

Equations of Lines

Sample task from achievethecore.org

Task by Illustrative Mathematics, annotation by Student Achievement Partners

GRADE LEVEL Eighth

IN THE STANDARDS 8.EE.B

WHAT WE LIKE ABOUT THIS TASK

Mathematically:

- Presents an unfamiliar problem that students must make sense of (MP.1)
- Keys directly on the meanings of parameters in a linear equation
- Involves two basic forms for the equation of a line (not just the for $y = mx + b$ but also the form $ax + by = c$)

In the classroom:

- Encourages students to share their developing thinking
- Allows students to use precise mathematical language in their arguments (MP.3, MP.6)

MAKING THE SHIFTS¹



Focus

Belongs to the major work² of eighth grade



Coherence

Builds solid foundations for high school algebra



Rigor³

Conceptual Understanding: primary in this task

Procedural Skill and Fluency: secondary in this task

Application: not targeted in this task

¹For more information read [Shifts for Mathematics](#).

²For more information, see [Focus in Grade Eight](#).

³Tasks will often target only one aspect of rigor.

ADDITIONAL THOUGHTS

This task related directly to the cluster heading 8.EE.B, "Understand the connections between proportional relationships, lines, and linear equations." Specifically, for each 1 unit moved horizontally, a point moving along the line $y = ax + b$ moves a units vertically. Notice how this sentence involves a proportional relationship, a line in the plane, and the equation of that line.

This task in itself doesn't build/rely upon procedural skill with equations of lines in the plane, but tasks of that nature are appropriate in grade 8 as well.

For more insight into the expectations for slope and linear equations in grade 8, read pages 10–12 of the progressions document, *6–8 Expressions and Equations*, available at www.achievethecore.org/progressions.

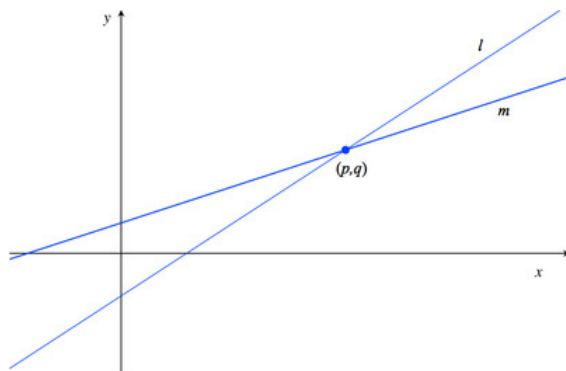
Illustrative Mathematics

8.EE Equations of Lines

Alignment 1: 8.EE.B

Not yet tagged

The figure below shows the lines l and m described by the equations $4x - y = c$ and $y = 2x + d$ respectively, for some constants c and d . They intersect at the point (p, q) .



- How can you interpret c and d in terms of the graphs of the equations above?
- Imagine you place the tip of your pencil at point (p, q) and trace line l out to the point with x -coordinate $p + 2$. Imagine I do the same on line m . How much greater would the y -coordinate of your ending point be than mine?

Commentary

This task requires students to use the fact that on the graph of the linear equation $y = ax + c$ the y -coordinate increases by a when x increases by one. Specific values for c and d were left out intentionally to encourage students to use the above fact as opposed to computing the point of intersection, (p, q) , and then computing respective function values to answer the question.

Solution: Solution

- a. If we put the equation $4x - y = c$ in the form $y = 4x - c$ we see that the graph has slope 4. The slope of the graph of $y = 2x + d$ is 2. So the steeper line, l , is the one with equation $y = 4x - c$ and therefore $-c$ is the y -coordinate of the point where l intersects the y -axis. The other line, m , is the one with equation $y = 2x + d$ so d is the y -coordinate of the point where m intersects the y -axis.
- b. The line l has slope 4. So on l , each increase of one unit in the x -value produces an increase of 4 units in the y -value. Thus an increase of 2 units in the x -value produce an increase of $2 \cdot 4 = 8$ units in the y -value. The line m has slope 2. So on l_2 , each increase of 1 unit in the x -value produces an increase of 2 units in the y -value. Thus an increase of 2 units in the x -value produces an increase of $2 \cdot 2 = 4$ units in the y -value. Thus your y -value would be $8 - 4 = 4$ units larger than my y -value.



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