

The modulus symbol

Introduction

Inequalities often arise in connection with the modulus symbol. This leaflet describes how.

1. The modulus symbol

The modulus symbol is sometimes used in conjunction with inequalities. For example, $|x| < 1$ means all numbers whose actual size, irrespective of sign, is less than 1. This means any value between -1 and 1 . Thus

$$|x| < 1 \quad \text{means} \quad -1 < x < 1$$

Similarly, $|y| > 2$ means all numbers whose actual size, irrespective of sign, is greater than 2. This means any value greater than 2 and any value less than -2 . Thus

$$|y| > 2 \quad \text{means} \quad y > 2 \text{ or } y < -2$$

Example

Solve the inequality $|2x + 1| < 3$.

Solution

This is equivalent to $-3 < 2x + 1 < 3$. We treat both parts of the inequality separately.

First consider

$$-3 < 2x + 1$$

Solving this yields $x > -2$.

Now consider the second part, $2x + 1 < 3$. Solving this yields $x < 1$.

Putting both results together we see that $-2 < x < 1$ is the required solution.

Exercises

In each case solve the given inequality.

1. $|3x| < 1$,
2. $|12y + 2| > 5$,
3. $|1 - y| < 3$.

Answers

1. $-\frac{1}{3} < x < \frac{1}{3}$,
2. $y > \frac{1}{4}$ and $y < -\frac{7}{12}$,
3. $-2 < y < 4$.