*Technical...
take good notes!
(Assumes a LOT from Alg. 1)

Geometry 3.6

Find the distance between a point and a line*

Find the distance between parallel lines*

pythagorean theorem

hypotenuse

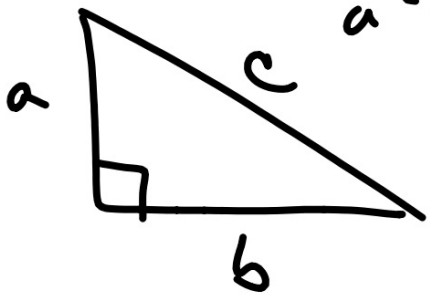
distance

parallel

perpendicular

equidistant

$a^2 + b^2 = c^2$



construction: perpendicular from a point not on a line

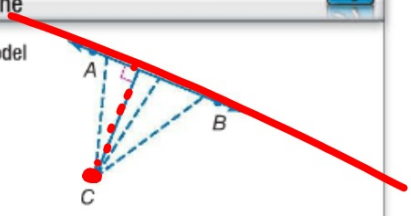
p. 216
p. 55

...because it is the shortest...
(why?)

KeyConcept Distance Between a Point and a Line

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

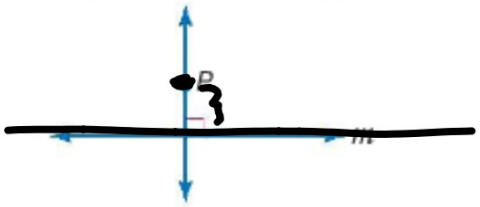
Model



Postulate 3.6 Perpendicular Postulate

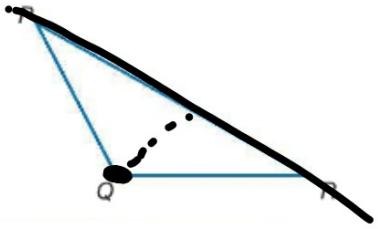
Words If given a line and a point not on the line, then there exists exactly one line through the point that is perpendicular to the given line.

Model



GuidedPractice

1. Copy the figure. Then construct and name the segment that represents the distance from Q to $\overleftrightarrow{PR}$.



Example 2 Distance from a Point to a Line on Coordinate Plane

COORDINATE GEOMETRY Line ℓ contains points at $(-5, 2)$ and $(1, -6)$. Find the distance between line ℓ and point $P(2, 4)$.

Always graph and estimate first.

1. equation of ℓ: $m = \frac{-8}{8} = -1$

$y = -x + B$

$-6 = -4 + B$

$+4 \quad +4$

$-2 = B$

② eqn of $\perp$ line: $y = x + B$

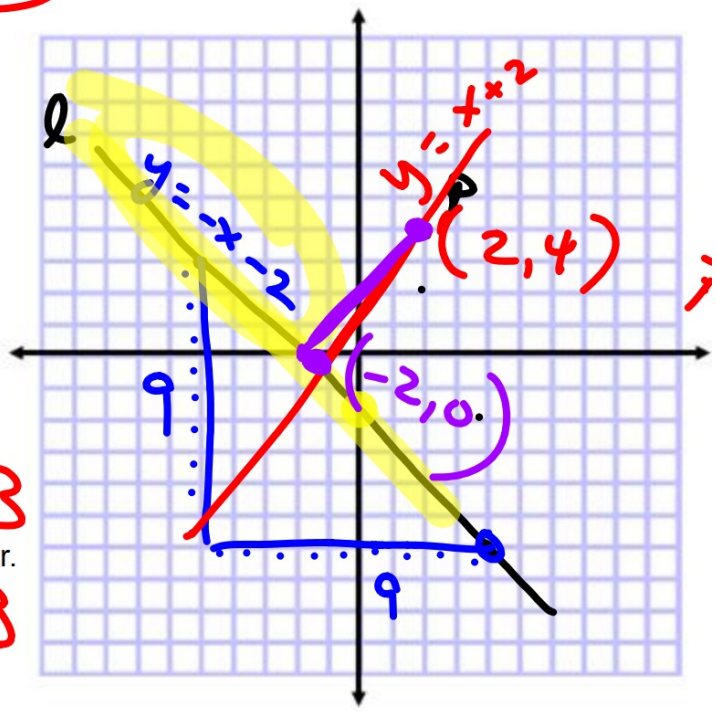
$4 = 1 \cdot 2 + B$

$4 = 2 + B$

$-2 \quad -2$

1. You know 1 ord. pair, you need the other ord. pair.
2. Find the equation of line l*
3. Find the equation of line p (perp. to l)*
4. Find the point of intersection of p and l*
   (You now know the other ord. pr.)
5. Find the distance (Pyth. theor.) with 2 ord. pairs.*

* Covered in Algebra 1 (separately...now all in same problem! You need a plan!



$y = -x - 2$

$y = x + 2$

$2y = 0$

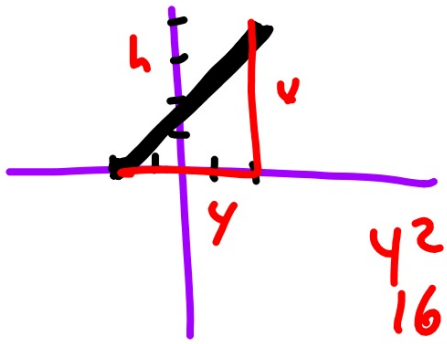
$\frac{2y}{2} = \frac{0}{2}$

$y = 0$

$y = x + 2$

$0 = x + 2$

$-2 \quad -2$



$(-2, 0)$

$y^2 + y^2 = h^2$

$16 + 16 = h^2$

$32 = h^2$

$5.7 \approx h$

COORDINATE GEOMETRY **Find the distance from P to ℓ.**

4. Line ℓ contains points (4, 3) and (−2, 0). Point P has coordinates (3, 10).

9-16

p.220

Whiteboards:

1. You know 1 ord. pair, you need the other ord. pr.
2. Find the equation of line l*
3. Find the equation of line p (perp. to l)*
4. Find the point of intersection of p and l*
   (You now know the other ord. pr.)
5. Find the distance (Pyth. theor.) with 2 ord. pairs.*

5. Line ℓ contains points $(-6, 1)$ and $(9, -4)$. Point P has coordinates $(4, 1)$.

6. Line ℓ contains points $(4, 18)$ and $(-2, 9)$. Point P has coordinates $(-9, 5)$.

KeyConcept Distance Between Parallel Lines

The distance between two parallel lines is the perpendicular distance between one of the lines and any point on the other line.

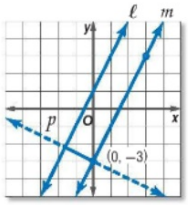
Is the y-intercept a point on the line?
Can we know what it is from the equation?

Example 3 Distance Between Parallel Lines

Find the distance between the parallel lines ℓ and m with equations $y = 2x + 1$ and $y = 2x - 3$, respectively.

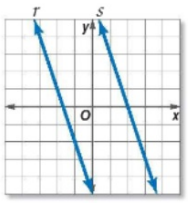
1. Pick one line, call it m
2. Write the equation of line p perp to m*
3. Find the point of intersection of l and p
   (Now you know 2 points)
4. Use pyth theorem to find distance*

* Covered in Algebra 1 (separately...now all in same problem!)
You need a plan!



GuidedPractice

3A. Find the distance between the parallel lines r and s whose equations are $y = -3x - 5$ and $y = -3x + 6$, respectively.



Theorem 3.9 Two Lines Equidistant from a Third

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

