② Ladder: 27 ft · How many yards?

※ Convert feet to yards

Given: 1 yard equals 3 feet

$$1 \text{ yd} = 3 \text{ft} \iff 3 \text{ft} = 1 \text{yd}$$

※ Will the amount of yards be greater or less than the amount of feet?

Use this statement: $\underline{3} \text{ft} = \underline{1} \text{yd}$

# of yards will be less than 27

$3 \text{ft} = 1 \text{ yd}$

$27 \text{ft} = X \text{ yd}$ X is a placeholder for the amount of yards that 27 ft equal.

"X is our unknown"

Which math operation $(+, -, \div, \times)$ can we apply to 3 in order to get 27?

$$\times 9 \left(\begin{array}{c} 3 \text{ft} = 1 \text{ yd} \\ 27 \text{ft} = X \text{ yd} \end{array} \right) \times 9$$

We can apply this operation to the # of yards as well. This tells us that X = 9.

$$27 \text{ ft} = 9 \text{ yd}$$

To check our understanding: For every single yard, we have 3 feet. If we have 9 yards, we multiply by 3 to get 27 feet. This confirms our answer!

On your own: Convert 15 ft to yd

Convert 22 ft to yd

③ X yd = 27 ft $\iff$ 27 ft = X yd

1 yd = 3 ft $\iff$ 3 ft = 1 yd

$$\frac{a}{b} = \frac{c}{d}$$ ← proportion

$$\left.\begin{array}{l} 27\ \underline{ft} = X\ \underline{yd} \\ 3\ \underline{ft} = 1\ \underline{yd} \end{array}\right\}$$ 2 statements that deal with converting between feet and yards

Do you see a way to represent these statements as a proportion?

#feet = # yards

$$\frac{27\,ft}{3\,ft} = \frac{X\,yd}{1\,yd} \iff \frac{3\,ft}{27\,ft} = \frac{1\,yd}{X\,yd}$$

# of ft per yd = # of ft per yd

# of yd per ft = # of yd per ft

$$\frac{27\,ft}{\ } = \frac{3\,ft}{\ } \iff \frac{X\,yd}{\ } = \frac{1\,yd}{\ }$$

X yd   1 yd $\overline{27ft}$ $\overline{3ft}$

- All the above are examples of proportions and offer us a way to solve problem #2.

- How can we use the proportion

$$\frac{27 \text{ ft}}{X \text{ yd}} = \frac{3 \text{ ft}}{1 \text{ yd}}$$

to solve for X (i.e. solve $27ft = X \text{ yd}$)?

$$\frac{27}{X} = \frac{3}{1} \qquad \boxed{\frac{3}{1} = 3}$$

$$\Rightarrow \frac{27}{X} = 3 \quad \Rightarrow \quad X \cdot \frac{27}{X} = 3 \cdot X \qquad \boxed{\frac{X}{X} = 1}$$

$$\Rightarrow 27 = 3X$$

$$\Rightarrow \frac{27}{3} = X$$

$$\Rightarrow 9 = X$$

Q: What if the ladder is 14 ft long —
How can we use proportions to convert
the feet to yards?

1 yd = 3 ft
x yd = 14 ft

$$\begin{array}{l} 3\text{ft} = 1\text{yd} \\ 14\text{ft} = x\text{yd} \end{array} \Rightarrow \frac{1\text{yd}}{x\text{yd}} = \frac{3\text{ft}}{14\text{ft}}$$

$$\frac{x\text{yd}}{1\text{yd}} = \frac{14\text{ft}}{3\text{ft}}$$

$$\frac{x\text{yd}}{1\text{yd}} = \frac{14\text{ft}}{3\text{ft}}$$ • what's next?

* cross multiply

* multiply?

$$\frac{x}{1} = x = \frac{14}{3}$$

$$x = \frac{14}{3} \text{ yds.}$$

$$X = \frac{14}{3} = 4\frac{2}{3} \text{ yd.} \left[4 \times 3 = 12\right]$$

* Improper → numerator (top) > denominator
  fraction   (bottom)

* mixed → $2\frac{1}{2}$ = 2.5
  numbers   ↓ ↖ fract.   greater
              whole   (remainder)   than
              num.