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MCT4C
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Jan 27-10:05 AM

§Simple Algebra and Linear Systems

Let us start by solving a linear equation given one unknown variable. Let's say that we have:

$$x+6= 45$$

Recall that we can move terms from one side of the equal sign to the other as long as
"what you do to one side ... you do to the other side"
In this case, the +6 is in the way of x being ISOLATED!
How do we get rid of +6? We subtract both sides by six!

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Hence:

$$x+6= 45$$

Becomes:

$$x+6 - 6 = 45 - 6$$

Ergo:

$$x = 39$$

Now we can do a left side/right side check to see if we did this properly.

LEFT SIDE	RIGHT SIDE
x+6 39 + 6 45	45

LS = RS

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Now let's say that we have:

$$x - 25 = 77$$

Is x ISOLATED? No! What is in the way of it being ISOLATED? -25! How do we get rid of a -25? We add both sides by 25!

$$x - 25 + 25 = 77 + 25$$
$$x = 102$$

LEFT SIDE	RIGHT SIDE
x-25 102 - 25 77	77

LS = RS

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Now let's say that we have:

$$4x - 5 = 175$$

Is x ISOLATED? No! What is in the way of it being ISOLATED? A multiple of 4 and subtraction of -5! When ISOLATING for a variable, remember that you must do things in reverse of EVALUATING. When EVALUATING, you use BEDMAS. When ISOLATING, you use SAMDEB (the reverse ofBEDMAS).

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Solution using SAMDEB:

$$4x - 5 = 175$$

First we add 5 to BOTH SIDES.

$$4x - 5 + 5 = 175 + 5$$
$$4x = 180$$

Now we divided BOTH SIDES by 4.

$$\frac{4x}{4} = \frac{180}{4}$$

$$x = 45$$

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Checking our solution we find:

LEFT SIDE	RIGHT SIDE
4x-5 4(45)-5 180-5 175	175

LS = RS

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Dividing is very similar:

$$\frac{-x}{7} + 10 = 220$$

First we subtract 10 BOTH SIDES.

$$\frac{-x}{7} + 10 - 10 = 220 - 10$$

$$\frac{-x}{7} = 210$$

Now we multiply BOTH SIDES by 7.

$$\frac{\cancel{7}(-x)}{\cancel{7}} = (210)(7)$$

$$x = 1470$$

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Checking our solution we find:

LEFT SIDE	RIGHT SIDE
$\frac{x}{7}+10$ $\frac{1470}{7} + 10$ 210 + 10 220	220

LS = RS

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Slopes

Given a linear system on a Cartesian Plane, we must recognize four kinds of slopes. Recall that it was the French Swiss mathematician who devised the equation:

$y = mx + b$

where m is the slope and b is the y-intercept. As any respectable Swiss, he enjoyed the Alps, hence m, the slope means "la monter" and the b for "la base" (the base of the mountain - where it starts).

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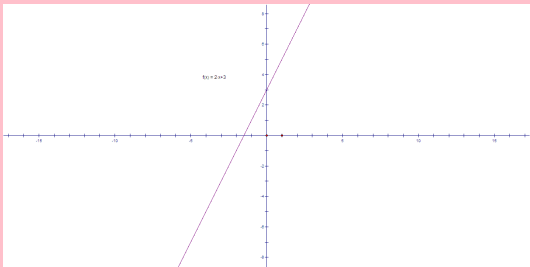
The Increasing or Positive Slope

As the function goes from left to right (or as x increases) the y value increases.



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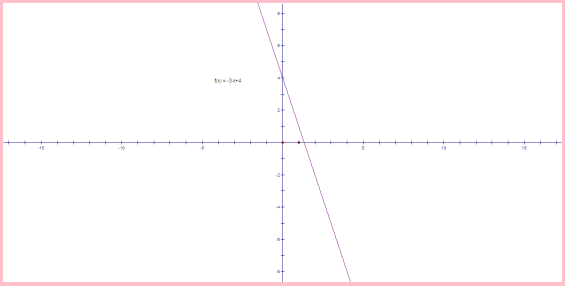
The Decreasing or Negative Slope

As the function goes from left to right (or as x increases) the y value decreases.



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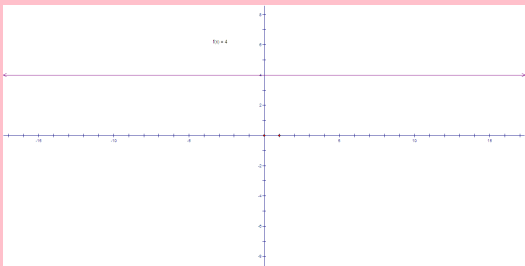
The ZERO Slope

As the function goes from left to right (or as x increases) the y value does not change; neither increasing nor decreasing.



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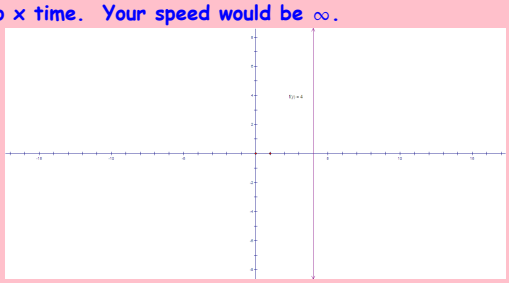
The INFINITE (∞) Slope

This slope is unfortunately often called an undefined slope. In essence, as y increases (from bottom to top) x does not change. It is like moving from one y point to another in zero x time. Your speed would be ∞.



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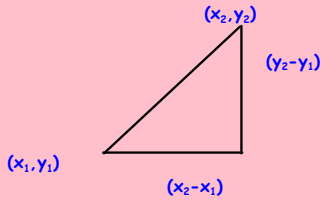
Finding the Slope

If you are given just two points, you can find the slope of a line using a simple triangle trick (often referred to as "rise over run").

Let's say that we have points (x_1,y_1) and (x_2,y_2).



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The Slope Equation

As mentioned slope is rise over run, therefore:

$$m = \frac{(y_2-y_1)}{(x_2-x_1)}$$

Example: What is the slope given the points (4,3) and (7,6)? Let us define (4,3) as the first point and (7,6) as the second.

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Example: What is the slope given the points (4,3) and (7,6)?

Let us define (4,3) as the first point and (7,6) as the second.

$$m = \frac{(y_2-y_1)}{(x_2-x_1)}$$

$$m = \frac{(6-3)}{(7-4)}$$

$$m = \frac{3}{3}$$

$$m = 1$$

Does it matter which point is selected as first or second?

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The x and y intercepts

Finding the y-intercept once you are given the equation of a line, is simple as you let x = 0.

Example: Given the equation y = 3x - 7 find the y-intercept.

Solution: Let x = 0.

$y = 3x - 7$
$y = 3(0) - 7$
$y = -7$

The y intercept is (0,-7).

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The x and y intercepts

Finding the x-intercept once you are given the equation of a line, is also simple as you let y = 0.

Example: Given the equation y = 3x - 7 find the x-intercept.

Solution: Let y = 0.

y = 3x - 7
0 = 3x - 7
3x = 7
x = 7/3
The x intercept is (7/3, 0).

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The x and y intercepts

Find the intercepts given the linear equation
6x - 5y = 30.

Find the x-intercept so let y = 0.
6x - 5y = 30
6x - 5(0) = 30
6x = 30
x = 5 so (5,0)

Find the y-intercept so let x= 0.
6(0) - 5y = 30
- 5y = 30
y = -6 so (0,-6)

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The Ultimate Question

Find the equation of the line that passes through the points (2,9) and (4,-9).

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The Ultimate Question

Find the equation of the line that passes through the points (2,9) and (4,-9). Express the equation in general form.

First, let's find the slope. Let (2,9) be the first point and let (4,-9) be the second.

$$m = \frac{(y_2-y_1)}{(x_2-x_1)}$$

$$m = \frac{(-9-9)}{(4-2)}$$

$$m = \frac{-18}{2}$$

$$m = -9$$

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Now let's find the y-intercept (the b value).

Since the equation of the line is:

$y = mx + b$ where (x,y) are ordered pairs (points) and m is the slope we just calculated

$y = -9x + b$ let's use the point (2,9)

$9 = -9(2) + b$

$9 = -18 + b$

$b = 9 + 18$

$b = 27$

Hence the equation is $y = -9x + 27$

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Let's check to see if this is correct using the other given point (4,-9) in the equation $y = -9x + 27$.

LEFT SIDE	RIGHT SIDE
y -9	-9x + 27 -9(4) + 27 -36 + 27 -9

LS = RS

Now let us express the equation of the line in general form (that is $ax + by - c = 0$)

$$y = -9x + 27$$

$$9x + y - 27 = -9x + 27 + 9x - 27$$

$$9x + y - 27 = 0$$

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Exit Ticket: In class/group activity:
Complete & hand-In. §1.10 #44 & §5.2 #10,30

Homework:
§1.10 #5-25 (odd only) and 37,39
§5.2#5-11 (odd only) and 21-33 (odd only)

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