In 2.4 we have continued to look at different forms of lines, namely: 1. Slope-intercept, 2. Standard form, 3. Point-Slope form. 2.4 focused on Standard form and horizontal and vertical lines. In this section we will look at point-slope form of a line, why we might prefer this form in certain instances and discuss the relationship that parallel and perpendicular lines have.

What information would you guess it would be best to have to use point-slope form?

Def: Given the slope of a line, $m$, and a point on that line $(x\_{1},y\_{1})$, the **point-slope form this line** is $\left(y-y\_{1}\right)=m(x-x\_{1})$

Ex: Given the following information, find a linear equation that has the following properties:

1. $m=-3;p\_{1}=(2,-1)$ $ y+1=-3(x-2)$
2. $p\_{1}=\left(3,4\right), p\_{2}=(-1,6)$ $y-4=-\frac{1}{2}(x-3)$
3. $p\_{1}=\left(-3,-4\right), p\_{2}=(-1,-6)$ $y+4=-1(x+3)$
4. $p\_{1}=\left(2,1\right), p\_{2}=(3,1)$ $y-1=0\left(x-2\right)\rightarrow y=1$
5. $p\_{1}=\left(2,1\right), p\_{2}=(2,2)$ $no matter what y is x=2$

## Graphing a Line In Point-Slope Form

Recall, we need 2 points to graph a line (a third to check it is a line).

In point slope form we are given what two important pieces of info? POINT AND SLOPE

So 1. Plot your point

 2. Use slope to find another point.

Ex: Graph the answers to a, b, & c of the previous example.

## Parallel and Perpendicular Lines

Def: Two lines are **parallel** if they do not touch.

What must be true about two parallel lines if they indeed never touch?

Theorem: Two parallel lines have

1. The same slope
2. Different y-intercepts

Def: Two lines are perpendicular if they meet at 90$°$ angles.

Negative Reciprocals

Theorem: Two lines are perpendicular if their slopes are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Ex: Write the equations of a line (in any form) containing the specified point and is

1. parallel and 2) perpendicular

to the given line.

1. $\left(6,0\right); 5x+4y=1$ $∥:y-0=-\frac{5}{4}\left(x-6\right) ⊥:y-0=\frac{4}{5}(x-6)$
2. $\left(-5,6\right); 4x-y=3$ $∥:y-6=4\left(x+5\right) ⊥:y-6=-\frac{1}{4}(x+5)$

Ex: Find an equation of the lines that are 1) parallel and 2) perpendicular to the line:

$y=3x+4$ $∥:y=3x+2 ⊥:y=-\frac{1}{3}x+1$

Ex: Fill in the blank so that the line will be 1) parallel and 2) perpendicular to the line:

 $y=-2x+3$

Ans: Parallel: y = ­­\_\_\_x + \_\_\_\_ Perpendicular y = \_\_\_\_x + \_\_\_\_

Note: par: same slope, anything but 3; Slope is 1/2 , any y-int.

Ex: Determine at a glance whether or not these two lines are parallel and explain why.

$$y+8=-6x$$

$$-2x+y=5$$

NO: Diff. slopes!

## Applications

Example 3: Pg 120.

Fossil-fuel emissions. World wide carbon-dioxide emissions in 2004 were 27 billion metric tons. If no changes are made to current practice, this amount is expected to grow to 31 billion metric tons in 2010. Assuming constant growth since 2000, what will world wide carbon-dioxide emissions be in 2015.

Sol:

Algebraic:

Let x= Number of years since 2000.

Let y = Number of billion tons of emissions

So we have two points given:

$$p\_{1}=\left(4,27\right), p\_{2}=(10,31)$$

So, $m=\frac{(31-27)bill tons}{6 years}=\frac{4}{6}=\frac{2}{3}bill tons/year$

This means we have a line $y-27=\frac{2}{3}(x-4)$

Now to answer the question, what will y be when x=15?

$$y-27=\frac{2}{3}\left(15-4\right)\rightarrow y-27=\frac{2}{3}\left(11\right)\rightarrow y=\frac{22}{3}+\frac{81}{3}=\frac{103}{3}=34\frac{1}{3} bill tons $$

TEAM UP IN PAIRS. FIRST 2 GROUPS TO HAND IN CORRECT ANSWERS TO PROB. 1-10 ON PAGE 123 WILL EARN 2 PTS EA. EC ON 1ST EXAM.