Day 1 Plumbing Challenges

Fraction Counting Warm-ups

- Work with a partner.

- Take turns being the pointer and the counter.

- The first counter should start counting by halves slowly. As the counter says each number, the pointer should point at the corresponding mark on the ruler using a pencil. The counter should agree with the pointer before continuing to the next number.

- To count by halves, start by saying $\frac{0}{2}, \frac{1}{2}, \frac{2}{2}, \frac{3}{2}$, and so on. Continue up to the 6 inch mark.

- Now switch roles. The new counter should do the same thing except that instead of counting by halves using improper fractions, use mixed numbers instead.

- Start by counting $0, \frac{1}{2}, 1, 1\frac{1}{2}, 2, 2\frac{1}{2}$, and so on. Continue up to the 6 inch mark.

- Switch roles again. The new counter should now count by fourths using improper fractions.

- Start by saying $\frac{0}{4}, \frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{4}{4}, \frac{5}{4}$, and so on. Continue up to the 4 inch mark.

- Switch roles again. The new counter should count by fourths using mixed numbers instead of improper fractions.

- Start by counting $0, \frac{1}{4}, \frac{2}{4}, \frac{3}{4}, 1, 1\frac{1}{4}, 1\frac{2}{4}$, and so on. Continue up to the 4 inch mark.

- Switch roles. Count by eighths using improper fractions up to 2.

- Switch roles one last time. Count by eighths using mixed numbers up to 2.

Adding and Subtracting Fractions on a Ruler

For the following challenges, do not do any work with a paper and pencil. Talk with your partner to see if you can discover a way to work out each problem using only the ruler to do the computation. Record your answer to each problem.

1. $3\frac{1}{2} + 2\frac{1}{2} =$

2. $7\frac{1}{2} - 1\frac{1}{2} =$

3. $4\frac{1}{4} + 5\frac{1}{4} =$

4. $3\frac{1}{4} + 2\frac{1}{2} =$

5. $5\frac{3}{4} + 1\frac{1}{2} =$

6. $6\frac{3}{4} + \frac{3}{4} =$

7. $8\frac{1}{2} - 3\frac{1}{4} =$

8. $9\frac{3}{4} - 2\frac{1}{4} =$

9. $11\frac{3}{4} - 5\frac{1}{2} =$

10. $6\frac{1}{4} - 3\frac{1}{2} =$

11. $8\frac{1}{4} - 2\frac{3}{4} =$

12. $5\frac{1}{2} - \frac{3}{4} =$

13. $2\frac{1}{2} + 1\frac{1}{8} =$

14. $3\frac{1}{4} + 4\frac{3}{8} =$

15. $5\frac{1}{8} + 3\frac{3}{4} =$

16. $7\frac{5}{8} + 2\frac{3}{4} =$

17. $8\frac{3}{8} - 2\frac{5}{8} =$

18. $6\frac{1}{4} - 4\frac{7}{8} =$

19. $9\frac{1}{8} - 5\frac{1}{2} =$

20. $10\frac{3}{4} - 5\frac{3}{8} =$

Determining Take-offs

To complete the blueprint challenges on the following pages, you will need to determine the take-offs that correspond to different fittings. Whenever a fitting is attached to the end of a pipe it adds a small amount to the overall length of the pipe. When following a blueprint, it is often necessary to "take off" a small amount from the measurements shown so that the pipes will be the correct length after the fittings are attached.

1. Begin by measuring the length of a small piece (between 6 and 12 inches) of PVC pipe. Record the length to the nearest 1/16 of an inch.

2. Now attach a 90 degree fitting to the end of the pipe and attach another pipe to the fitting (but make sure you keep track of which pipe you already measured). Push the pipes into the fitting as much as possible.

3. Find the place on the fitting where the center line of one pipe intersects the center line of the other pipe. Measure from this point to the end of the pipe you measured before. Record this length to the nearest 1/16 of an inch. Subtract to determine the difference between the two values. This tells you the value of the take-off for a 90 degree fitting. Whenever you see a 90 degree angle on the blueprint, you will need to subtract this value from the length of the attached pipes.

   Take-off for 90° fittings:

4. Repeat the procedure above for the 45 degree fitting. (The 45 degree fitting actually makes a 135 degree angle, but plumbers call it a 45 degree fitting because it diverts the flow of water by 45 degrees relative to flowing in a straight line.)

   Take-off for 45° fittings:

5. Repeat the procedure above once more for the T fitting.

   Take-off for T fittings:

Blueprint Challenges

Now you are ready to build the designs shown on the following pages. Once you have completed each challenge, we will check whether you were accurate enough by placing the model onto an outline of the model drawn on posterboard. If your measurements are not precise enough, the model will not fit and you will need to make adjustments.

Remember to consider the take-offs for the pipes before you start cutting. If a pipe has a fitting attached to both ends, you will need to account for both take-offs to find the length that you should cut the pipe.
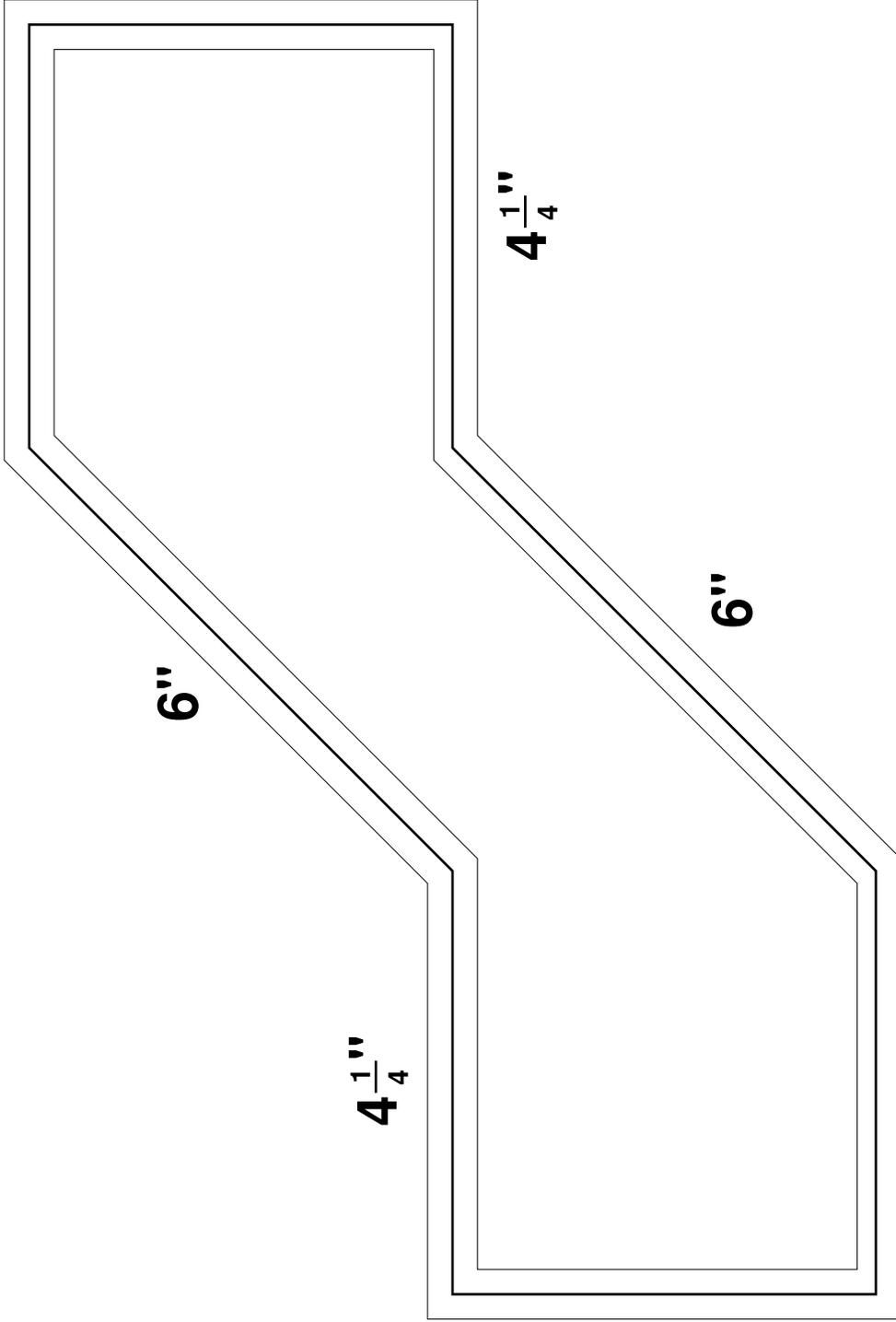
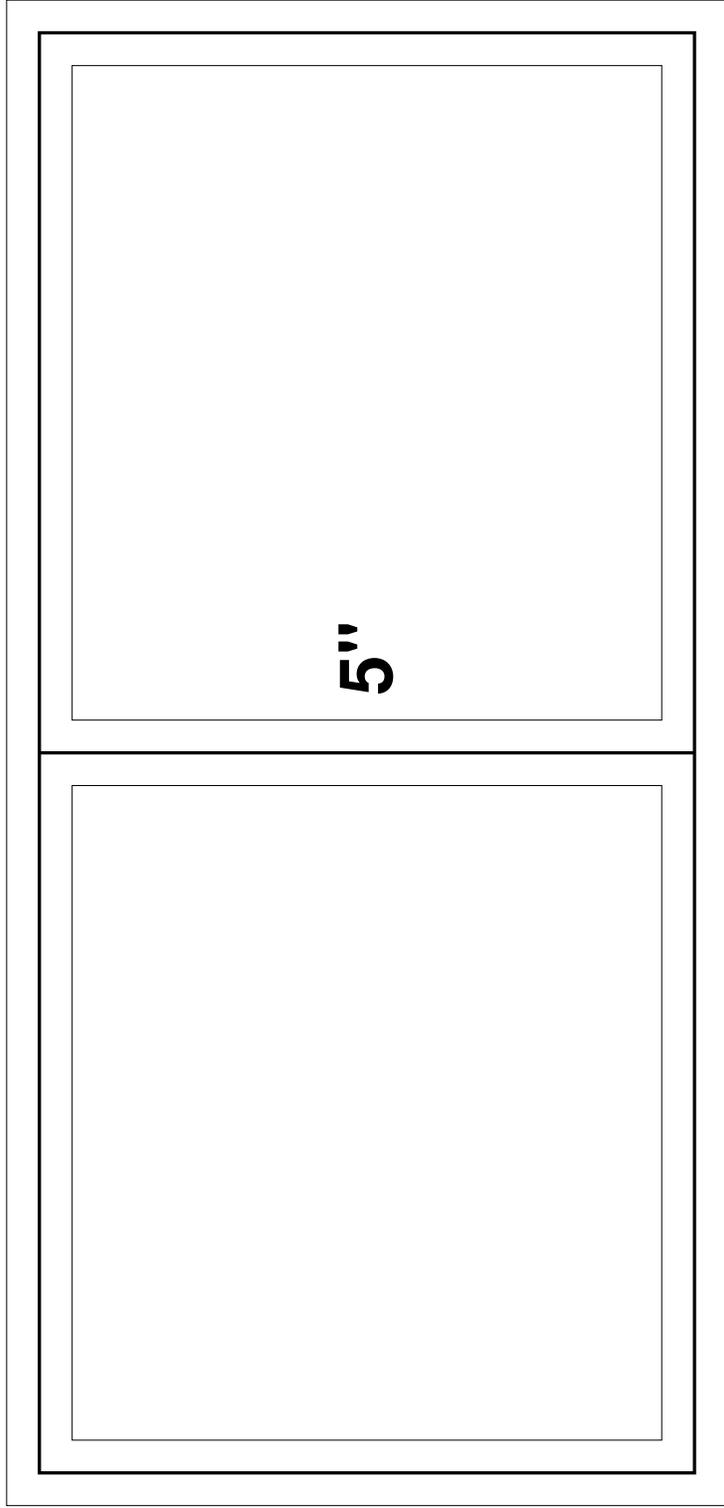$6\frac{1}{2}''$

$7\frac{1}{4}''$

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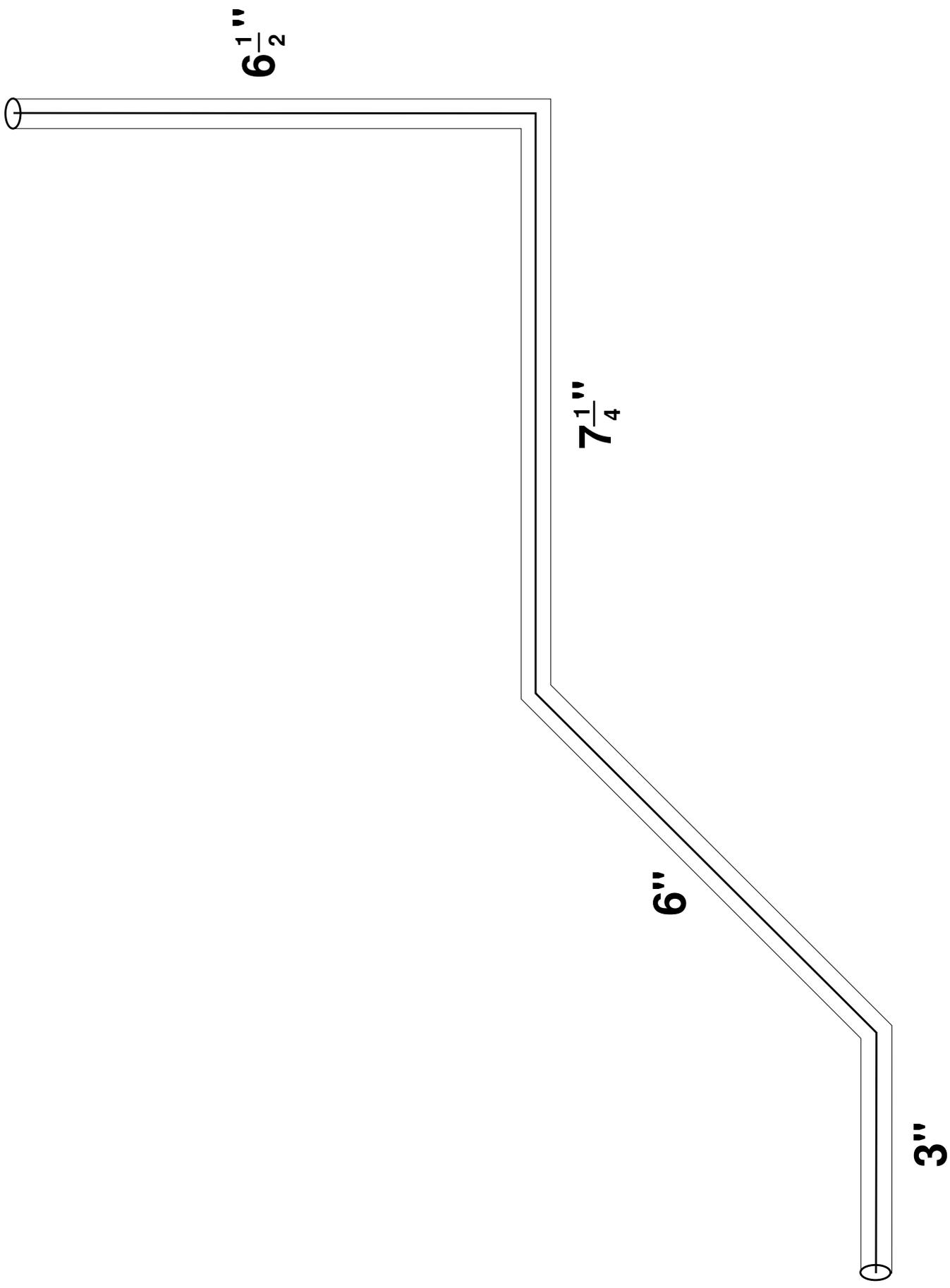
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