Session 2.3

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Notes to keep in mind

Make sure you have these things in your notes, because I will refer to them with the expectation that you have learned, memorized, or written them down.

1. Slope definition: $slope = \dfrac{rise}{run} = \dfrac{y_2 - y_1}{x_2 - x_1}$
2. Slope-intercept form is $y = mx + b$ (m is the slope and b is the y-intercept)
3. Two lines are **parallel** if they have the same slope
4. Points are **collinear** if they lie on the same line. *Note:* it is sufficient to check slopes between all the points are equal (think about it!).
5. Two lines are **perpendicular** if the slope of one is the negative inverse of the other.
   (a) Slopes are m_1 and m_2 and $m_1 = -\dfrac{1}{m_2}$
   (b) The y-intercepts don't matter — only the slopes matter
   (c) Draw it out and see why it makes sense!

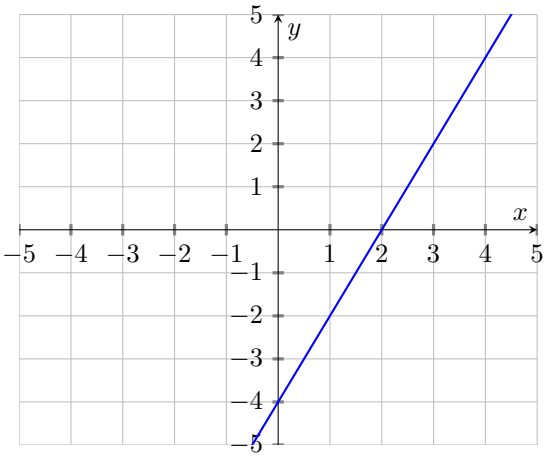
Main problems

1. Find the (x, y) point on each line for the specified variable value of x.
   (a) $y = -x - 6$ where $x = -3$
   (b) $y = |x - 1331/4|$ where $x = 0$
   (c) $y = |x + 4|$ where $x = -5$
   (d) $y = |x - 5| + 7$ where $x = -5$
   (e) $y = x^2 + x - 6$ where $x = -3$
   (f) $y = (x - 13)(x + 2)(x + 7)$ where $x = -2$
2. For each set of three points say whether or not they're on the same line, and prove it.
   (a) $(-1, -2), (1, 2)$, and $(3, 6)$
   (b) $(5, 8), (7, 11)$, and $(10, 13)$
   (c) $(0, 2), (3, -10)$, and $(4, -14)$
   (d) $(2, 1), (6, 9)$, and $(9, 12)$
3. For each line, write two line equations of one that is parallel, and one that is perpendicular
   (a) $y = 2x - 6$
   (b) $y = -x - 6$
   (c) $y = \dfrac{3}{2}x - 2$
   (d) $y = -\dfrac{2}{3}x + 2$
   (e) $y = \dfrac{7}{6}x - \dfrac{3}{2}$
4. Find the slope of a line that passes through $(2, 5)$ and $(4, 9)$
5. Is the line through $(0, 1)$ and $(5, -3)$ parallel to the line $y = -\dfrac{4}{5}x + 3$? Explain.

6. Are the points $(-2, 7)$, $(5, -3)$, and $(14, 22)$ collinear (a.k.a. on the same line)? Explain.
7. Determine the point at which $y = -6x + 4$ crosses the x-axis
8. Write an equation in slope-intercept form that describes the values in the table:

x	3	2	1	-1	-3
y	-14	-11	-8	-2	4

9. Find the y-intercept of a line that has slope 2 and passes through $(6, 14)$.
10. Find the value of p so that the line through $(-4, 7)$ and $(12, p)$ is parallel to the line $y = 4x - 6$.
11. Find an equation of the line through the point $(-6, 3)$ that is perpendicular to the line $x = -2$
12. Write the equation $y = \dfrac{\frac{1}{3}x + 1}{12}$ in general linear form $Ax + By = C$, where A, B, and C are **integers**.
13. Find the slope and y-intercept and write an equation of the line



14. Denote all possible values of x. Use a number line if you find it more convenient

(a) $|x| \leq 3$
(b) $\left|\dfrac{x}{3}\right| \geq 4$
(c) $|3x| \leq 6$
(d) $|x - 3| \leq 5$
(e) $|x + 3| \geq 2$
(f) $|x - 2| + 3 \leq 3$

15. Plot each of these equations on the same graph. *Extra:* find the (x, y) point that satisfies both equations.

(a) $\begin{cases} 4x + y = 8 \\ 5x + 2y = 13 \end{cases}$
(b) $\begin{cases} 2x + 2y = 6 \\ -x + 2y = 12 \end{cases}$
(c) $\begin{cases} 2x + 4y = 5 \\ x + 2y = 8 \end{cases}$
(d) $\begin{cases} 2x + 2y = 4 \\ -3x + 5y = 6 \end{cases}$
(e) $\begin{cases} 10x + 7y = 49 \\ 10y - x = 70 \end{cases}$
(f) $\begin{cases} 2x + 9y = 0 \\ 3x + 5y = 17 \end{cases}$

More problems

1. Work on the algebra questions from: http://www.ilmathcontest.com/hs/Questions/Reg/R16AA.pdf
2. More problems from 2015: http://www.ilmathcontest.com/hs/Questions/Reg/R15AA.pdf