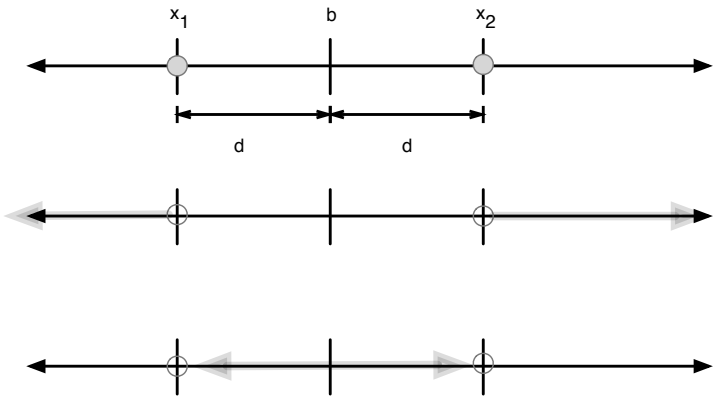
1 Introduction

Absolute value problems involve the operation

$$|a| \tag{1-1}$$

which reads as "the absolute value of a". The absolute value means that the result will be positive whether a is positive or negative.

The three possible problems are shown in the figure.



They can be represented by three expressions

$$|x - b| = d \tag{1-2}$$

$$|x - b| > d \tag{1-3}$$

$$|x - b| < d \tag{1-4}$$

corresponding to the three pictures from top to bottom. b is the midpoint and d is the distance (which is always positive) from the midpoint to either of the numbers x_1 or x_2.

If $b = 0$ then $x_1 = -x_2$. Supposed $x_2 = 1$. We then get the three expressions.

$$|x| = 1 \tag{1-5}$$

$$|x| > 1 \tag{1-6}$$

$$|x| < 1 \tag{1-7}$$

The first says that x can only be 1 or -1. The second says it can be any number > 1 or < -1. The third says it must be between (but not including) 1 and -1.

Given two points, x_1 and x_2 you just have to find the constants b and d. These are found from

$$b = \frac{x_2 + x_1}{2} \tag{1-8}$$

$$d = \frac{x_2 - x_1}{2} \tag{1-9}$$

Note that x_2 is always bigger than x_1.

2 Problems

2.1 Problem 1

Find the three expressions if $x_1 = -4$ and $x_2 = 4$.

2.2 Problem 2

Find the three expressions if $x_1 = -2$ and $x_2 = 4$.