**如何在平面直角坐标系上画各种函数**

**简介—平面直角坐标系与它的难点**

在数学的领域内，有一种让人十分疑惑的题型：将函数的图解画在笛卡尔平面上。这种题的难点在于，学生需要在坐标平面上把具体的数值转变为抽象的表示，这需要视角的心理转变。但是这种难点可以轻松克服：只要掌握住固定的方法与技巧，任何题目都是万变不离其宗。

**词汇定义**

斜率（slope）：一个用来描述平面上线条方向的数字，计算方法是垂直变化与水平变化的比率（rise/run）

y轴截距（y-intercept）当x=0的时候y的值

x轴截距（x-intercept）当y=0的时候x的值

二元一次方程（linear equation）：这种方程含有两个未知数x和y，并且含有未知数的项的[次数](https://baike.baidu.com/item/%E6%AC%A1%E6%95%B0/10931262?fromModule=lemma_inlink)都是1（一次）。二元一次方程画出来的图形是一条直线。

* E.g. y = 2x - 4

二次方程（quadratic equation）：这种方程含有两个未知x和y，并且含有数未知数的最高次数是2（二次）。二次方程画出来的图形一条曲线。

* E.g. y = x² + 7x + 6

绝对值方程（absolute value equation）：[绝对值符号](https://baike.baidu.com/item/%E7%BB%9D%E5%AF%B9%E5%80%BC%E7%AC%A6%E5%8F%B7/7805762?fromModule=lemma_inlink)中含有未知数的方程

* E.g. y = | x – 8 |

斜率截距形式（slope-intercept form）：斜率截距形式是一个写二元一次方程的一种格式： y = mx + b，m是斜率，b是y的轴截距

标准形式（standard form）：斜率截距形式是一个写二元一次方程的一种格式：ax + by = c，条件是a > 0和b ≠ 0和a、b ∈ I（a与b都是整数）

**二元一次方程**

所有二元一次方程都可化标准式，否则不为二元一次方程，它却在平面上画函数的基本知识。那么这种方程到底该怎么h画出来呢？

在画方程的图形之前，要明确一点：所有二元一次方程都可以化成ax + by = c的标准式，而a、b是常数且不等于0，不然就会变成一元一次方程或常数。再然后呢，就可以写成斜率截距式：y = mx + b。在画图形时，我们需要用这个公式代入一个坐标系上的点，就是y轴截距，也等于方程内的b值。它也可以理解为一个坐标为（0, y）的点。

例：4x + 2y = -8。首先，第一步是要将它改写为斜率轴截距形式：y=-2x-8。随后，通过分析斜率轴截距的函数，可以推测出斜率是-2。接着将y等于0代进去，找出x的轴截距，就得到了（-4, 0）这个点。两个点能够连成一条线，所以再结合b的点（0, -8），画出的直图形线

**二次方程**

* U形图像的开口朝上或朝下取决于a的正负。如果a>0，开口就朝上，而相反，a < 0，开口就朝下。

接着便是更加复杂一点的一元二次方程。

例：y = x²，这个方便时候就设y = 4，然后将4的值代入，那么x就可以取到2和-2的值。如果y = 9，那么x就可以取到3和-3的值，最后连接所画出来的所有点—不过要注意用曲线—我们就得到了一个形状像U的图（parabola），也是二次方程的图解。

**绝对值方程**

* V形图像的开口朝上或朝下取决于a的正负。如果a > 0，开口就朝上，而相反，a < 0，开口就朝下。

第三种图形就是绝对值方程的图像。绝对值方程往往都是以y = a | x |的形式出现的。想要去画出这种方程，也可以通过代入的方法。

例：y = | x |，代入y = 2，这时x有两种可能性，毕竟解这种方程需要考虑到绝对值的性质，分别就是2和它的相反数。接着，代入y = 4也可以得到x = 4和x = -4。最终，将所有点用直线连接，就得到了一个“V“形状的图像，而这就是绝对值方程的图像。

**练习题**

1. 在做表上画出 7x+12y=42的直线图形。
2. 给定一个方程的斜率是4/5，并且它画出来的线与坐标平面的原点相交，请用斜率轴截距形式写出这个方程并且画在坐标系上。
3. 在坐标系上画出y = 2x²的二次方程。
4. 在坐标系上画出y = 3| x |的绝对值方程。

英译版

**How to draw various functions on a planar Cartesian coordinate system**

**Introduction—The Planar Cartesian Coordinate System and Its Difficulties**

In the field of mathematics, there is a very confusing type of problem: drawing a diagram of a function on a Cartesian plane. The difficulty of this kind of problem is that students need to transform concrete values into abstract representations on the coordinate plane, which requires a psychological change of perspective. But this difficulty can be easily overcome: as long as you master the fixed methods and techniques, any topic will never deviate.

**Definition of terms**

**Slope**: A number used to describe the direction of a line on a plane, calculated as the ratio of vertical change to horizontal change (rise/run)

Y-intercept is the value of y when x=0

X-intercept is the value of x when y=0

**Binary linear equation**: This equation contains two unknowns, x and y, and the term containing the unknowns is 1 (once). The graph drawn by a binary equation is a straight line.

E.g. y = 2x - 4

**Quadratic equation:** This equation contains two unknowns x and y, and the highest order of the number of unknowns is 2 (quadratic). A quadratic equation draws a curve.

E.g. y = x² + 7x + 6

**Absolute Value Equation**: An equation with an unknown number in the absolute value symbol

E.g. y = | x – 8 |

**Slope-intercept form**: The slope intercept form is a form for writing a binary equation: y = mx + b, where m is the slope and b is the axial intercept of y

**Standard form**: The slope intercept form is a form for writing a binary linear equation: ax + by = c, provided that a > 0 and b ≠ 0 and a, b ∈ I (a and b are integers)

**Binary Linear Equations**

All binary linear equations can be normalized, otherwise they are not binary linear equations, but they draw the basic knowledge of functions on a flat surface.

Before drawing the graph of the equation, it is important to be clear: all binary linear equations can be reduced to the standard formula ax + by = c, and a and b are constant and not equal to 0, otherwise they will become unary equations or constants. Then, you can write the slope intercept: y = mx + b. When drawing the graph, we need to use this formula to substitute the point on a coordinate system, which is the y-intercept, which is also equal to the b value in the equation. It can also be understood as a point with coordinates (0, y).

**Example**: 4x + 2y = -8. First of all, the first step is to rewrite it in the form of slope axis intercept: y=-2x-8. Subsequently, by analyzing the function of the slope axis intercept, it can be inferred that the slope is -2. Then, substituting y equal to 0 and finding the axial intercept of x, we get the point (-4, 0). Two points can be connected to form a line, so combine the points of b (0, -8) to draw a straight line

quadratic equation

The opening of the U-shaped image is facing up or down depending on the positive or negative of a. If a>0, the opening will face up, while conversely, a < 0, the opening will face down.

Then there's the more complex **quadratic equation.**

For **example**, if y = x², set y = 4 and then substitute the value of 4 into it, then x can get the values of 2 and -2. If y = 9, then x can take the values of 3 and -3, and finally connect all the points drawn — but be careful to use curves — and we get a diagram shaped like U (parabola), which is also a quadratic equation.

Equation of absolute value

The opening of the V-shaped image is facing up or down depending on the positive or negative of a. If a > 0, the opening will face up, while conversely, a < 0, the opening will face down.

The third type of graph is the image of the **absolute value equation**. Absolute equations tend to start with y = a | x |. If you want to draw this kind of equation, you can also use the method of substitution.

**Example**: y = | x |, substituting y = 2, then x has two possibilities, after all, the solution of this equation needs to take into account the properties of the absolute value, which is 2 and its opposite. Then, substituting y = 4 also gives x = 4 and x = -4. Eventually, by connecting all the points with a straight line, you get an image of a "V" shape, which is the image of the absolute value equation.

**Exercises**

1.Draw a straight line with 7x+12y=42 on the table.

2.Given that the slope of an equation is 4/5 and the line it draws intersects the origin of the coordinate plane, write the equation as the slope axis intercept and plot it on the coordinate system.

3.Plot a quadratic equation of y = 2x² on the coordinate system.

4.Draw y = 3| The absolute value equation for x |.