Chapter 2 Review

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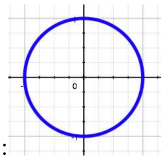
Algebra 2 Lv 1

This review sheet should help you to study for the test. This is just a guide; it is very brief and is not guaranteed to cover everything on the test. Unless you are extremely confident with a topic, go back to your homework, the book, and lessons on our class web site to relearn the topic. Studying math is good, but the most important thing is practice. This review is no substitute for practice!

Section 2.1: Functions, relations and graphs

- A *relation* is any old set of (x, y) pairs
  - Here's a table showing a relation:

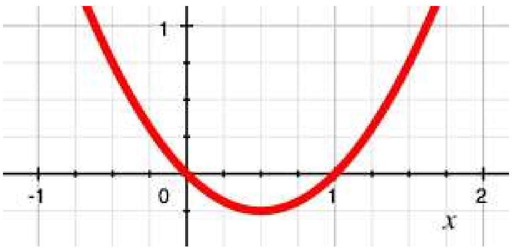
x	y
2	3
2	4
3	4

  - Here's a graph of a relation. This one is the set of *solutions* to the equation $x^2 + y^2 = 1$ (the set of all (x, y) that make the equation true): 

- A *function* is a relation for which every x input has at most one y value for output, or for which every x value appears at most in one (x, y) pair. Graphically this can be tested with the *vertical line test*: For a function, every vertical line must cross the graph at most once. (If it crosses more than once, that means some x input has more than one y output. The circle graph above fails the vertical line test so it is not a function. Note that all functions are relations but not all relations are functions. Here is a table showing a function:

x	y
2	3
4	4
3	4

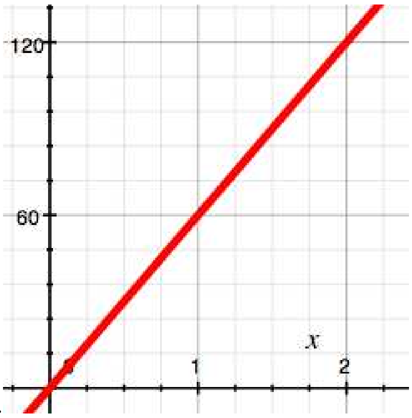
Here is a graph of a function. This one is $f(x) = x^2 - x$.

- 

- The input variable x is sometimes called the *independent* variable; the output variable y is called the *dependent* variable because it *depends* on x.

2.2 Slope and rate of change

- Slope of a line is the rise over the run. Algebraically, $m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$. It doesn't matter which two points you choose or which one comes first, but *you must be consistent*. Convince yourself that $\frac{y_2 - y_1}{x_2 - x_1} = \frac{y_1 - y_2}{x_1 - x_2}$ but $\frac{y_2 - y_1}{x_2 - x_1} \neq \frac{y_2 - y_1}{x_1 - x_2}$.

- Convince yourself that a positive slope goes up from left to right; a negative slope goes down from left to right; a zero slope is horizontal (the rise is 0); a vertical line (not a function!) has undefined slope (the run is 0).
- Parallel lines have the same slope; perpendicular lines have slopes in which each is the negative reciprocal of the other (so a line of slope m is perpendicular to a line of slope $-\frac{1}{m}$).
- Convince yourself that the slope of a graph is the same number as the rate of change of the y value per unit of x value. So if we have a graph of time in hours on the x-axis and distance in miles on the y-axis, the slope of that line is the rate of change of distance in $\frac{\text{miles}}{\text{hour}}$, otherwise known as speed. 

2.3 and 2.4 Graphs of linear equations

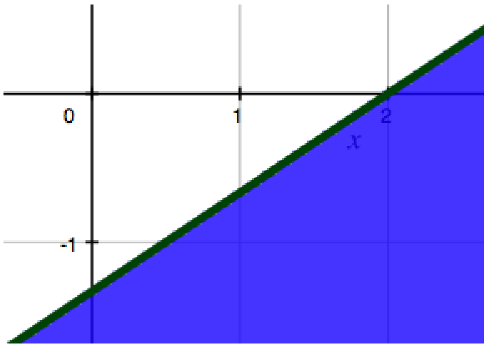
- Slope/intercept form: $y = m\,x + b$, where m is the slope and b is the y-intercept. A horizontal line (zero slope) is of the form $y = 0\,x + b$ or $y = b$.
- Standard form: $A\,x + B\,y = C$, where the x-intercept can be found by setting $y = 0$ and solving for x, giving $x = \frac{C}{A}$ and similarly the y-intercept is $y = \frac{C}{B}$.
- A vertical line has an equation like $x = c$ for some number c. Of course this fails the vertical line test, so it's not a function!
- Point/slope form: $y - y_1 = m\,(x - x_1)$ is an equation for a line of slope m going through the point (x_1, y_1). Note that if $x_1 = 0$ we have the familiar slope-intercept form.
- Two points: If you have two points and want to determine the line connecting them, you can compute the slope using $\frac{y_2 - y_1}{x_2 - x_1}$ and then use the point-slope method.

2.5 Correlation and best-fit

- Skip this section!

Linear inequalities

- To graph an inequality like $2\,x - 3\,y \geq 4$, do the following:
  - Graph the equation first: $2\,x - 3\,y = 4$
  - Find a point not on that line (usually $(0, 0)$ is the easiest) and determine whether it is a solution to the inequality. If so, shade that side of the line. If not, shade the other side. In this case, $(0, 0)$ is not a solution because the inequality $2 \cdot 0 - 3 \cdot 0 \geq 4$ is false, so we shade the side that does not contain $(0, 0)$.
  - If it's a strict inequality (using $>$ or $<$) use a dotted line to indicate that the line is not part of the solution. If it uses $\leq$ or $\geq$ use a regular line.

- 

2.7 Piecewise functions

- Piecewise functions are made up of simpler functions with restricted domains. For example:

$$f(x) = \begin{cases} 2x - 1, & \text{if } x \leq 1 \\ 3x + 1, & \text{if } x > 1 \end{cases}$$

- To evaluate, take your x value, then figure out which line of the function definition applies based on the inequality. So for the function above, to compute $f(2)$, we note that $2 > 1$ so we use $3x + 1 = 3 \cdot 2 + 1 = 7$. To compute $f(0)$, note that $0 \leq 1$ so we use $f(0) = 2 \cdot 0 - 1 = -1$
- To graph a piecewise function, graph each simpler function like always but restrict the domain according to the definintion. Use open points for points that are not in the function and filled-in points for points that are in the function.

2.8 Absolute value

- The absolute value function is a special kind of piecewise function:

$$|x| = \begin{cases} x, & \text{if } x \geq 0 \\ -x, & \text{if } x < 0 \end{cases}$$

- Note that the range of the absolute value function is the set of all nonnegative real numbers, or $y \geq 0$.
- You can use what you know about the $f(x) = x$ function and the $f(x) = -x$ functions to learn about the absolute value function.