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3-6 Lesson Reading Guide

Perpendiculars and Distance

Lesson 3-6

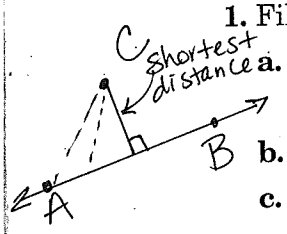
Get Ready for the Lesson

Read the introduction to Lesson 3-6 in your textbook.

Name three examples of situations in home construction where it would be important to construct parallel lines.

Walls, Woodfloor, Siding, windows, sidewalk

Read the Lesson



1. Fill in the blank with a word or phrase to complete each sentence.

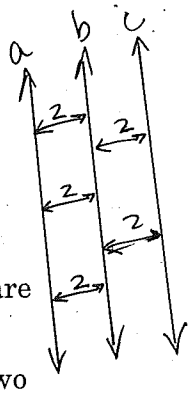
a. The distance from a line to a point not on the line is the length of the segment perpendicular to the line from the point.

b. Two coplanar lines are parallel if they are everywhere equidistant.

c. In a plane, if two lines are both equidistant from a third line, then the two lines are parallel to each other. a ∥ c

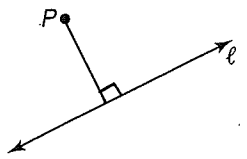
d. The distance between two parallel lines measured along a perpendicular to the two lines is always the same.

e. To measure the distance between two parallel lines, measure the distance between one of the lines and any point on the other line.

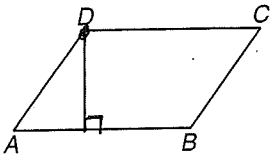


2. On each figure, draw the segment that represents the distance indicated.

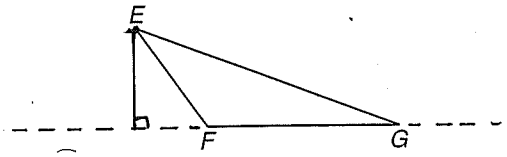
a. P to ℓ



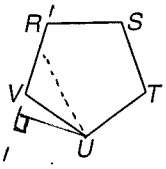
b. D to $\overleftrightarrow{AB}$



c. E to $\overleftrightarrow{FG}$



d. U to $\overleftrightarrow{RV}$



Remember What You Learned

3. A good way to remember a new word is to relate it to words that use the same root. Use your dictionary to find the meaning of the Latin root *aequus*. List three words other than equal and equidistant that are derived from this root and give the meaning of each.

aequus = fair or equal

equilibrium equivalent equinox

equity equilateral

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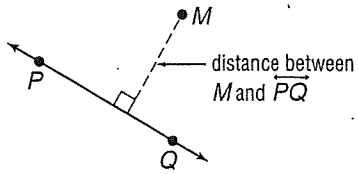
3-6 Study Guide and Intervention

Perpendiculars and Distance

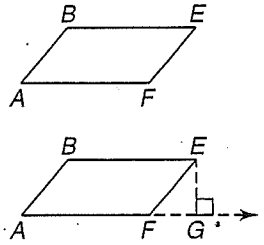
Distance From a Point to a Line When a point is not on a line, the distance from the point to the line is the length of the segment that contains the point and is perpendicular to the line.



Example **Draw the segment that represents the distance from E to $\overleftrightarrow{AF}$.**

Extend $\overleftrightarrow{AF}$. Draw $\overline{EG} \perp \overleftrightarrow{AF}$.

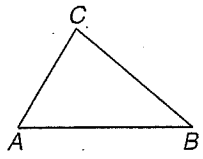
$\overline{EG}$ represents the distance from E to $\overleftrightarrow{AF}$.



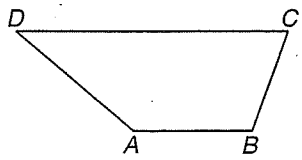
Exercises

Draw the segment that represents the distance indicated.

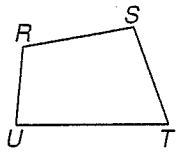
1. C to $\overleftrightarrow{AB}$



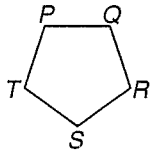
2. D to $\overleftrightarrow{AB}$



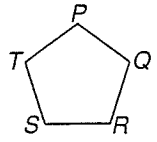
3. T to $\overleftrightarrow{RS}$



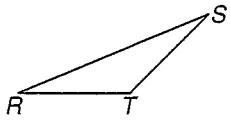
4. S to $\overleftrightarrow{PQ}$



5. S to $\overleftrightarrow{QR}$

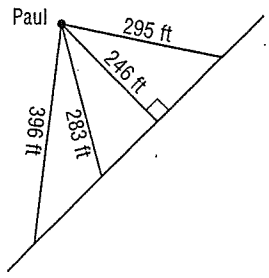


6. S to $\overleftrightarrow{RT}$



1. **DISTANCE** What does it mean if the distance between a point P and a line l is zero? What does it mean if the distance between two lines is zero?

2. **DISTANCE** Paul is standing in the schoolyard. The figure shows his distance from various classroom doors lined up along the same wall.



How far is Paul from the wall itself?

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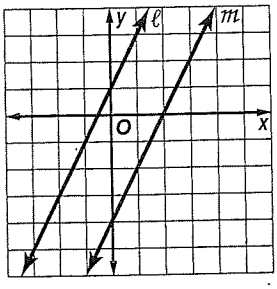
3-6 Study Guide and Intervention *(continued)*

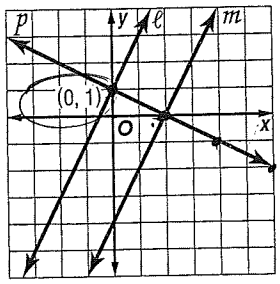
Perpendiculars and Distance

Distance Between Parallel Lines The distance between parallel lines is the length of a segment that has an endpoint on each line and is perpendicular to them. Parallel lines are everywhere **equidistant**, which means that all such perpendicular segments have the same length.

Example **Find the distance between the parallel lines ℓ and m whose equations are $y = 2x + 1$ and $y = 2x - 4$, respectively.**



Draw a line p through (0, 1) that is perpendicular to ℓ and m.



$m = \frac{2}{1}$

$\perp m = \frac{-1}{2}$

Line p has slope $-\frac{1}{2}$ and y-intercept 1. An equation of p is $y = -\frac{1}{2}x + 1$. The point of intersection for p and ℓ is (0, 1).

To find the point of intersection of p and m, solve a system of equations.

Line m: $y = 2x - 4$
Line p: $y = -\frac{1}{2}x + 1$ } find the intersection

Use substitution.

$2x - 4 = -\frac{1}{2}x + 1$ — Set them equal

$4x - 8 = -x + 2$

$5x = 10$

$x = 2$

Substitute 2 for x to find the y-coordinate.

$y = -\frac{1}{2}x + 1$

$= -\frac{1}{2}(2) + 1 = -1 + 1 = 0$

The point of intersection of p and m is (2, 0).

Use the Distance Formula to find the distance between (0, 1) and (2, 0).

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(2 - 0)^2 + (0 - 1)^2}$

$= \sqrt{5}$

The distance between ℓ and m is $\sqrt{5}$ units.

Exercises

Find the distance between each pair of parallel lines.

1. $y = 8$
   $y = -3$

2. $y = x + 3$
   $y = x - 1$

3. $y = -2x$
   $y = -2x - 5$

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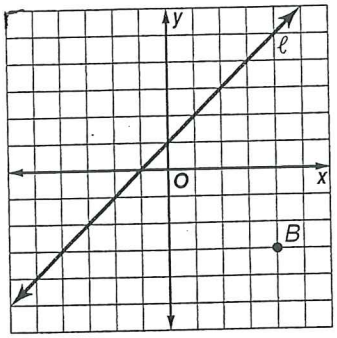
3-6 Practice

Perpendiculars and Distance

Construct a line perpendicular to ℓ through B. Then find the distance from B to ℓ.

1



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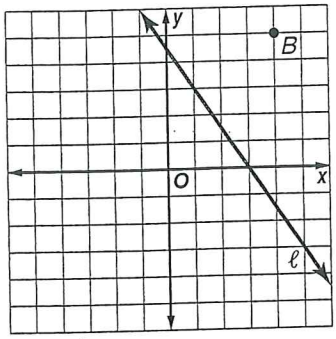
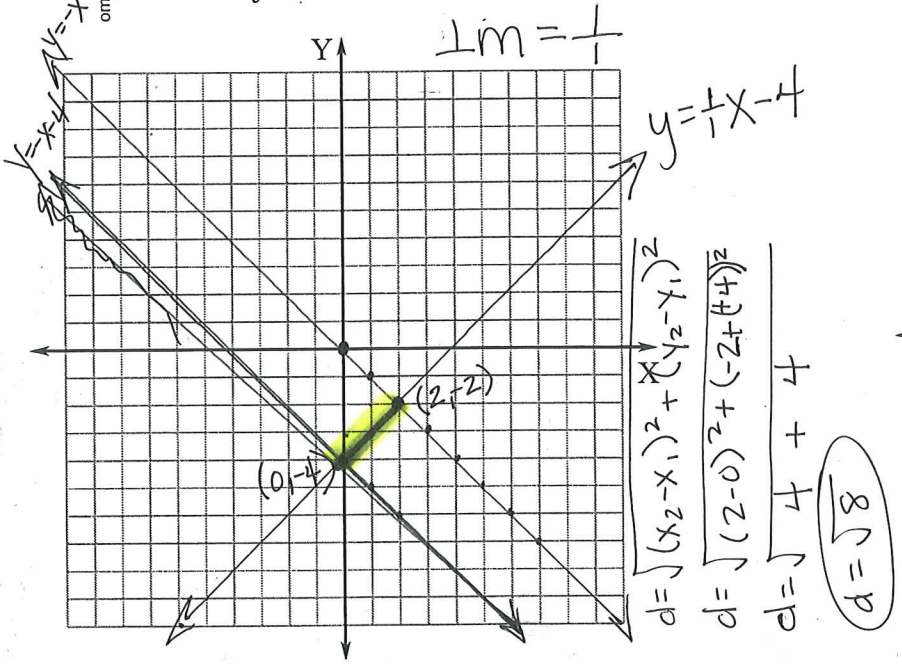


Find the distance between each pair of parallel lines.

3 $y = -x$
$y = -x - 4$

$m = \frac{-1}{1}$

$\perp m = \frac{1}{1}$



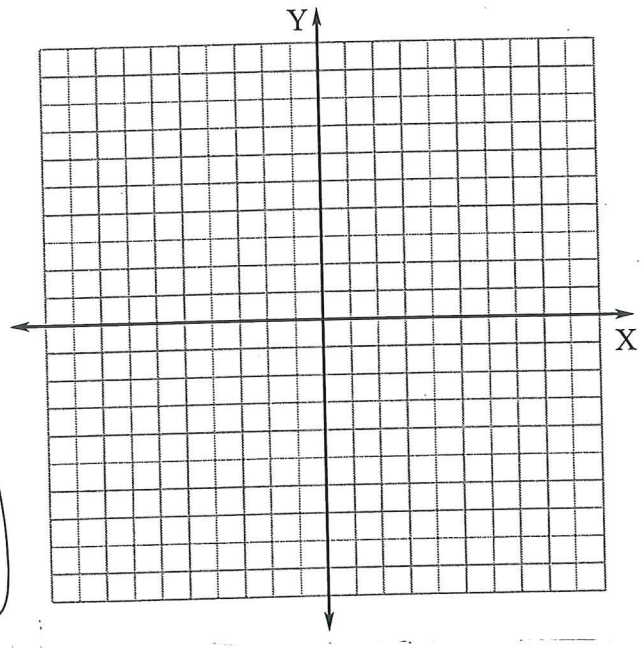
$d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

$d = \sqrt{(2-0)^2+(-2+4)^2}$

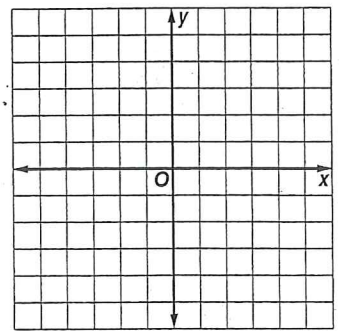
$d = \sqrt{4+4}$

$d = \sqrt{8}$

4 $y = 3x + 12$
$y = 3x - 18$



5 Graph the line $y = -x + 1$. Construct a perpendicular segment through the point at $(-2, -3)$. Then find the distance from the point to the line.



6 **CANOEING** Bronson and a friend are going to carry a canoe across a flat field to the bank of a straight canal. Describe the shortest path they can use.