Name _____ Date _____

Binary Addition

Remember

Add binary numbers in columns, just like decimals: $0 + 0 = 0$, $0 + 1 = 1$, $1 + 1 = 10_2$ (write 0, carry 1), $1 + 1 + 1 = 11_2$ (write 1, carry 1).

Example

$$\begin{array}{cccccc} & {\scriptstyle 1} & {\scriptstyle 1} & {\scriptstyle 1} & & \\ & 0 & 1 & 0 & 1 & \\ + & 0 & 0 & 1 & 1 & \\ \hline & 1 & 0 & 0 & 0 & \end{array}$$

Right: $1 + 1 = 10_2$, write 0, carry 1.

Then: $1 + 0 + 1 = 10_2$ and $1 + 1 + 0 = 10_2$, then $1 + 0 + 0 = 1$.

Check: $5 + 3 = 8$ ✓

1 ON YOUR OWN Add in columns and check in decimal.

$$\begin{array}{cccccc} & \square & \square & \square & \square & \\ & 0 & 1 & 1 & 0 & \\ + & & 0 & 1 & 1 & 1 \\ \hline & \square & \square & \square & \square & \square \end{array}$$

Check: ☐

$$\begin{array}{cccccc} & \square & \square & \square & \square & \\ & 1 & 0 & 1 & 1 & \\ + & & 1 & 0 & 0 & 1 \\ \hline & \square & \square & \square & \square & \square \end{array}$$

Check: ☐

$$\begin{array}{cccccc} & \square & \square & \square & \square & \\ & 1 & 1 & 1 & 1 & \\ + & & 0 & 0 & 0 & 1 \\ \hline & \square & \square & \square & \square & \square \end{array}$$

Check: ☐

$$\begin{array}{cccccc} & \square & \square & \square & \square & \\ & 0 & 0 & 1 & 1 & \\ + & & 0 & 1 & 0 & 1 \\ \hline & \square & \square & \square & \square & \square \end{array}$$

Check: ☐

$$\begin{array}{cccccc} & \square & \square & \square & \square & \\ & 1 & 1 & 0 & 0 & \\ + & & 0 & 1 & 1 & 0 \\ \hline & \square & \square & \square & \square & \square \end{array}$$

Check: ☐

$$\begin{array}{cccccc} & \square & \square & \square & \square & \\ & 0 & 1 & 1 & 1 & \\ + & & 0 & 1 & 1 & 1 \\ \hline & \square & \square & \square & \square & \square \end{array}$$

Check: ☐

Names (pair) _____ Date _____

2 IN PAIRS **Find the mistake.** Mia worked out $0110_2 + 0011_2 = 1011_2$. Check in decimal, find the mistake and add correctly.

$$\begin{array}{r} \square\,\square\,\square\,\square \\ 0\;1\;1\;0 \\ +\;\;0\;0\;1\;1 \\ \hline \square\,\square\,\square\,\square\,\square \end{array}$$

3 ON YOUR OWN Add. Watch for a carry into a new column.

$$\begin{array}{r} \square\,\square\,\square\,\square\,\square \\ 1\;0\;1\;1\;1 \\ +\;\;1\;1\;0\;1 \\ \hline \square\,\square\,\square\,\square\,\square\,\square \end{array}$$

Check: ☐

$$\begin{array}{r} \square\,\square\,\square\,\square\,\square \\ 1\;1\;1\;1 \\ +\;\;1\;1\;1\;1 \\ \hline \square\,\square\,\square\,\square\,\square\,\square \end{array}$$

Check: ☐

4 IN PAIRS The sum of two 4-bit numbers can have more bits. What is the largest possible sum? How many bits does it have?

☐ = ☐ bits: ☐

The Binary Addition app · otooly.com/binary-addition

Calculate mode: enter two numbers and follow the carries step by step; **Practise** gives you new sums.

★ ON YOUR OWN **Exit card.** $1010_2 + 0111_2 =$ ☐