Name _____ Date _____

From Decimal to Binary

Method 1: subtracting powers

The largest power of 2 that fits into 13 is 8.

$13 - 8 = 5,\ \ 5 - 4 = 1,\ \ 1 - 1 = 0$

$13 = 8 + 4 + 1$

1101_2

Method 2: dividing by 2

$13 \div 2 = 6$, remainder 1

$6 \div 2 = 3$, remainder 0

$3 \div 2 = 1$, remainder 1

$1 \div 2 = 0$, remainder 1

read the remainders upwards: 1101_2

Remember

When dividing by 2, the first remainder is the **last** digit (it tells us whether the number is even). That is why we read the remainders **from the bottom up**. Always check by converting back to decimal.

1 ON YOUR OWN Convert by subtracting powers: 1, 2, 4, 8, 16, 32, 64.

$26 =$ ☐ $=$ ☐

$50 =$ ☐ $=$ ☐

2 ON YOUR OWN Convert by dividing by 2.

100	$\div 2 =$	☐	rem.	☐	37	$\div 2 =$	☐	rem. ☐
☐	$\div 2 =$	☐	rem.	☐	☐	$\div 2 =$	☐	rem. ☐
☐	$\div 2 =$	☐	rem.	☐	☐	$\div 2 =$	☐	rem. ☐
☐	$\div 2 =$	☐	rem.	☐	☐	$\div 2 =$	☐	rem. ☐
☐	$\div 2 =$	☐	rem.	☐	☐	$\div 2 =$	☐	rem. ☐
☐	$\div 2 =$	☐	rem.	☐	☐	$\div 2 =$	☐	rem. ☐
☐	$\div 2 =$	☐	rem.	☐				

$100 =$ ☐

$37 =$ ☐

Names (pair) _____ Date _____

3 IN PAIRS Each of you converts 90 in your own way. Compare your answers and check them.

My way:

$90 =$ ☐

My partner's way:

$90 =$ ☐

4 IN PAIRS **How many bits are needed?** Write the number in binary and count the digits.

Number	Binary	Bits
100	☐	☐
255	☐	☐
256	☐	☐

5 ON YOUR OWN **Find the mistake.** Luka converted 6: $6 \div 2 = 3$ rem. 0, $3 \div 2 = 1$ rem. 1, $1 \div 2 = 0$ rem. 1, and wrote $6 = 011_2$. What went wrong? Write it correctly.

The Binary Numbers app · otooly.com/binary-numbers

Convert mode: type a decimal number and check your binary answer; **Practice** mode gives you new numbers.

★ ON YOUR OWN **Exit card.** $19 =$ ☐