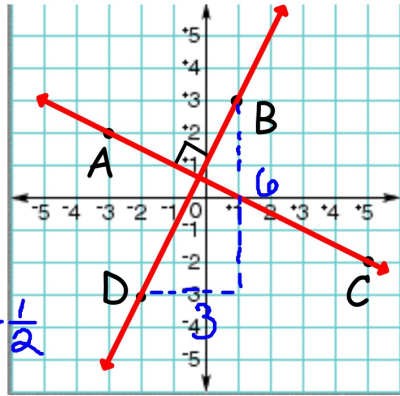## Launch:

$\overleftrightarrow{AC}$ and $\overleftrightarrow{DB}$

are perpendicular

$-\dfrac{1}{2} \cdot \dfrac{2}{1} = -1$

2. What is the slope of $\overleftrightarrow{AC}$ $\dfrac{-4}{8} = -\dfrac{1}{2}$

3. What is the slope of $\overleftrightarrow{DB}$ $\dfrac{6}{3} = 2$

4. What is the <u>product</u> of the two slopes you found in Problems 2 and 3?

-1

7.8

7.8   Perpendicular Lines

Objective: To find and compare the relationship that exists between the slopes in equations of lines and recognize when two lines are perpendicular.

Theorem 7.6

Two lines are perpendicular if and only if the product of their slopes is -1.

** The slopes of perpendicular lines are <u>opposite</u> <u>reciprocals</u> of each other**

$y = mx + b$

Examples: Are the following lines perpendicular?

$y = 3x - 2$ $\boxed{m = 3}$

&

$y = \dfrac{1}{3}x + 7$ $\boxed{m = \frac{1}{3}}$

No

Yes

$2x + 3y = 7$

&

$-6x + 4y = 5$
$+6x \qquad +6x$
$4y = 6x + 5$
$\div 4 \quad \div 4$
$y = \dfrac{3}{2}x + \dfrac{5}{4}$ $\boxed{m = 3/2}$

$2x + 3y = 7$
$-2x \quad -2x$
$3y = -2x + 7$
$\div 3 \qquad \div 3$
$y = \dfrac{-2}{3}x + \dfrac{7}{3}$

$\boxed{m = -2/3}$

Recall from Algebra 1:

Point-slope form of an equation of a line

$$\boxed{y - y_1 = m(x - x_1)}$$

For You to Do

9. Find an equation of the line through $P(3, 5)$ that is perpendicular to line ℓ with equation $2x + y = 9$.

* Find the slope of the given line:

$$2x + y = 9$$
$$-2x \qquad -2x$$
$$y = -2x + 9$$
$$\boxed{m = -2}$$

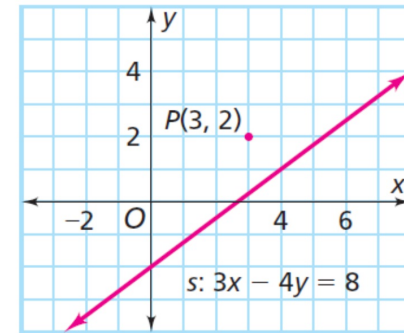*** Find the opposite reciprocal of the first line:** $\boxed{m = \tfrac{1}{2}}$

* Plug in the point & the slope:
$$\boxed{y - 5 = \tfrac{1}{2}(x - 3)}$$

1. Write equations for two different lines that are perpendicular to the line with equation $x + y = 3$. Are there other possibilities?

3. Find the distance from P to s in the figure below.

$P(3, 2)$

$s: 3x - 4y = 8$

On Your Own

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5. Write an equation for at least one line perpendicular to the line with each equation.

a. $x + y = 2$
b. $x - y + 2 = 0$
c. $19x + 3y = 17$
d. $y = 3 + 4x$

6. Write an equation of the line through the given point and perpendicular to the line with the given equation.

a. $(0, 0), 2x - 3y = 14$
b. $(0, -3), y = -x + 2$
c. $(-4, -3), 2x + y + 6 = 0$
d. $(1, 2), 2x - 3y + 1 = 0$

7. Find the distance from the given point to the given line.

a. $(1, -2)$ to the line with equation $3x - y = -5$
b. $(-1, 0)$ to the line with equation $y = 5x - 1$
c. $(2, 2)$ to the line through points $(3, 1)$ and $(7, 4)$
d. $(1, 2)$ to the line with equation $20x - 21y = 58$

9. **Standardized Test Prep** What is the equation of the line that is perpen-
dicular at the point $(4, 1)$ to the line with equation $y = -\frac{1}{2}x + 3$?

A. $y = \frac{1}{2}x - 1$

B. $y = 2x + 7$

C. $-x + y = -3$

D. $2x - y = 7$