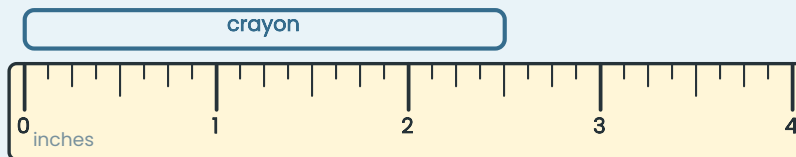


Winter Logic & Measurement: The Frost Valley Math Lab

6 complete activities from Winter Logic & Measurement, each with a worked answer.



Unit	Equals
1 ft	12 in
1 m	100 cm
1 lb	16 oz

HOW TO USE

1. Read the situation and the evidence first.
2. Show your thinking in the work boxes, not only an answer.
3. Explain how you know your answer makes sense.
4. Try the new problem at the bottom of the page.

6 activities • 3 answer pages • From the 16-activity collection

10 US Letter pages • Print at 100% / Actual Size

Original Bobotemp educational printable • Fictional names, places and prices

Reading the Weather Board

Name _____ Date _____

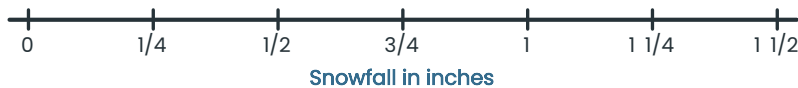
LEVEL 1



Build a line plot marked in fourths. Then add the data.

A weather helper in the fictional town of Frost Valley recorded the snowfall each day for one week. Use the number line from 0 to $1\frac{1}{2}$ inches, marked in fourths. Put one X above the line for each day. Then find the total snowfall for the week.

SNOWFALL (IN)



EVIDENCE TO USE

- Fictional data. Unit: inches.
- Days 1-7: $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{1}{2}$, 1 , $\frac{1}{4}$, 0 , $\frac{1}{4}$
- Mark the number line every $\frac{1}{4}$ inch.

1. Mark 7 Xs above the printed number line, one for each day.

[illegible]

2. Rewrite each amount in fourths and add.

[illegible]

3. Write the total as a mixed number in simplest form.

TRY IT • What is the difference between the greatest and the least daily snowfall this week?

Name _____ Date _____

LEVEL 2 ●●○

Build a ratio table. Multiply both quantities by the same number.

The fair's warm-drink table uses a sample recipe card: 3 scoops of drink mix for every 2 cups of water. Volunteers plan to fill a pitcher with 10 cups of water. Build a ratio table to find how many scoops keep the same ratio. Grade 6 Stretch: find the unit rate in scoops per cup.

RATIO TABLE

Cups of water	2				10
Scoops of mix	3				?

EVIDENCE TO USE

- Recipe card: 3 scoops per 2 cups of water
- Pitcher: 10 cups of water
- Keep the ratio the same.

1. Complete a ratio table from 2 cups to 10 cups.

[illegible]

2. Write the number of scoops for 10 cups.

A blank sheet of graph paper with a grid pattern. The grid consists of 10 columns and 10 rows of squares. The paper has rounded corners and a light gray background.

3. Show that your new ratio is equivalent to 3 : 2.

TRY IT • A bigger batch uses 24 scoops of drink mix. How many cups of water keep the same ratio?

Name _____ Date _____

Who Measured What?

LEVEL 2 ●●○

Use a 3x3 logic grid. Mark X for 'no' and O for 'yes.' Use only the clues.

Amara, Diego, and Keiko each read one snow gauge at the Frost Valley weather station. The three readings were $\frac{1}{2}$ inch, $\frac{3}{4}$ inch, and $1\frac{1}{4}$ inches. Each student read a different gauge. Use the clues and a 3x3 logic grid to match each student to a reading.

LOGIC GRID: X = NO, O = YES

	$\frac{1}{2}$ in	$\frac{3}{4}$ in	$1\frac{1}{4}$ in
Amara			
Diego			
Keiko			

EVIDENCE TO USE

- Readings: $\frac{1}{2}$ in, $\frac{3}{4}$ in, $1\frac{1}{4}$ in
- Clue 1: Diego's reading was greater than Keiko's.
- Clue 2: Amara's and Keiko's readings add up to exactly $1\frac{1}{4}$ inches.
- Clue 3: Amara's reading was not $\frac{3}{4}$ inch.

1. Find which two readings add up to $1\frac{1}{4}$ inches.

2. Fill in the grid and record which clue you used for each mark.

3. Check that your answer fits all three clues.

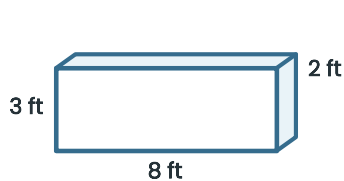
TRY IT • What if Clue 3 were removed? List every arrangement that still fits Clues 1 and 2.

Name _____ Date _____

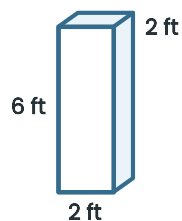
Find the volume of each part. Add the volumes. Then divide by the volume of one box.

Students plan a cardboard-box fort for the fair. It has two parts that sit side by side without overlapping: a wall that is 8 ft long, 2 ft thick, and 3 ft tall, and a tower with a 2 ft by 2 ft base that is 6 ft tall. Each box measures 2 ft by 1 ft by 1 ft. The class already has 15 boxes. How many more boxes do they need?

DRAWN TO ONE SCALE. THE PARTS DO NOT OVERLAP, AND THE BOXES FIT WITH NO GAPS. BOXES ON HAND: 15



wall



tower



one box

1. Find the volume of the wall and of the tower.

2. Find the total number of boxes the fort needs.

[illegible]

3. Find how many more boxes the class needs.

TRY IT • What if the tower is only 4 ft tall? How many boxes would the whole fort need?

Map Route Planner

1. Reading the Weather Board

LEVEL 1

Day 6 had the greatest daily range: $22 - 6 = 16$ degrees F.

WORKED REASONING • Subtract the low from the high for each day. Day 1: $28 - 15 = 13$. Day 2: $31 - 20 = 11$. Day 3: $25 - 12 = 13$. Day 4: $34 - 25 = 9$. Day 5: $30 - 18 = 12$. Day 6: $22 - 6 = 16$. Day 7: $26 - 14 = 12$. The greatest range is 16 degrees, on Day 6. Check: Day 6 had by far the lowest low (6°F), so a large range makes sense even though Day 6 also had the lowest high.

WATCH FOR • Students may pick the day with the highest high (Day 4) instead of the greatest difference. Day 4 actually has the smallest range, 9 degrees, because its low was also high.

TRANSFER • The low was 17°F , because $29 - 12 = 17$.

2. Fraction Snow Gauge

LEVEL 1

The weekly total is $3 \frac{1}{2}$ inches of snow.

WORKED REASONING • Rewrite each amount in fourths: $\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{2}{4}, \frac{5}{4}, \frac{0}{4}, \frac{1}{4}$. Add the numerators: $1 + 2 + 3 + 2 + 5 + 0 + 1 = 14$. The total is $\frac{14}{4}$ inches, and $\frac{14}{4} = 3 \frac{2}{4} = 3 \frac{1}{2}$ inches. The line plot has 1 X at 0, 2 Xs at $\frac{1}{4}$, 2 Xs at $\frac{1}{2}$, 1 X at $\frac{3}{4}$, and 1 X at $1 \frac{1}{4}$, for 7 Xs in all. Check: about $\frac{1}{2}$ inch a day for 7 days is about $3 \frac{1}{2}$ inches, so the total is reasonable.

WATCH FOR • A common error is adding numerators and denominators, such as $\frac{1}{4} + \frac{1}{2} = \frac{2}{6}$. The denominator names the size of the pieces, so rewrite every amount in fourths and add only the numerators.

TRANSFER • The difference is $1 \frac{1}{4}$ inches, because $1 \frac{1}{4} - 0 = 1 \frac{1}{4}$.

6. Recipe Scaling Kitchen

LEVEL 2

Use 15 scoops of drink mix for 10 cups of water.

WORKED REASONING • Ratio table: 2 cups → 3 scoops, 4 cups → 6 scoops, 6 cups → 9 scoops, 8 cups → 12 scoops, 10 cups → 15 scoops. Another way: $10 \div 2 = 5$ batches, and $5 \times 3 = 15$ scoops. Grade 6 unit rate: $3 \div 2 = 1 \frac{1}{2}$ scoops per cup, and $10 \times 1 \frac{1}{2} = 15$ scoops. Check: 15 : 10 simplifies to 3 : 2, the same ratio.

WATCH FOR • Adding the same amount to both quantities ($2 + 8 = 10$ cups, so $3 + 8 = 11$ scoops) changes the ratio. Equivalent ratios come from multiplying both quantities by the same number.

TRANSFER • 16 cups of water. $24 \div 3 = 8$ batches, and $8 \times 2 = 16$ cups.

7. Who Measured What?

LEVEL 2

Amara $\frac{1}{2}$ | Diego $1 \frac{1}{4}$ | Keiko $\frac{3}{4}$: Amara read $\frac{1}{2}$ inch, Diego read $1 \frac{1}{4}$ inches, and Keiko read $\frac{3}{4}$ inch.

WORKED REASONING • Clue 2: the pair sums are $\frac{1}{2} + \frac{3}{4} = 1 \frac{1}{4}$, $\frac{1}{2} + 1 \frac{1}{4} = 1 \frac{3}{4}$, and $\frac{3}{4} + 1 \frac{1}{4} = 2$. Only $\frac{1}{2}$ and $\frac{3}{4}$ work, so Amara and Keiko have those two readings, and Diego has $1 \frac{1}{4}$. Clue 3: Amara's reading was not $\frac{3}{4}$ inch, so Amara read $\frac{1}{2}$ and Keiko read $\frac{3}{4}$. Clue 1 check: Diego's $1 \frac{1}{4}$ is greater than Keiko's $\frac{3}{4}$, which is true. Only one arrangement fits all three clues.

WATCH FOR • Some students mark Diego as the greatest reading after Clue 1 alone. Clue 1 only compares Diego and Keiko, so Amara could still have the greatest reading. Wait for more clues before making a final mark.

TRANSFER • Two arrangements fit: Amara $\frac{1}{2}$, Diego $1 \frac{1}{4}$, Keiko $\frac{3}{4}$; and Amara $\frac{3}{4}$, Diego $1 \frac{1}{4}$, Keiko $\frac{1}{2}$. Without Clue 3, the puzzle would not have exactly one solution.

11. Block Fort Blueprint

LEVEL 3

The fort needs 36 boxes in all, so the class needs 21 more boxes.

WORKED REASONING • Wall: $V = 8 \times 2 \times 3 = 48$ cubic ft. Tower: $V = B \times h = (2 \times 2) \times 6 = 24$ cubic ft. Total: $48 + 24 = 72$ cubic ft. One box: $2 \times 1 \times 1 = 2$ cubic ft. Boxes needed: $72 \div 2 = 36$. Still needed: $36 - 15 = 21$ boxes. Check: $36 \text{ boxes} \times 2 \text{ cubic ft} = 72 \text{ cubic ft}$.

WATCH FOR • Forgetting to add the tower, or dividing a length instead of a volume, gives the wrong count. Find the total volume first, then divide by the volume of one box.

TRANSFER • The fort would need 32 boxes. The tower would be $2 \times 2 \times 4 = 16$ cubic ft, the total would be $48 + 16 = 64$ cubic ft, and $64 \div 2 = 32$.

12. Map Route Planner

LEVEL 3

The route is 16 grid units, which takes 96 minutes (1 hour 36 minutes), so the group arrives at 12:06 p.m.

WORKED REASONING • Leg 1: $(2, 1)$ to $(2, 7)$ is $7 - 1 = 6$ units. Leg 2: $(2, 7)$ to $(9, 7)$ is $9 - 2 = 7$ units. Leg 3: $(9, 7)$ to $(9, 4)$ is $7 - 4 = 3$ units. Total: $6 + 7 + 3 = 16$ units. Time: $16 \times 6 = 96$ minutes = 1 hour 36 minutes. 10:30 a.m. + 1 hour = 11:30 a.m.; + 30 minutes = 12:00 noon; + 6 minutes = 12:06 p.m.

WATCH FOR • Comparing only the start point $(2, 1)$ and the end point $(9, 4)$ gives $7 + 3 = 10$ units, which ignores the route the group actually walks. Add the length of every leg.

TRANSFER • It saves 36 minutes. The new route is $7 + 3 = 10$ units, which takes $10 \times 6 = 60$ minutes, and $96 - 60 = 36$.