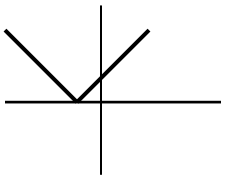
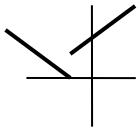
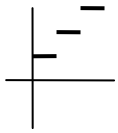
M^2=Math Mediator Lesson 15: Graphing Inequalities

Total Recall (Warm-up) (5 minutes approx.)	Total Recall: Exercises from yesterday's lesson on special functions. Name the following functions:    1. 2. 3. A: 1. Abs. Value; 2. Piece-wise; 3. Step Function. 4. Find f(x) for the following values in this function: $f(x) = \begin{cases} 2x+1 & x < 2 \\ (1/2)x - 2 & x \geq 2 \end{cases}$ Find f(2); f(1) and f(6)? A: f(2) = -1; f(1) = 3; f(6) = 1
Direct Instruction (15 minutes approx.)	In a previous lesson, we discussed single variable inequalities and graphed them on a number line. The inequality involved a single variable 'x', and the variable was part of an expression which related to cost of a driveway project or temperature or elevation. Today's lesson involves adding a second variable and graphing the solution of the two variable inequality. Digital pictures have now become more common than photographic film pictures. Many cameras and cell phones offer the ability to capture good quality images using large amounts of memory, or grainier or fuzzy, less quality images using a smaller amount of memory. Depending on the picture, memory size and other pictures you want to store, you can select the quality and memory size of your photo. Some typical choices are: SHQ: Super High Quality: 1280 x 960 pixels or about 1.2 MB per photo HQ: High Quality: 1024 x 768 pixels or about 0.8 MB per photo SQ: Standard Quality: 640 x 480 pixels or about 0.3 MB per photo One size of memory card that you can purchase is a 32 MB card. It might be useful to plan out how many pictures can fit onto this size of memory card, and which types; SHQ, HQ, and SQ. First, lets just analyze taking two types of pictures, best and least or SHQ and SQ. We will set variables for them and create an inequality and plot the various answers. For each SHQ photo, 1.2 MB is used, so using 'x' for SHQ photos; 1.2x is the amount of memory used for 'x' number of SHQ photos. For each SQ photo, 0.3 MB is used, and we will use 'y' for SQ photos; so for every SQ photo, 0.3y MB of memory is used. $1.2x + 0.3y \leq 32$ is the inequality, describing the photos we can fit on a 32 MB memory card. Larger memory cards are available, but cost more. Solving the inequality $1.2x + 0.3y \leq 32$ for y, it is: **$y \leq -4x + 106$** which we

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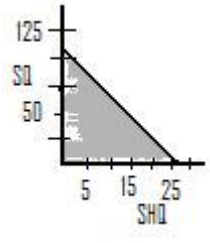
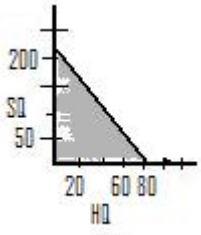
<tr><td></td><td> 

can plot to be: Where the shaded region is the various solutions to the inequality and the line is the boundary. In this case, the line is solid, meaning that solutions can be found on the line itself because the inequality contained the less than or equal to sign. For all SQ photos, the solution is 32 divided by 0.3 equals 106 photos, and this is the y-intercept. For all SHQ photos, the solution is 32 divided by 1.2 or 26 photos. Various combinations of both photos that would fit on the 32 MB memory card lie on and below the line. For 60 SQ photos taken, how many SHQ photos would fit on the 32 MB card? Answer: Substitute 60 for y: $60 \leq -4x + 106$ and solve for ‘x’. $x \leq$ 11.</td></tr>
<tr><td>Review and practice (15 minutes approx.)</td><td>U-DO: Create an inequality and graph the line for HQ and SQ photos, however this time planning for the use of a 64 MB card. Then solve the number of HQ photos that can be placed on the 64 MB card if 80 SQ photos are stored also.

Step 1: Find inequality: $0.8x + 0.3y \leq 64$ $y \leq -2.67x + 213.3$

Step 2: Graph the boundary line: $y = -2.67x + 213.3$; use a solid line for $\leq$ or $\geq$ and use a dashed line for $<$ or $>$. In this case it is solid for $\leq$.

Step 3: Select a point above or below the line to test for shading. If the test point makes the inequality true, that is the region shaded. If the test point makes the inequality false, then the region shaded is on the other side of the line.

For the number of HQ if 80 SQ are used: $x \leq 49$.</td></tr>
<tr><td>Practice (15 minutes approx.)</td><td>Graph the following inequalities:

1. $x < 3$ (A: notice there is no y value, therefore, y is unrestricted or all.)
2. $y \geq 2$ (A: here, all x values are possible, with y of 2 or greater)
3. $y > (1/2)x + 4$ (A: slope is +1/2; y-intercept is 4, dashed line)
4. $3x - y \geq 1$ (A: slope is +3; y-intercept is -1; solid line)
5. $y < | x + 1 |$ (A: either the value within the absolute value marks is positive or it is negative. Then you have to analyze both situations. First is $y < x + 1$; and the second is $y < -(x + 1)$.)
6. $y \geq -2 | x + 2 | + 3$ (A: Same as number 5, two situations need to be analyzed because of the absolute value. The first is that the quantity</td></tr>
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	under the absolute value is positive, the second is negative. a. First: $y \geq -2(x + 2) + 3$ or $y \geq -2x - 1$ b. Second: $y \geq -2(-x - 2) + 3$ or $y \geq -2x + 7$
Wrap-up and homework assignment (5 minutes approx.)	Wrap up closing comments and housekeeping.