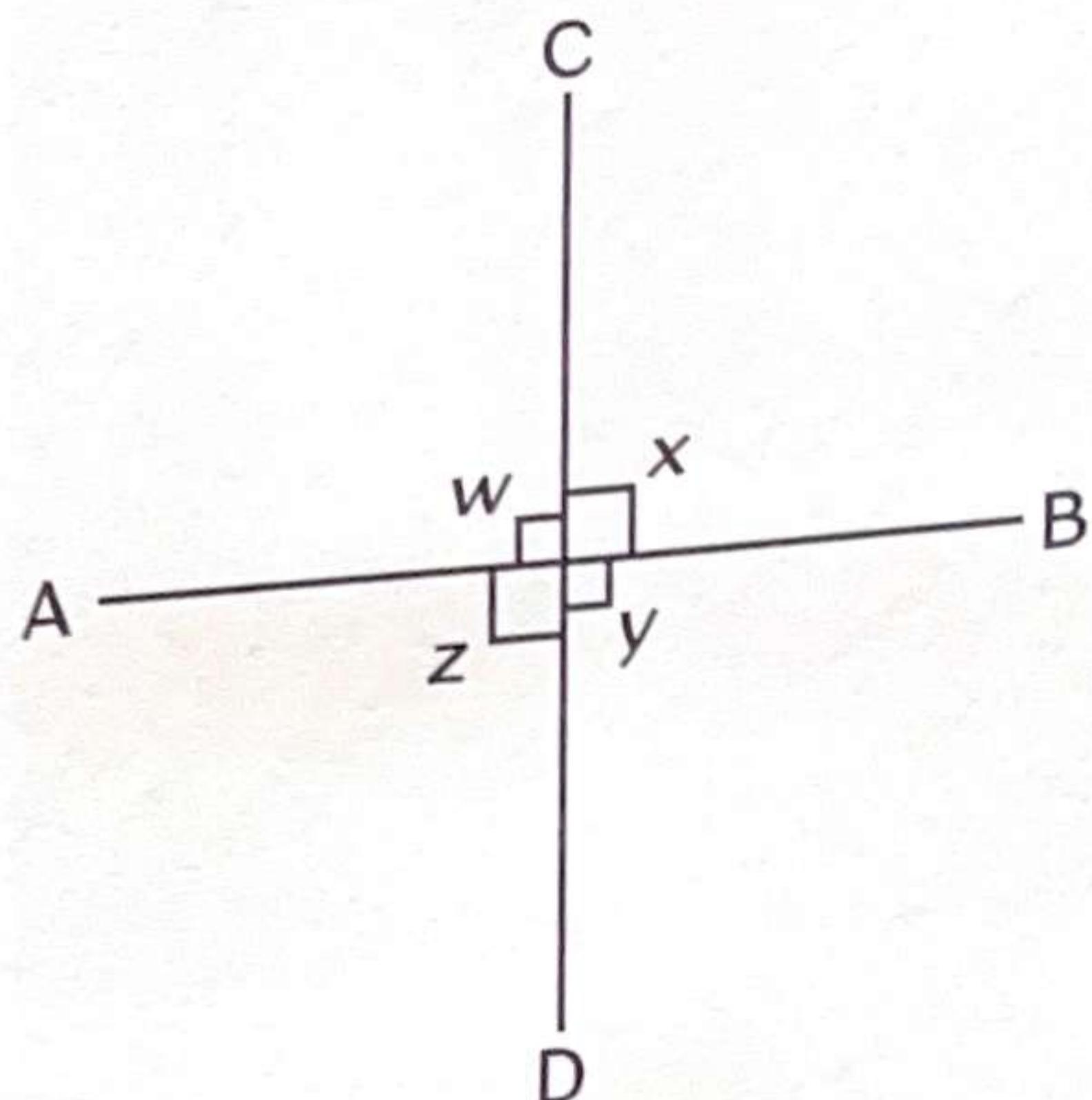
$$\angle C = \angle a \\ = 127^\circ$$

A diagram showing a right-angled triangle MAB. The horizontal base BA is at the bottom. The vertical side MA is on the left. The hypotenuse AB is at the top. An angle at vertex A is labeled 53° . An angle at vertex B is labeled a .



Angles at a Point

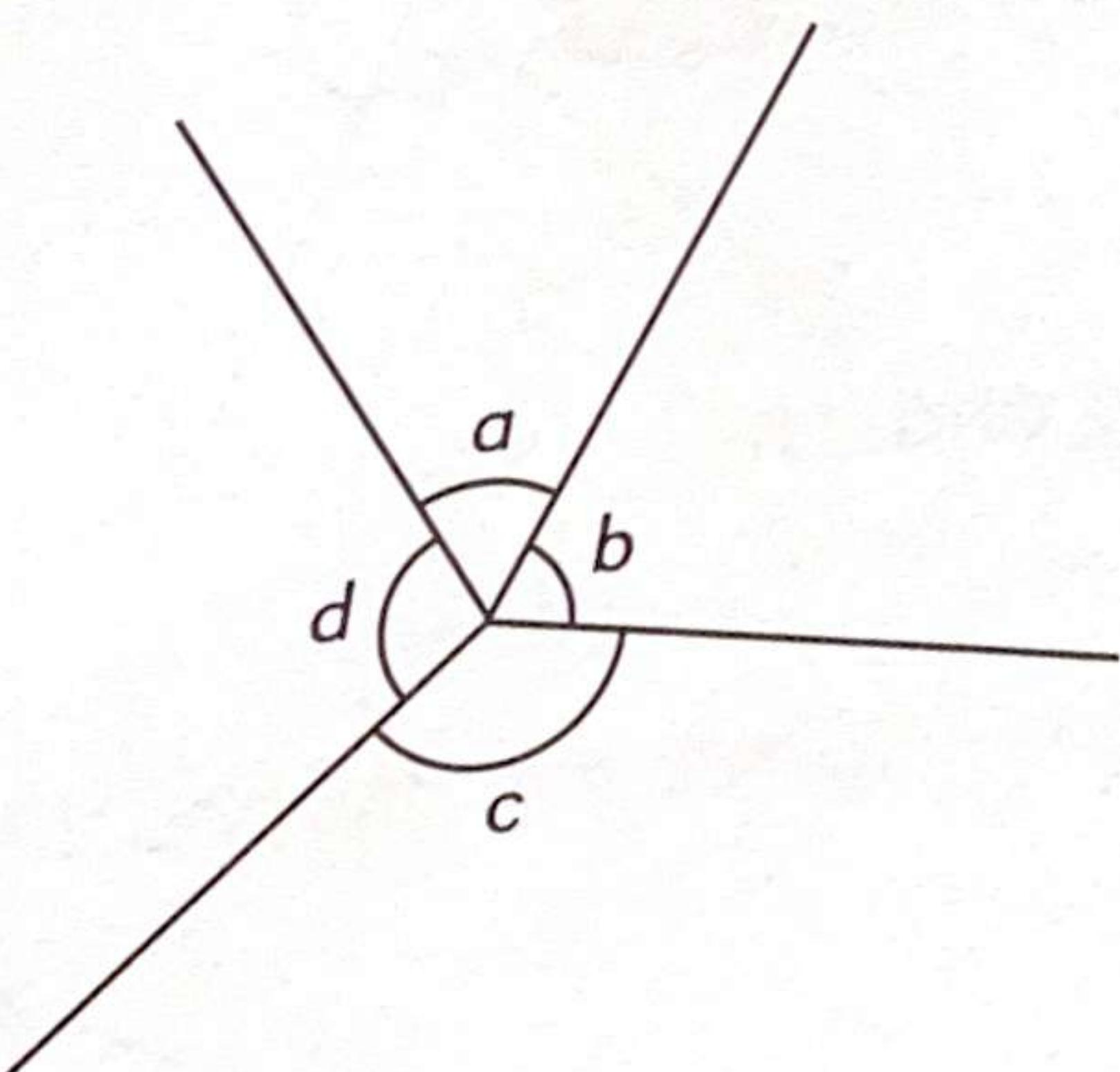
In the figure, AB is perpendicular to CD.
 $\angle w, \angle x, \angle y$ and $\angle z$ are four angles at a point.



$$\angle w = \angle x = \angle y = \angle z$$

$$\begin{aligned}\angle w + \angle x + \angle y + \angle z &= 90^\circ + 90^\circ + 90^\circ + 90^\circ \\ &= 360^\circ\end{aligned}$$

$\angle a, \angle b, \angle c$ and $\angle d$ are angles at a point.
 $\angle a = 60^\circ, \angle b = 70^\circ, \angle c = 130^\circ$ and $\angle d = 100^\circ$.



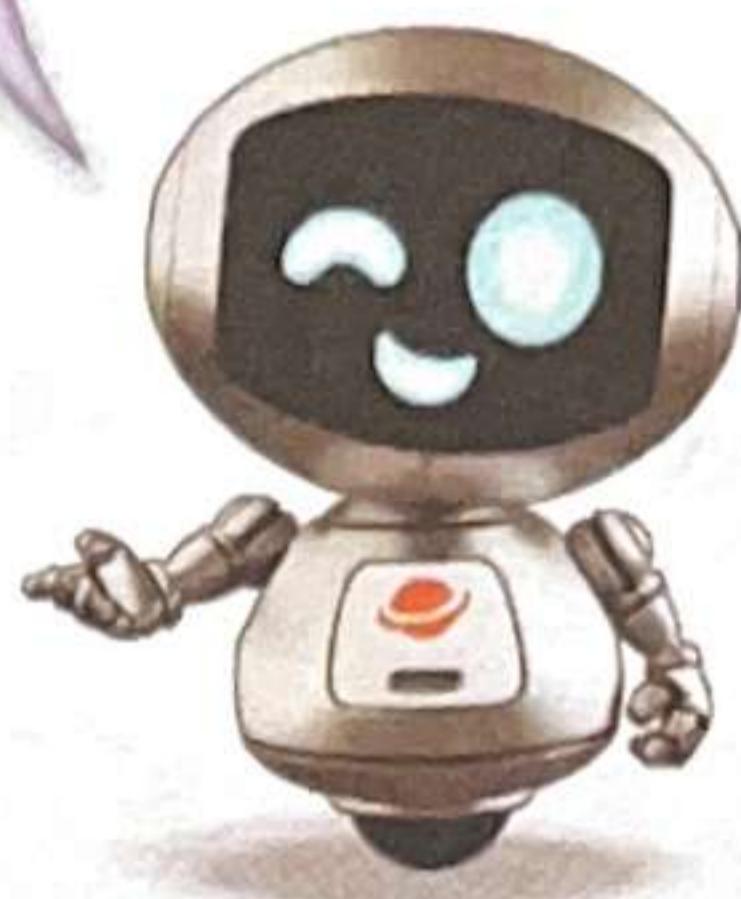
$$\begin{aligned}\angle a + \angle b + \angle c + \angle d &= 60^\circ + 70^\circ + 130^\circ + 100^\circ \\ &= 360^\circ\end{aligned}$$

The sum of angles at a point is 360° .

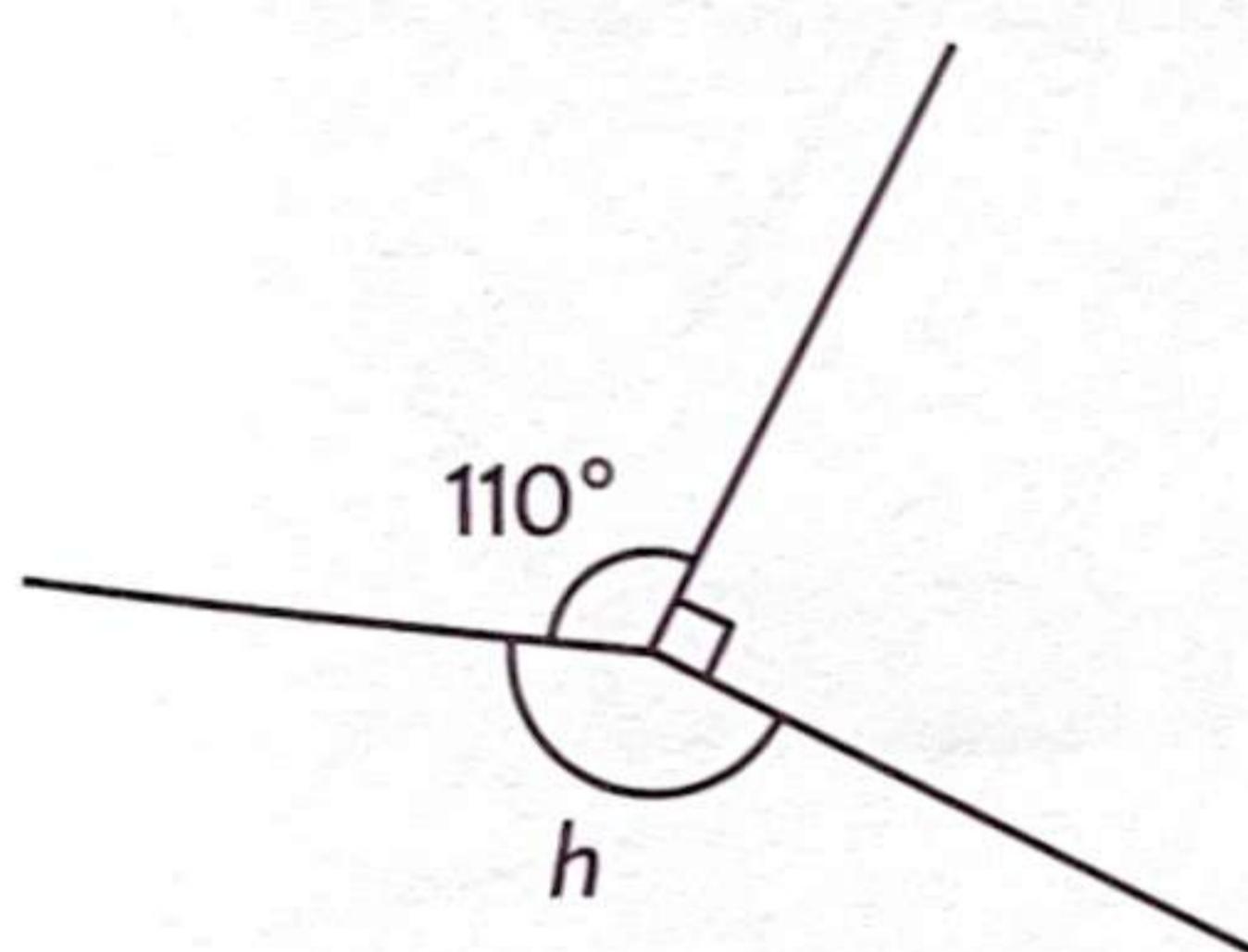
The three angles formed by the blades of the turbine are the same.



What is the size of each of the three angles?



Find $\angle h$.

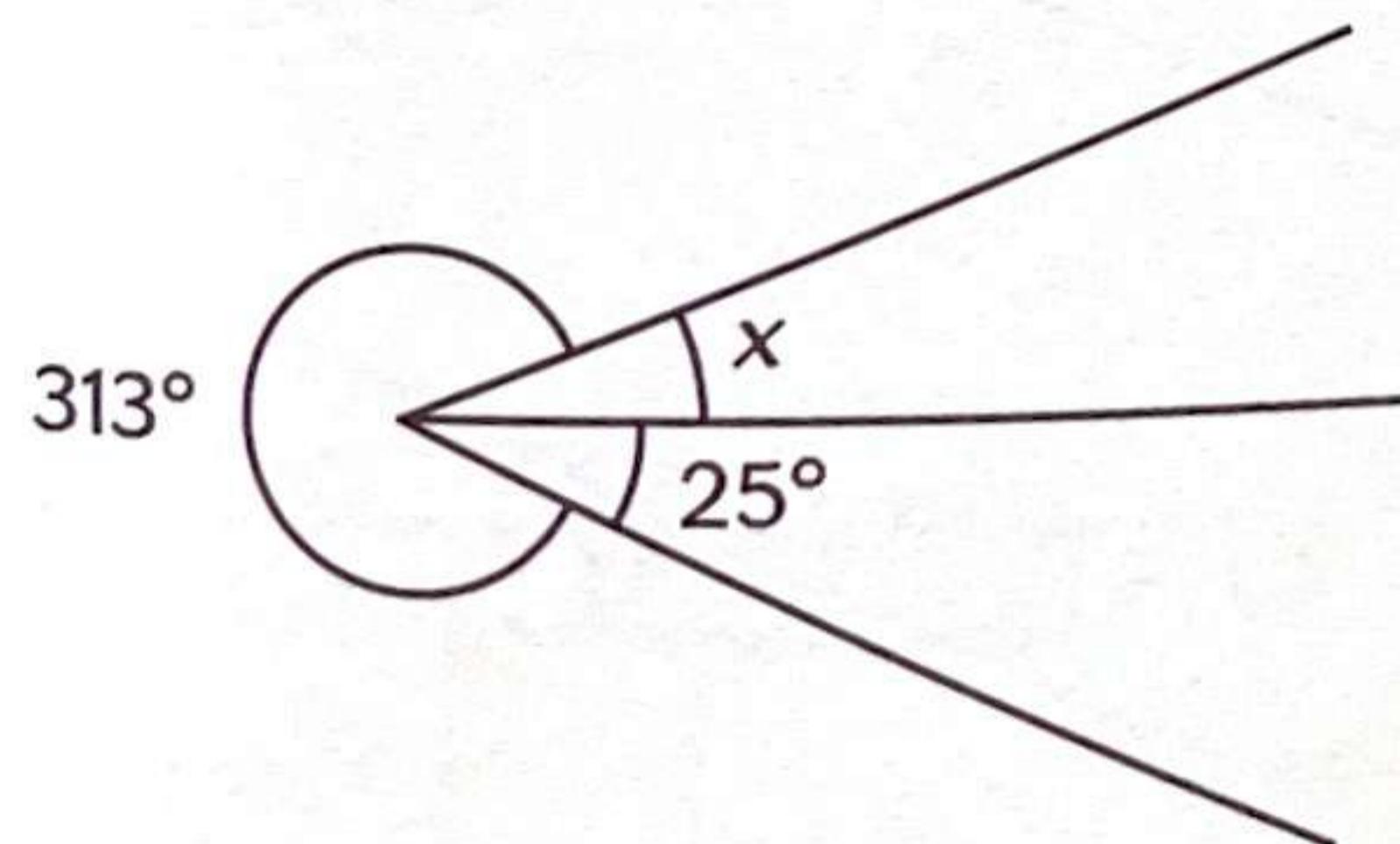


$$\begin{aligned}\angle h &= 360^\circ - 110^\circ - 90^\circ \\ &= 160^\circ\end{aligned}$$

$$110^\circ + 90^\circ + \angle h = 360^\circ$$

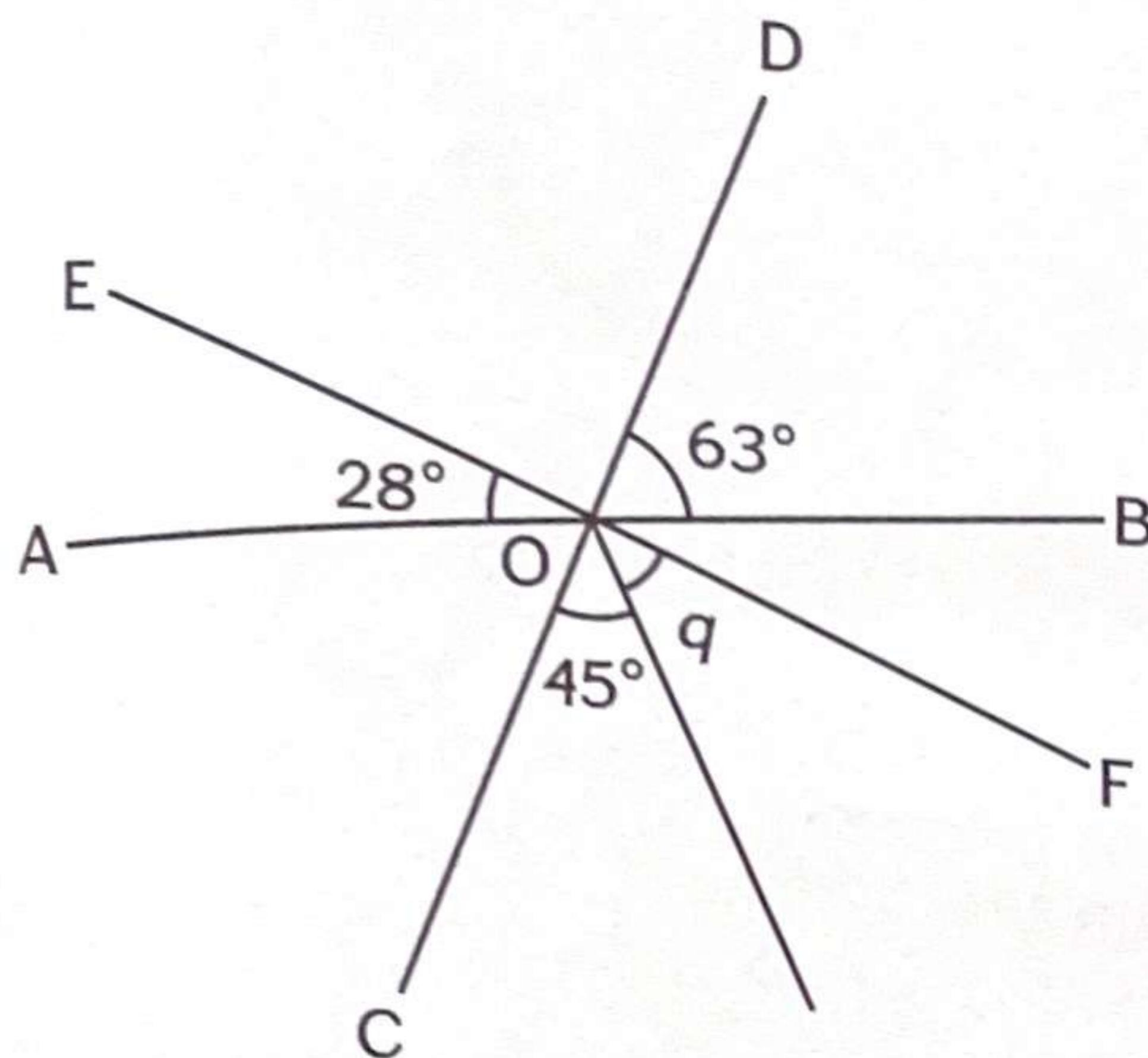


Find $\angle x$.



$$\begin{aligned}\angle x &= 360^\circ - 313^\circ - 25^\circ \\ &= 22^\circ\end{aligned}$$

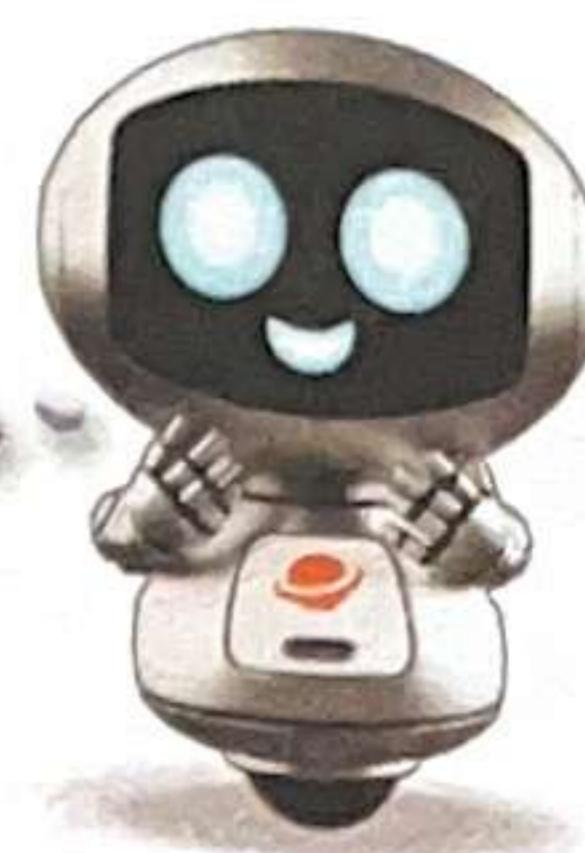
AOB, COD and EOF are straight lines. Find $\angle q$.



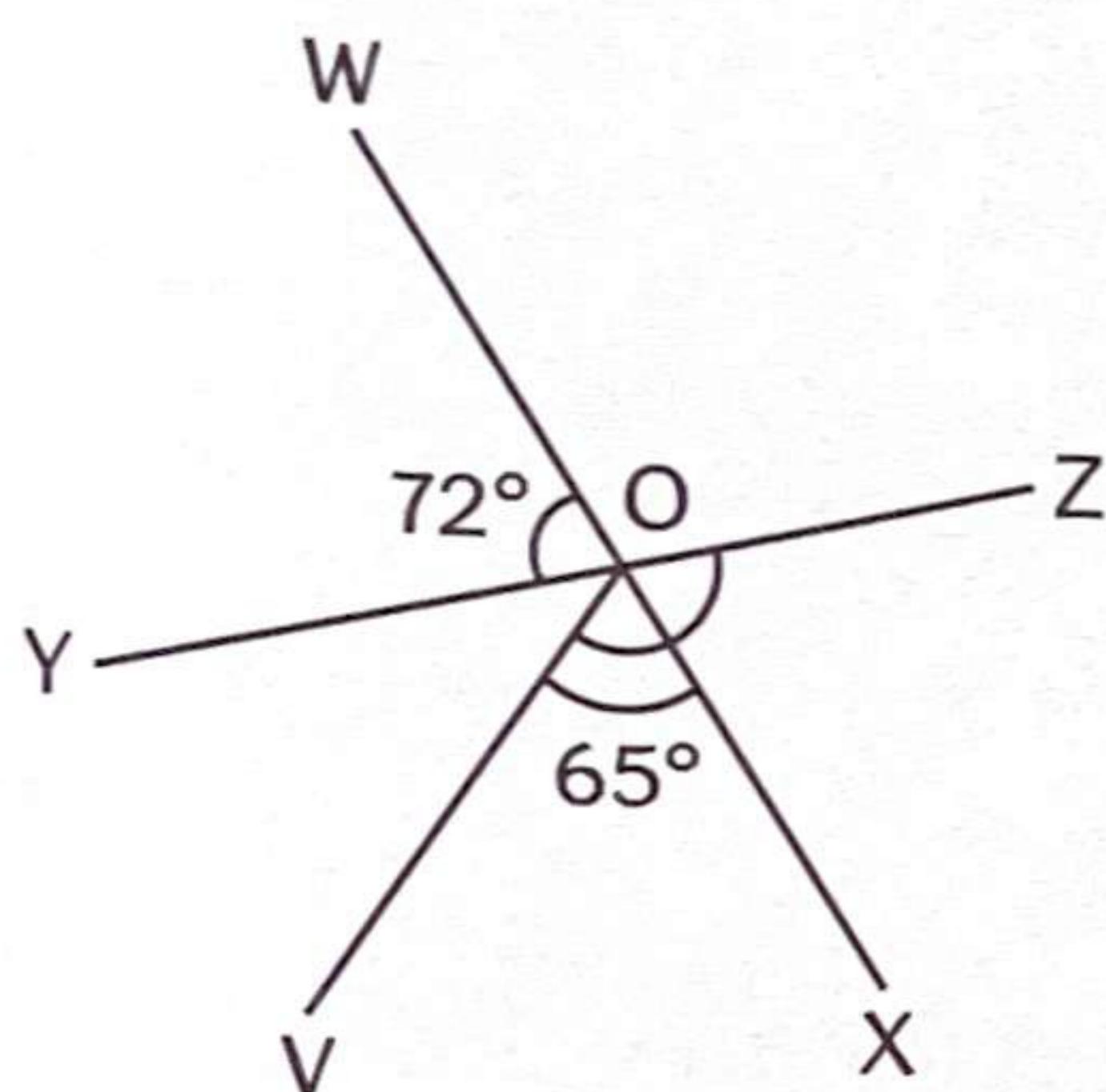
$$\begin{aligned}\angle BOF &= \angle AOE \\ &= 28^\circ\end{aligned}$$

$$\begin{aligned}\angle q &= 180^\circ - 63^\circ - 28^\circ - 45^\circ \\ &= 44^\circ\end{aligned}$$

Can you think of other ways to find $\angle q$?



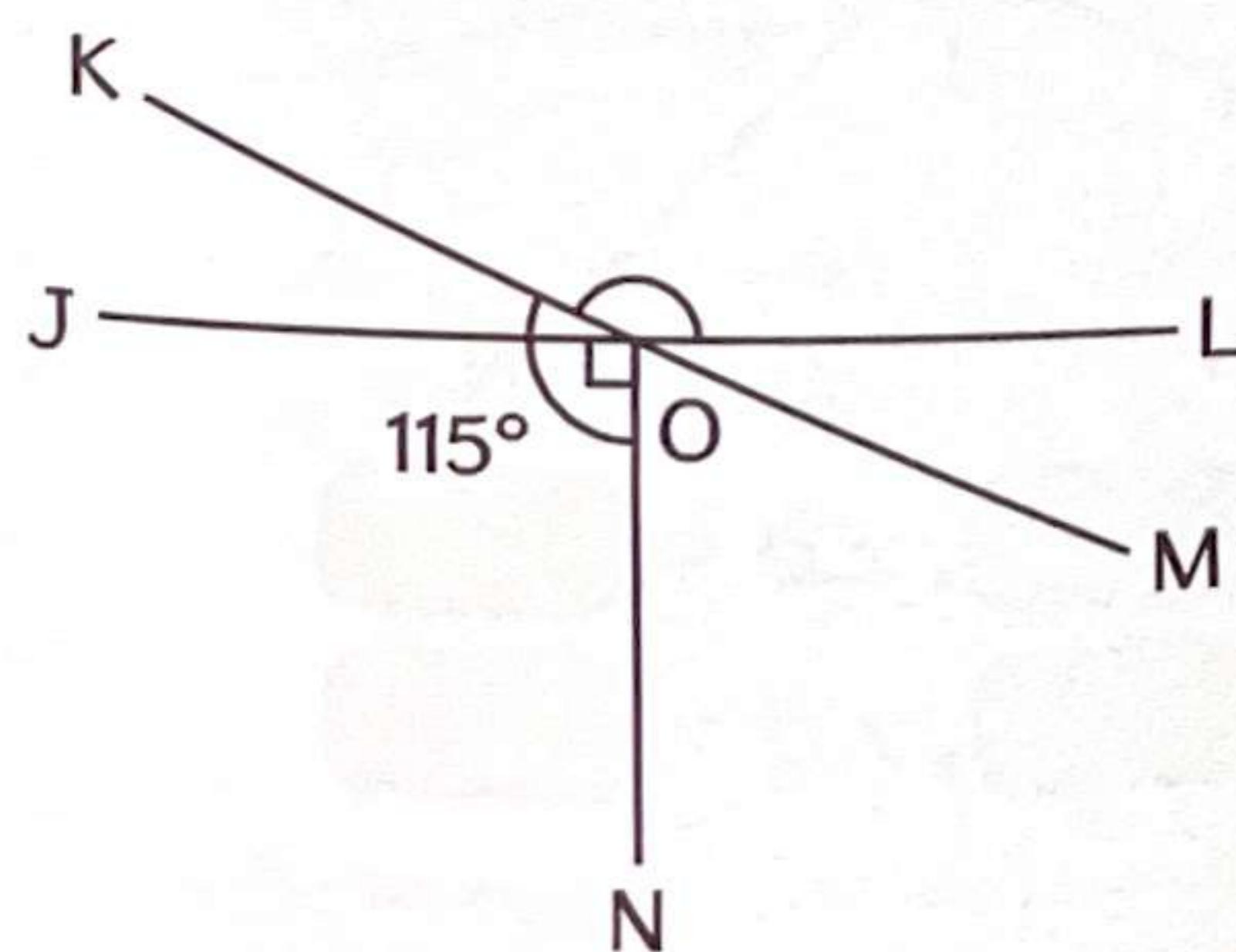
WX and YZ are straight lines. Find $\angle VOZ$.



$$\begin{aligned}\angle ZOX &= \angle WOY \\ &= 72^\circ\end{aligned}$$

$$\begin{aligned}\angle VOZ &= 65^\circ + 72^\circ \\ &= 137^\circ\end{aligned}$$

JL and KM are straight lines. $\angle KON = 115^\circ$. Find $\angle KOL$.



Method 1

$$\begin{aligned}\angle NOL &= 180^\circ - 90^\circ \\ &= 90^\circ\end{aligned}$$

$$\begin{aligned}\angle KOL &= 360^\circ - 90^\circ - 115^\circ \\ &= 155^\circ\end{aligned}$$

Method 2

$$\begin{aligned}\angle KOJ &= 115^\circ - 90^\circ \\ &= 25^\circ\end{aligned}$$

$$\begin{aligned}\angle KOL &= 180^\circ - 25^\circ \\ &= 155^\circ\end{aligned}$$