Questions

1. The scale on a map is $\frac{3}{4}$ inch to 15 miles. If the distance between two cities on the map is 5.5 inches, how far apart are the two cities?

2. A recipe calls for $\frac{3}{4}$ cup of molasses. If the recipe is for 8 people, how many cups of molasses would you need if you expanded the recipe to be for 12 people?

3. Alfonse Elric and Winry Rockbell are traveling in Mexico. They know a speed of 100 kph is approximately the same as 62 mph. If the road they are traveling on has a speed limit of 90 kph, how many mph is the is the speed limit?

4. Jake is 6 feet tall, and notices that he casts a shadow of 8 feet. At the same time, the new public scuplture of the part casts a shadow of 23 feet. How tall is the sculpture?

5. It takes a person using a large lawn mower 4 hours to mow all the grass in the park. A person using the small mower takes 5 hours to mow all the lawns. How long would it take two people using these two mowers together to mow the all the grass in the park?

6. A tropical fish company has two employees, Juan and Chet, who alternate cleaning the fish tanks each week. Juan takes 5 hours to clean the tanks, but Chet takes 7 hours since he doesn't has as much experience as Juan. For a special promotional sale, the boss (Hugo) wants all the tanks cleaned Saturday morning just before the store opens. If Juan and Chet work together, how long will it take them to clean the tanks?

7. The carbon:hydrogen ratio in naphthalene is 5:4. If a sample of naphthalene has 12345 carbon atoms, how many hydrogen atoms does it have?

Solutions

1. Use $\frac{3}{4} = 0.75$ inches. Let x be the unknown distance (in miles) between the two cities.

$$\begin{aligned}
\frac{\text{map measurement in inches}}{\text{actual distance in miles}} &= \frac{\text{second map measurement in inches}}{\text{second actual distance in miles}} \\
\frac{0.75 \cancel{\text{inch}}}{15 \cancel{\text{miles}}} &= \frac{5.5 \cancel{\text{inch}}}{x \cancel{\text{miles}}} \text{ Solve for x. Note Units cancel.} \\
\frac{0.75}{15} &= \frac{5.5}{x} \\
x &= \frac{5.5 \cdot 15}{0.75} = 110
\end{aligned}$$

The distance between the two cities is 110 miles.

2. Let x be the amount of molasses you need if the recipe is expanded to feed 12 people.

$$\begin{aligned}
\frac{\text{initial amount of molasses}}{\text{initial number of people}} &= \frac{\text{new amount of molasses}}{\text{new number of people}} \\
\frac{\frac{3}{4}\text{ cups}}{8\text{ people}} &= \frac{x\text{ cups}}{12\text{ people}} \\
\frac{\left(\frac{3}{4}\right)}{8} &= \frac{x}{12} \\
x &= \frac{\frac{3}{4} \cdot 12}{8} = \frac{9}{8} = 1\frac{1}{8}
\end{aligned}$$

To expand the recipe for 12 people you will need $1\frac{1}{8}$ cups of molasses.

3. Let x be the speed in mph corresponding to 100 kph.

$$\begin{aligned}
\frac{62\text{mph}}{100\text{kph}} &= \frac{x\text{mph}}{90\text{kph}} \\
\frac{62}{100} &= \frac{x}{90} \\
x &= \frac{62 \cdot 90}{100} = 55.8
\end{aligned}$$

The speed limit on the road is $55.8 \sim 56$ mph.

4. This is a similar triangle problem. Let x be the height of the sculpture.

$$\begin{aligned}
\frac{\text{Jake's height}}{\text{Length of Jake's Shadow}} &= \frac{\text{Sculpture's height}}{\text{Length of Sculpture's shadow}} \\
\frac{6\text{ft}}{8\text{ft}} &= \frac{x\text{ft}}{23\text{ft}} \\
\frac{6}{8} &= \frac{x}{23} \\
x &= \frac{6 \cdot 23}{8} = 17.25
\end{aligned}$$

The height of the sculpture is $17.25 \sim 17$ ft.

5. One person with large mower takes 4 hrs to do mowing. In one hour they complete $\frac{1}{4}$ of the job.

Second person with small mower takes 5 hrs to do the mowing. In one hour they complete $\frac{1}{5}$ of the job.

Working together, the job will take x hrs. In one hour they complete $\frac{1}{x}$ of the job.

$$\begin{aligned} \frac{1}{4}+\frac{1}{5} &= \frac{1}{x} \\ \frac{5}{20}+\frac{4}{20} &= \frac{1}{x} \\ \frac{9}{20} &= \frac{1}{x} \\ \frac{20}{9} &= \frac{x}{1} \\ x &= \frac{20}{9} = 2\frac{2}{9} \end{aligned}$$

It will take them $2\frac{2}{9}$ hours to complete the job together.

$$\frac{2}{9} \text{ hours} = \frac{2}{9} \cdot 60 \text{ minutes } = 13.33 \text{ minutes}$$

It will take them 2 hours and 13 minutes to complete the job together.

6. Juan takes 5 hrs. In one hour he complete $\frac{1}{5}$ of the job.

Chet takes 7 hrs. In one hour he complete $\frac{1}{7}$ of the job.

Working together, the job will take x hrs. In one hour they complete $\frac{1}{x}$ of the job.

$$\begin{aligned} \frac{1}{5}+\frac{1}{7} &= \frac{1}{x} \\ \frac{7}{35}+\frac{5}{35} &= \frac{1}{x} \\ \frac{12}{35} &= \frac{1}{x} \\ \frac{35}{12} &= \frac{x}{1} \\ x &= \frac{35}{12} = 2\frac{11}{12} \end{aligned}$$

It will take them $2\frac{11}{12}$ hours to complete the job together.

$$\frac{11}{12} \text{ hours} = \frac{11}{12} \cdot 60 \text{ minutes } = 55 \text{ minutes}$$

It will take them 2 hours and 55 minutes to complete the job together.

7. Let x be the number of hydrogen atoms in the sample.

$$\begin{aligned} \frac{5 \text{ carbon atoms}}{4 \text{ hydrogen atoms}} &= \frac{12345 \text{ carbon atoms}}{x \text{ hydrogen atoms}} \\ \frac{5}{4} &= \frac{12345}{x} \\ x &= \frac{12345 \cdot 4}{5} = 9876 \end{aligned}$$

The sample has 9876 hydrogen atoms.