

# Division Widget Proofs

Bus-stop frames and chunking examples across carries, decimals, prompts, remainders, and long working.

## Bus-stop / short division

empty prompt - whole number

$$4 \overline{) 484}$$

empty prompt - decimal

$$8 \overline{) 7.000}$$

intro carry

$$3 \overline{) 1\overset{4}{2}}$$

whole number, no carry

$$4 \overline{) 484} \begin{array}{r} 121 \\ \hline \end{array}$$

whole number, carry + remainder

$$4 \overline{) 9\overset{2}{2}5} \begin{array}{r} 231 \text{ r}1 \\ \hline \end{array}$$

leading zero quotient + carries

$$5 \overline{) 3\overset{0}{7}\overset{7}{2}8} \begin{array}{r} 075 \text{ r}3 \\ \hline \end{array}$$

decimal answer

$$3 \overline{) 4.\overset{1}{9}\overset{6}{8}} \begin{array}{r} 1.66 \\ \hline \end{array}$$

decimal dividend, added zero

$$5 \overline{) 7.\overset{1}{5}\overset{2}{0}} \begin{array}{r} 1.52 \\ \hline \end{array}$$

long decimal expansion

$$7 \overline{) 4.\overset{0}{4}\overset{0}{0}\overset{1}{0}\overset{3}{0}} \begin{array}{r} 0.5714 \\ \hline \end{array}$$

## Rule gap invariance

bus stop: no carry vs carry

no carry

$$4 \overline{) 484} \begin{array}{r} 121 \\ \hline \end{array}$$

carry

$$4 \overline{) 9\overset{2}{2}5} \begin{array}{r} 231 \text{ r}1 \\ \hline \end{array}$$

chunk rows: no carry vs carry

no carry

$$14 \overline{) 252} \begin{array}{r} 18 \\ -140 \\ \hline 112 \\ -70 \\ \hline 42 \\ -42 \\ \hline 0 \end{array}$$

$$-10 \times 14$$

$$-5 \times 14$$

$$-3 \times 14$$

carry

$$18 \overline{) 6\overset{1}{3}3.6} \begin{array}{r} 56\overset{1}{3}3.6 \\ -360 \\ \hline 273.6 \\ -180 \\ \hline 93.6 \\ -90 \\ \hline 3.6 \\ -3.6 \\ \hline 0 \end{array}$$

$$-20 \times 18$$

$$-10 \times 18$$

$$-5 \times 18$$

$$-0.2 \times 18$$

## Chunking / long division

whole number, exact

$$\begin{array}{r} 14 \overline{) 252} \\ -140 \quad -10 \times 14 \\ \hline 112 \\ -70 \quad -5 \times 14 \\ \hline 42 \\ -42 \quad -3 \times 14 \\ \hline 0 \end{array}$$

whole number, leading zero remainder

$$\begin{array}{r} 17 \overline{) 546} \\ -340 \quad -20 \times 17 \\ \hline 206 \\ -170 \quad -10 \times 17 \\ \hline 036 \\ -034 \quad -2 \times 17 \\ \hline 2 \end{array}$$

decimal answer step

$$\begin{array}{r} 15 \overline{) 186} \\ -150 \quad -10 \times 15 \\ \hline 36 \\ -30 \quad -2 \times 15 \\ \hline 6 \\ -6 \quad -0.4 \times 15 \\ \hline 0 \end{array}$$

decimal dividend + borrow marks

$$\begin{array}{r} 18 \overline{) 633.6} \\ -360 \quad -20 \times 18 \\ \hline 273.6 \\ -180 \quad -10 \times 18 \\ \hline 93.6 \\ -90 \quad -5 \times 18 \\ \hline 3.6 \\ -3.6 \quad -0.2 \times 18 \\ \hline 0 \end{array}$$