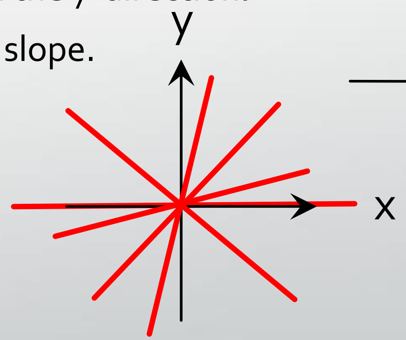
Graphing Lines and Quadratics

ID1050– Quantitative & Qualitative Reasoning

Lines

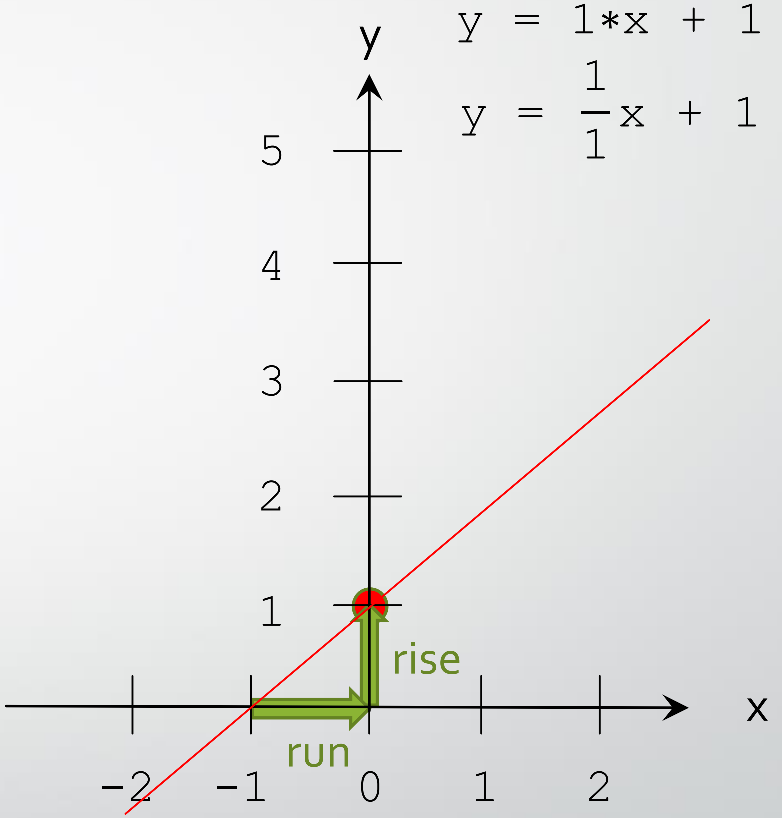
- Functions that have the form `y=ax+b` appear as lines when graphed.
  - They can be graphed in the normal way, plotting each point (x,y).
  - But we know they are lines, so we can graph them in a smarter way.
- The number in front of x, labeled a here, is called the 'slope'.
  - Slope is defined as 'rise over run'
    - 'run' is a unit step to the right along the x-axis
    - 'rise' is the amount the line increases (or decreases) in the y-direction.
    - A slope that is upward (from left to right) is a positive slope.
    - A slope that is downward is a negative slope.
    - A steep slope has a large value for a
    - A shallow slope has a small value for a.
    - A slope of 0 is a horizontal line.
- The term with no x in it, labeled b here, is called the 'y-intercept'.
  - It is the location where the line crosses the y-axis.



$$y = x + 1$$

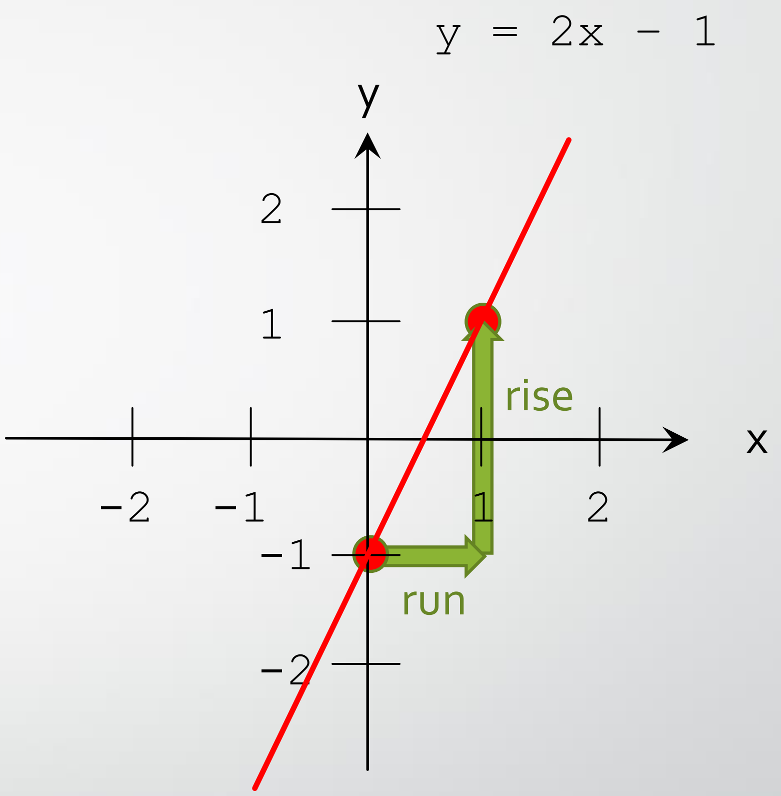
$$y = 1*x + 1$$

$$y = \frac{1}{1}x + 1$$



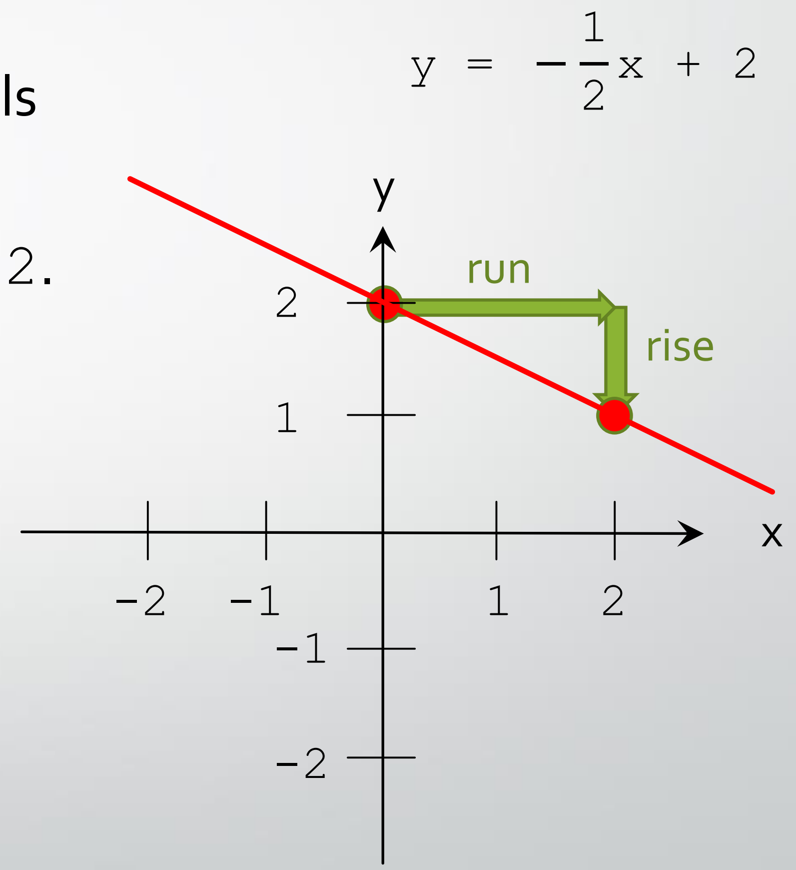
A Line Example

- Let's use these definitions to graph the equation $y=2x-1$
- The y-intercept is $^{-}1$, so the line crosses the y-axis at $^{-}1$.
- The slope is 2.
  - In fractional form, this is $2/1$, so the run is 1 and the rise is 2.
  - The slope is positive, so it runs upward (from left to right).
  - Starting at the intercept, step 1 to the right, then 2 up, and place a point here.
  - The line connects these two points and continues on past them.



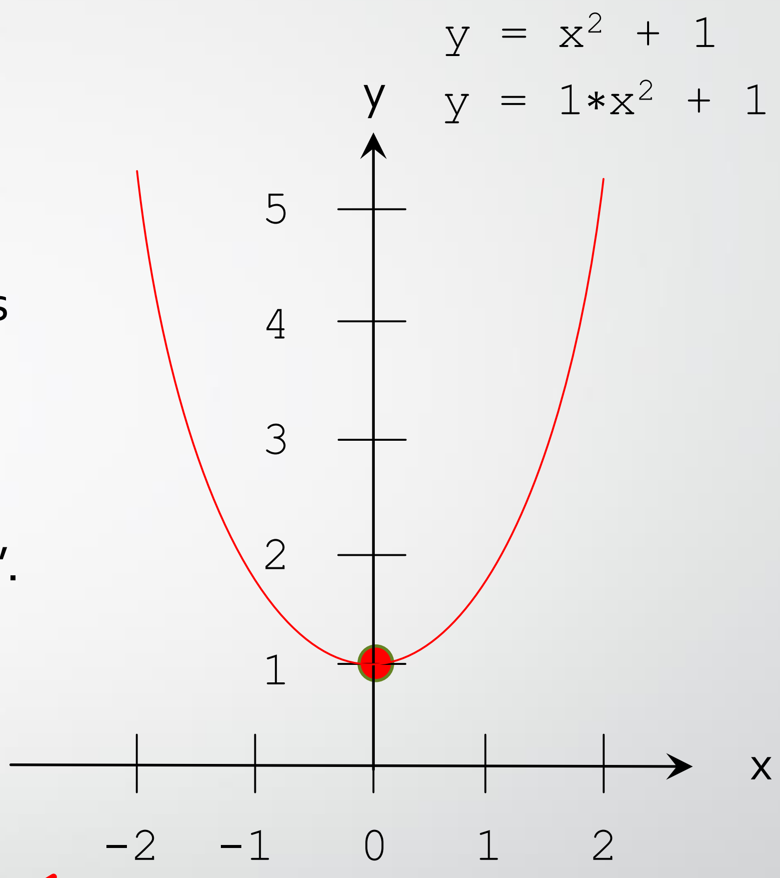
Another Line Example

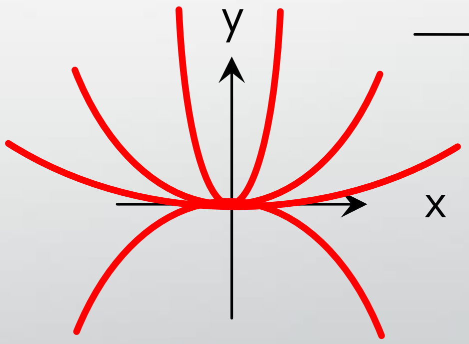
- Here, the graph is shown, and we can pick out the details from it.
- The line crosses the y-axis at 2, so the y-intercept (b) is 2.
- Starting from this point, if you step 2 units to the right, the graph drops down by 1.
  - The run is 2 .
  - The 'rise' is −1 .
  - The slope (a) is rise/run = −1/2
- So $y=ax+b$ is $y=-\frac{1}{2}x+2$



Quadratics

- Functions that have the form $y=ax^2+bx+c$ appear as parabolas or quadratics when graphed. (b or c could be zero.)
  - They can be graphed in the normal way, plotting each point (x,y).
  - Knowing they are parabolas, we can look at certain features.
- The number in front of x, labeled a here, is called the 'curvature'.
  - A parabola that opens upward has a positive curvature.
  - A parabola that opens downward has a negative curvature.
  - A narrow curvature has a large value for a.
  - A shallow curvature has a small value for a.

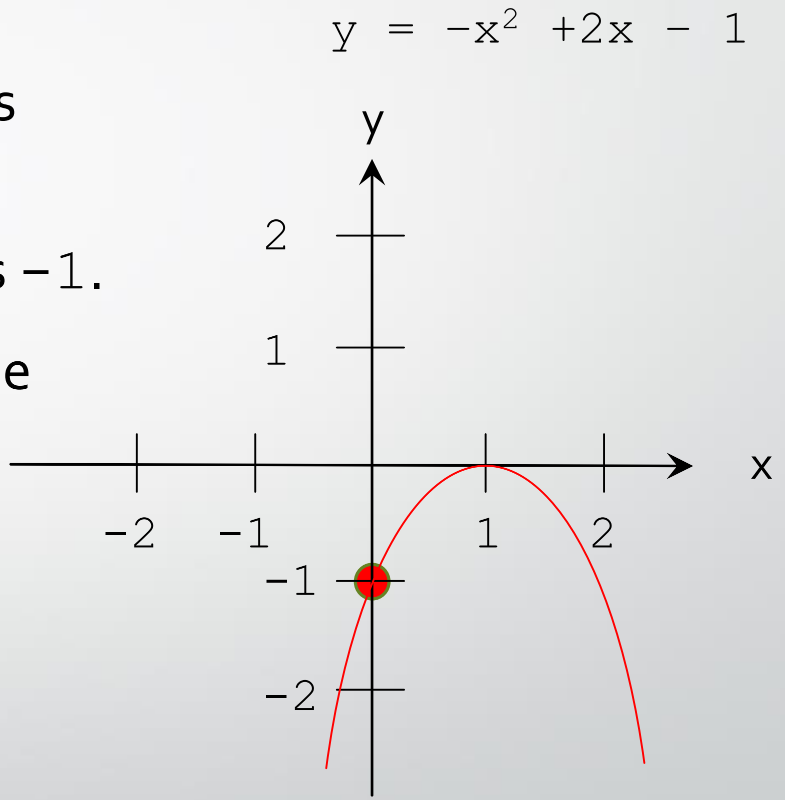




- The term with no x in it, labeled c here, is called the 'y-intercept'.
  - It is the location where the line crosses the y-axis.

A Quadratic Example

- Here, the graph is shown, and we can pick out the details from it.
- The line crosses the y-axis at -1, so the y-intercept (c) is -1.
- The graph opens downward, so the curvature (a) must be negative.
- So which of the equations in the following list can have generated this graph?
  1. $y=x^2+2x+1$
  2. $y=x^2+2x-1$
  3. $y=-x^2+2x+1$
  4. $y=-x^2+2x-1$



Conclusion

- Line graphs are generated from equations of the form $y=ax+b$.
  - They have a slope (a) and a y-intercept (b).
  - We can construct or identify the graph from these two values.
- Quadratic graphs (parabolas) are generated from equations of the form $y=ax^2+bx+c$.
  - The have a curvature (a) and a y-intercept (c).
  - We can identify the graph from these two values.