Lesson 11

RF7 Determine the equation of a linear relation, given: a graph, a point and the slope, two points, a point and the equation of a parallel or perpendicular line, a scatter plot.

Slope-Point Form of the Equation for a Linear Relation

Determine the equations of the line.



Recall from the previous lesson, to find the equation of the line in slope-intercept form ( y= mx +b) we need to find the slope and the y intercept

To find the slope form a graph use

 m = $\frac{rise}{run}$ or choose two points and use m = $\frac{y2-y1}{x2-x1}$

Using (2,2) and (4,1)

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

The y-intercept(b) is the point on the graph where the graph crosses the y axis.

 b = 3

The equation of the graph is : y = $\frac{-1}{2}$ x + 3

Now try this one:



The slope can be found using two points on the graph.

(-1, 1) and (2,-1) are two points on the graph.

 m = $\frac{-1-1}{2-(-1)}$

 = $\frac{-2}{3}$

Now there is a problem- It is not possible to determine the y intercept exactly from the graph.

The slope and one of the points can be used to find the y intercept.

 y = mx +b

Fill in the slope y = $\frac{-2}{3}$ x + b

Fill in the co-ordinates of one of the points for x and y .

Filling in (-1.1) gives

 1 = $\frac{-2}{3}$ (-1) + b

 1 = $\frac{2}{3}$ + b

 1 - $\frac{2}{3}$ = $\frac{2}{3}$ - $\frac{2}{3}$ + b

 $\frac{1}{3}$ = b

Equation

 y = $\frac{-2}{3}$ x + $\frac{1}{3}$

Putting the equation in **Point-Slope** form is another way to write the equation of a line when the y intercept can’t be directly found from the graph.

Point-Form of the Equation of a Linear Function

The equation of a line that passes through P(x1,y1) and has a slope of m is:

 y – y1 = m( x – x1)

Example 1:

1. Write the equation in slope-point form for the line below.
2. Write the equation in part (a) in slope-intercept form. What is the y-intercept of the line?



1. Answer:

Find 2 points on the line and find the slope.

Two points on the line are ( -1,-2) and (3,1)

 m = $\frac{1-(-2)}{3-(-1)}$

 = $\frac{3}{4}$

Now pick one of the points and write the equation of the line using

 y – y1 = m( x – x1)

Using (-1,-2) the equation would be : y- (-2) = $\frac{3}{4}$ ( x – (-1))

Don’t leave double negative signs so the equations becomes

 y + 2 = $\frac{3}{4}$ ( x + 1)

Using (3,1) the equation would be : y -1 = $\frac{3}{4}$ ( x -3)

1. To get the equation from (a) into slope-intercept form it must be rearranged so that y is by itself on one side of the equation.

\*\*\*NOTE: It doesn’t matter which of the equations you use from (a) the answer will be the same equation in (b) when it is in slope intercept form\*\*\*

 Using y -1 = $\frac{3}{4}$ ( x -3)

First multiply and get rid of the brackets

 y -1 = $\frac{3}{4}$ x - $\frac{9}{4}$

Move -1 to the right by +1 on both sides of the equations

 y -1 +1 = $\frac{3}{4}$ x - $\frac{9}{4}$ +1

Now deal with the fractions and simplify the equation.

**DO NOT CHANGE THE FRACTIONS TO DECIMALS!!!!**

 y = $\frac{3}{4}$ x - $\frac{9}{4}$ + $\frac{4}{4}$

 y = $\frac{3}{4}$ x - $\frac{5}{4}$

The intercept of the line is $\frac{-5}{4}$.

Example 2:

Find the equation of the line in Slope-Point Form that passes through point P( 5,2) and Q( 7,-6)

Answer:

Find the slope m = $\frac{y2-y1}{x2-x1}$

 m = $\frac{-6-2}{7-5}$

 m = $\frac{-8}{2}$

 m = -4

Now write the equation of the line in the form y – y1 = m( x – x1)

Using P(5,2) gives y – 2 = -4(x – 5) or

Using Q(7,-6) gives y-(-6) = -4(x -7)

 Which simplified is y + 6 = -4(x -7)

TRY THESE:

For each of the following give the equation of the line in slope-point and slope intercept form.

1.



1. The line passing through K( -7,-3) and L(-4 ,6)

Answers:

1. Slope- Point Slope- Intercept

y + 2 = ⅔(x+2) or y -2 = ⅔(x-4) y =⅔x - ⅔

1. y + 3 = 3(x+7) or y -6 = 3(x + 4) y = 3x + 18

Example 3:

1. Describe the graph of the linear function with the equation:

 y + 3 = ⅗ ( x – 1)

1. Graph the equation

Answer:

1. The equation is in slope- point form. The slope is located in front of the brackets with the x co-ordinate. The slope of this line is $⅗$.

The x co-ordinate of the point is 1. The y co-ordinate is -3.

The description of the line would be: The line passes through point(1,-3) with a slope of ⅗.

1. Graph

Mark the point (1,-3) on the graph. Use the slope to locate the next point.



Example 4:

The sum of the angles , d degrees, in a polygon is a linear function of the number of sides, n, of the polygon. The sum of the angles in a triangle is 180°. The sum of the angles in a quadrilateral is 360°.

1. Write a linear equation to represent the function.
2. Use the equation to determine the sum of the angles in a dodecagon.

Answer:

1. A triangle has 3 sides and the angle sum is 180°. This information can be written as an ordered pair, (3,180). Similarly a quadrilateral has 4 sides and an angle sum of 360° so this information can be written as (4,360)

Find the slope

 m = $\frac{y2-y1}{x2-x1}$

 m = $\frac{360-180}{4-3}$

 m = 180

The equation would be y-180 = 180( x- 3) or y – 360 = 180(x -4)

1. A dodecagon has 12 sides, so substitute 12 in the x for one of the equationand solve for y.

 y – 180 = 180( x -3)

 y – 180 = 180 ( 12-3)

 y – 180 = 180 (9)

 y – 180 = 1620

 y -180 +180 = 1620 + 180

 y = 1800

The angle sum in a dodecagon is 1800°.

Example 5:

Write an equation of the line that passes through (4,5) and is

1. Parallel to the line y= ⅔x -5
2. Perpendicular to the line y = ⅔x -5

Answer:

1. “Parallel to” always means has the same slope

 y= ⅔x -5 is in slope intercept form

The slope of the line is ⅔. For a line to be parallel it also has a slope of ⅔.

The equation is

 y – 5 = ⅔( x -4)

1. To find the slopes of perpendicular lines use the negative reciprocal

The negative reciprocal of ⅔ is $\frac{-3}{2}$ .

The equation is

 y – 5 = $\frac{-3}{2}$ ( x – 4)

Practice Questions from textbook : p.372-374 #4 to 14 & 18 to 25