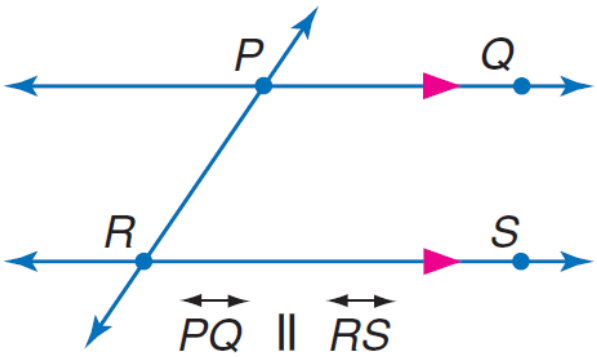
3-1 Parallel Lines and Transversals

Main Ideas:

- Idenfy the relaonships between two lines or between two planes
- Name angles formed by a pair of lines and a transversal

New Vocabulary:

- parallel lines
- parallel planes
- skew lines
- transversal
- consecuve interior angles
- alternate exterior angles
- alternate interior angles
- corresponding angles



$\overleftrightarrow{PQ}$ and $\overleftrightarrow{RS}$ are parallel lines. That means that they lie in the same plane and they will never touch each other.

The symbol $\parallel$ means *is parallel to.*

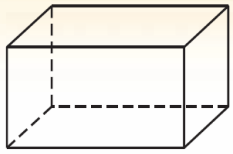
The symbol $\nparallel$ means *is not parallel to.*

We also speak of parallel planes as planes that never intersect. The ceiling and the floor of most rooms are parallel planes for this reason.

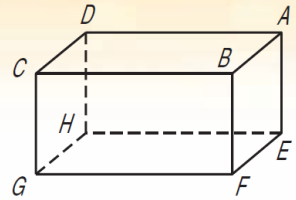
Follow along the steps given to draw a rectangular prism of your own.

Step 1 Draw two parallel planes to represent the top and bottom.

Step 2 Draw the edges. Make any hidden edges dashed.



Step 3 Label the vertices.

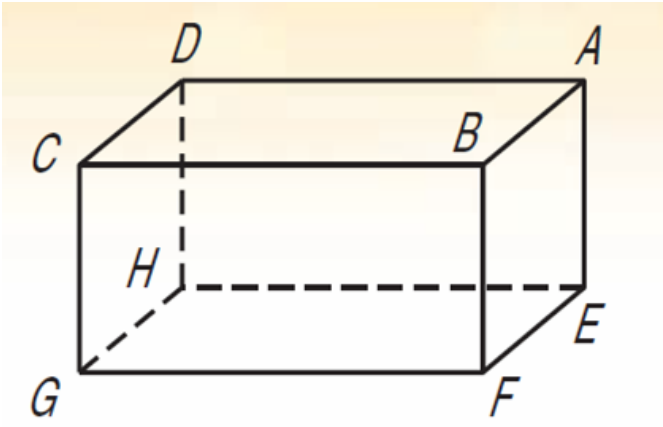


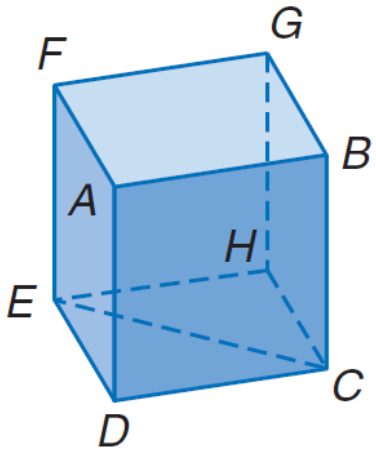
Draw your own prism here:

Next, answer the following quesons about your prism:

1. Name two parallel planes.
2. Name two parallel lines.
3. Choose one segment. Name it here: _____
4. Now, name all lines parallel to that segment.

It is also possible to have two lines that are not on the same plane and do not intersect. These are called skew lines. In the following diagram, $\overleftrightarrow{AB}$ and $\overleftrightarrow{DH}$ are lines that are skew to one another. Name two other **pairs** of skew lines.





Try it:

a. Name all planes that are parallel to plane ABG.

b. Name all segments that intersect $\overline{CH}$.

c. Name all segments that are skew to $\overline{BG}$.

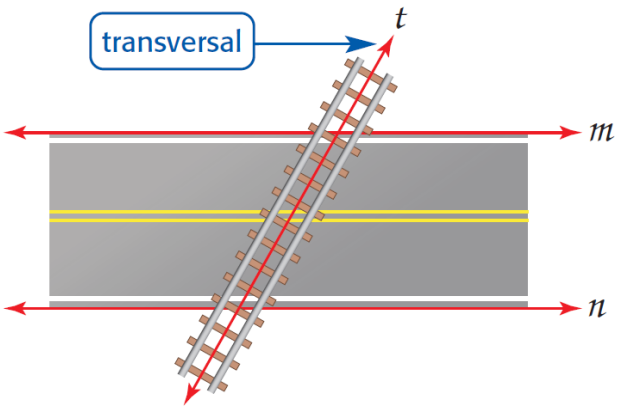
Answers

a. Name all planes that are parallel to plane ABG.
plane CDE

b. Name all segments that intersect $\overline{CH}$.
$\overline{BC}$, $\overline{CD}$, $\overline{CE}$, $\overline{EH}$, and $\overline{GH}$

c. Name all segments that are skew to $\overline{BG}$.
$\overline{AD}$, $\overline{CD}$, $\overline{CE}$, $\overline{EF}$, and $\overline{EH}$

When two or more lines lie in a plane, and another line intersects all of those lines, the line that intersects the others is called the transversal.



In this diagram, *t* is the transversal of *m* and *n*.

Transversals

The lines that the transversal intersects need not be parallel.

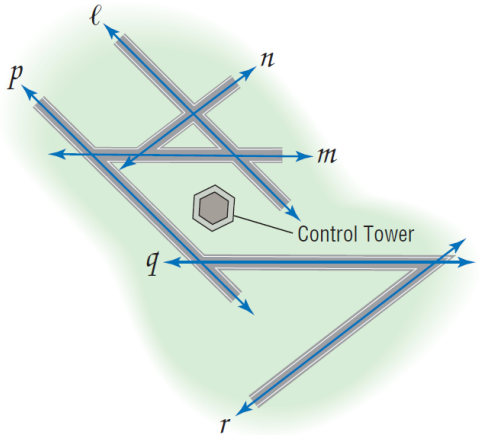
Try it:

AIRPORTS Some of the runways at O'Hare International Airport are shown below. Identify the sets of lines to which each given line is a transversal.

a. line *q*

b. line *m*

c. line *n*



Answers

a. line q
If the lines are extended, line q intersects lines ℓ, n, p, and r.

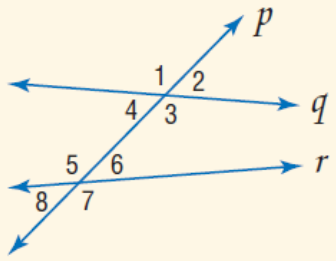
b. line m
lines ℓ, n, p, and r

c. line n
lines ℓ, m, p, and q

When a transversal intersects two or more lines, the angles that are formed are idenfied by specific relaonships to one another and to the lines.

Name	Angles
exterior angles	∠1, ∠2, ∠7, ∠8
interior angles	∠3, ∠4, ∠5, ∠6
consecutive interior angles	∠3 and ∠6, ∠4 and ∠5
alternate exterior angles	∠1 and ∠7, ∠2 and ∠8
alternate interior angles	∠3 and ∠5, ∠4 and ∠6
corresponding angles	∠1 and ∠5, ∠2 and ∠6, ∠3 and ∠7, ∠4 and ∠8

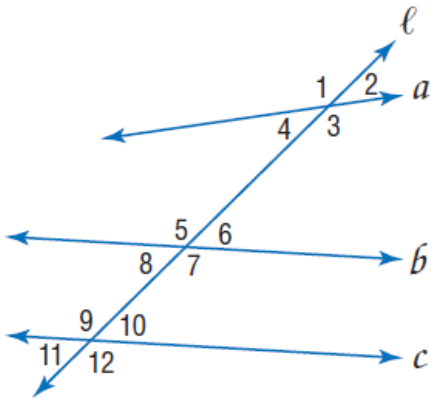
Transversal p intersects lines q and r.



Try it:

Identify Angle Relationships

Refer to the figure below. Identify each pair of angles as *alternate interior*, *alternate exterior*, *corresponding*, or *consecutive interior* angles.



a. ∠1 and ∠7

b. ∠2 and ∠10

c. ∠8 and ∠9

d. ∠3 and ∠12

e. ∠4 and ∠10

f. ∠6 and ∠11

Answers

a. ∠1 and ∠7
alternate exterior

b. ∠2 and ∠10
corresponding

c. ∠8 and ∠9
consecutive interior

d. ∠3 and ∠12
corresponding

e. ∠4 and ∠10
alternate interior

f. ∠6 and ∠11
alternate exterior

Your turn:

Refer to the figure below. Identify each pair of angles as *alternate interior*, *alternate exterior*, *corresponding*, or *consecutive interior* angles

3A. $\angle 4$ and $\angle 11$

3B. $\angle 2$ and $\angle 8$