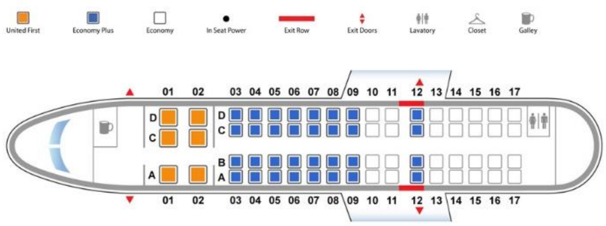
Math 4d. Classwork 7.

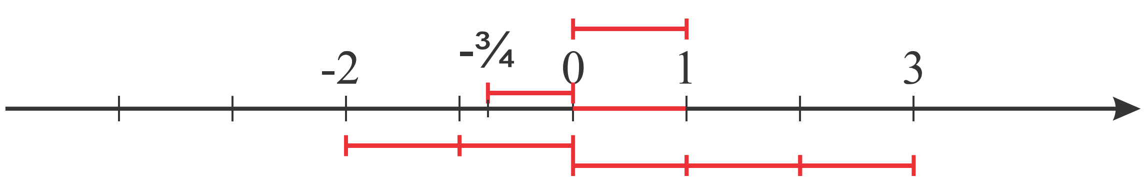
Coordinates.

Coordinates are a set of values that show an exact position of a point in space, on a plane or on a line. How many values do we need to show the exact position of the point on the number line? How many values do we need to find our place in a theater? In a (air)plane? What we can use as values?



On a number line each point represents a number and each number is linked to a point if an origin (point at 0), length of a unit segment, and the positive direction are defined. This number is a coordinate of a point on the line in the defined system: absolute value of this number shows the distance (how many unit segments can be put in) between the point and the origin and the sign shows on which side of the origin this point is located.

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

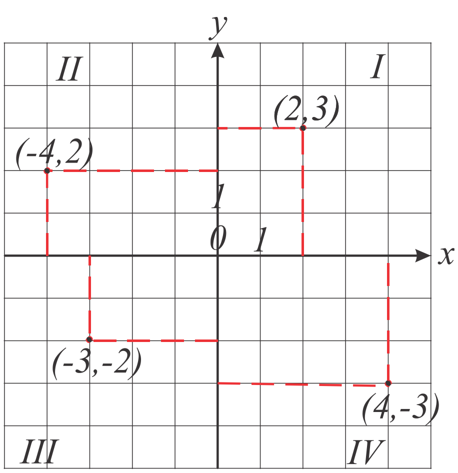


Can we solve the following equation? How many solutions does it have?

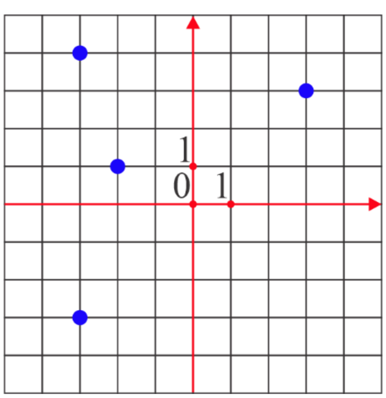
$$|x| = 5$$

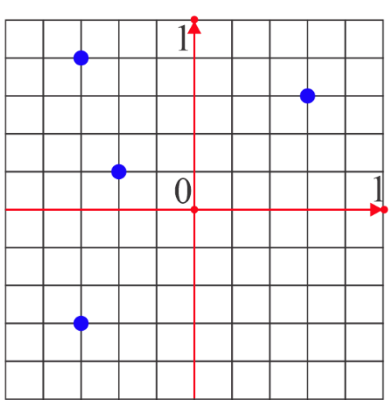
To solve an equation means to find all possible values which will give us a true statement when put into the equation instead of a variable.

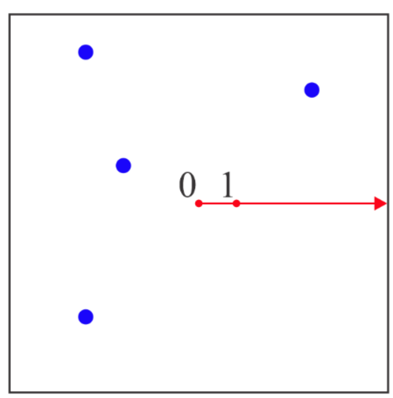
On a plane each point corresponds to a unique ordered pair of numbers. To define this pair for each point 2 perpendicular number line are usually used. These two number lines intersect at the point called origin, associated with pair (0,0), have the same unit segment, and are called axis, usually *x* and *y* axis. The pair of numbers allied with each point of the plane in this particular system of coordinate defined as a distance from the point to both axes, and the signs of these numbers correspond to a quadrant where point is located (quadrants I, II, III, and IV on the picture above). Such pair of numbers is an ordered pair, so the pair (n,m) and the pair (m,n) are linked to 2 different points. Absolute value of the first number in the pair is the distance to the *y* axis and absolute value of the second one is the distance to the *x* axis.



Can you imagine any other algorithm to linked a point in a plane and a pair of numbers?







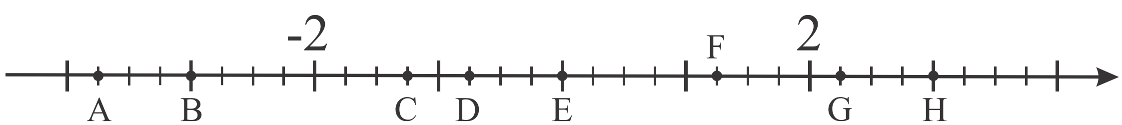
Exercises:

1. What are absolute values of numbers:
   Example: $|-7| = 7$

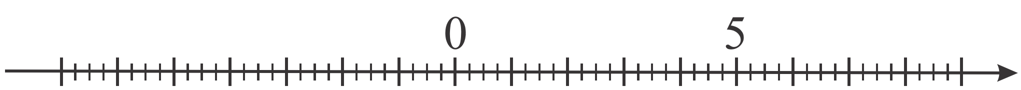
   $|5|$; $|-5|$; $|10|$; $|-10|$; $\left|\frac{1}{2}\right|$; $\left|-\frac{1}{2}\right| =$

   What does absolute value of a number represent?

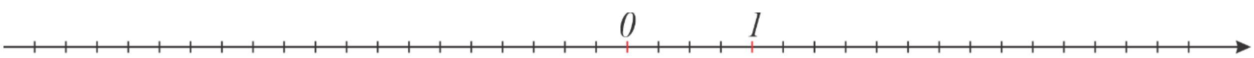
2. Find the coordinates of points A, B, C, D, E, F, G, and H on the number line below:



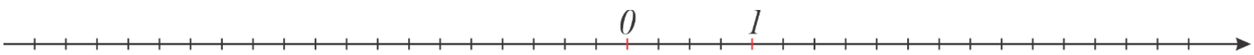
3. Mark the points A(0), B(1), C$\left(-1\frac{1}{2}\right)$, D(5), E(−5), F(−3), G(3)



4. On the line below mark the points with coordinates $2, -2,\ 4, -4,$
   $\frac{3}{4}, -\frac{3}{4};\ \ 2\frac{1}{2};\ \ -\frac{5}{2};\ \ \frac{6}{8};\ \ -\frac{10}{4}$



5. On the line below, mark the points, corresponding to the numbers which absolute values are $1, 3,\ \frac{1}{2},\ 4.$



6. Solve the equations:
   $|x| = 3$ $|y| = 10$ $|z| = -2$

7. Solve the equations:

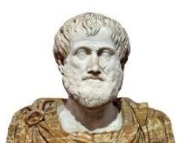
$|x+3| = 10$ $\qquad$ $|z-5| = 11$ $\qquad$ $|5x-1| = 8.1$

8. Compare (replace … with >, <, or =) if possible, if it is known that a and b are positive numbers and x and y are negative numbers:

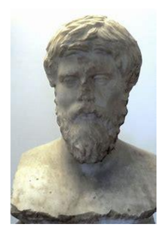
$0 \ \dots \ x$	$a \ \dots \ 0$	$-b \ \dots \ 0$	$0 \ \dots -x$
$a \ \dots \ x$	$y \ \dots \ b$	$-y \ \dots \ x$	$-a \ \dots \ b$
$\|x\| \ \dots \ x$	$-\|y\| \ \dots \ y$	$a \ \dots \ \|a\|$	$\|b\| \ \dots \ \|-b\|$
$\|x\| \ \dots \ a$	$\|x\| \ \dots -x$	$\|x\| \ \dots -\|y\|$	$a \ \dots \ \|-b\|$

9. Ancient Greek scientist Aristotle was born in 384 and died in 322. Another Greek scientist Pythagoras was born in 570 and dies in year 495. Ancient Greek historian Plutarch was born in 46 and died in 120. How among them was born earlier? For how long did they live?

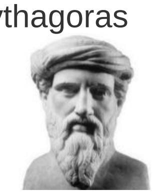
Aristotle



Plutarch



Pythagoras



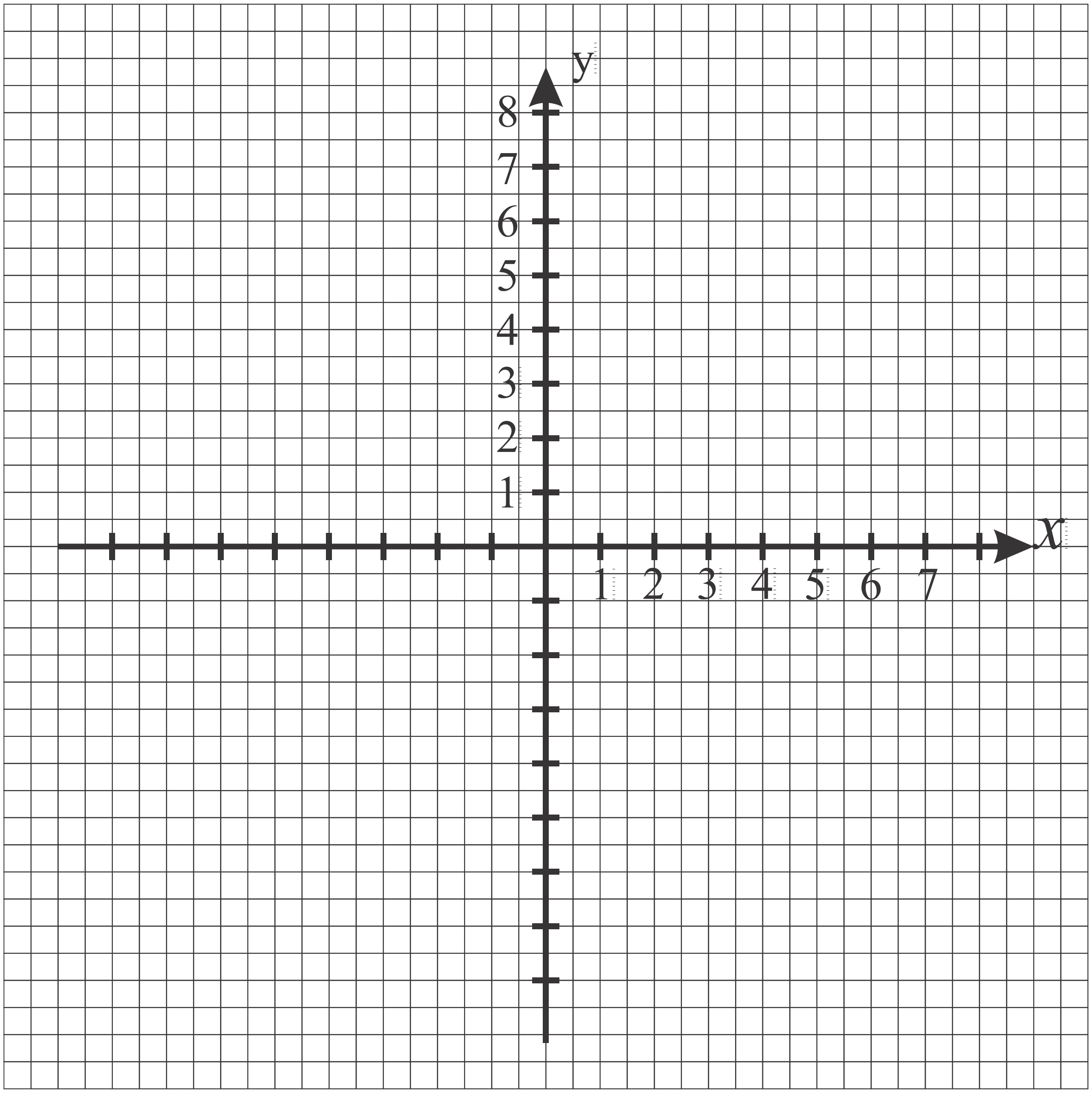
10. Evaluate:

$a.\ \frac{1}{2}\cdot\frac{2}{3}\cdot\frac{3}{4}\cdot\frac{4}{5};$ $\qquad$ $b.\ \frac{6}{7}\cdot\frac{7}{8}\cdot\frac{8}{9}\cdot\frac{9}{10}\cdot\frac{10}{11};$ $\qquad$ $c.\ \frac{1}{2}\cdot\frac{2}{3}\cdot\frac{3}{4}\cdot\dots\cdot\frac{23}{24}\cdot\frac{24}{25}$

$d.\ 1\frac{1}{2}\cdot 1\frac{1}{3}\cdot 1\frac{1}{4}\cdot 1\frac{1}{5};$ $\qquad$ $e.\left(1+\frac{1}{4}\right)\cdot\left(1+\frac{1}{5}\right)\cdot\left(1+\frac{1}{6}\right)\cdot\left(1+\frac{1}{7}\right)\cdot\left(1+\frac{1}{8}\right);$

$f.\ \left(1-\frac{1}{2}\right)\cdot\left(1-\frac{1}{3}\right)\cdot\left(1-\frac{1}{4}\right)\cdot\dots\cdot\left(1-\frac{1}{99}\right)\cdot\left(1-\frac{1}{100}\right);$

11. Using the following coordinates mark the points and connect them:



(1; -4)→(0; -4) → (1; -3) → (1; -6) → (3; -6) → (2; -5) → (3; -1) → (2; 2) → (4; $2\frac{1}{2}$) → (5; 3) → (5; 4) → (3; 4) → (2; 5) → (1; 5) → (0; 6) → (0; 5) → ($-\frac{1}{2}$; 3) → (0; 0) → (-2; -1) → (-3; -4) → (-3; -5) → (-4; -5) → ($-4\frac{1}{2}$; -4) → (-6; -3) → (-5; -5) → (-3; -6) → (1; -6) eye (2; 4).