

# Worksheet: Decimal Expansions from Binary Numbers

## Part A: Worked Example

**Example:** Find the decimal expansion of the binary integer  $(0101011111)_2$ .

**Step 1: Write digits with place values.**

$$(0101011111)_2 = 0 \cdot 2^9 + 1 \cdot 2^8 + 0 \cdot 2^7 + 1 \cdot 2^6 + 0 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0$$

**Step 2: Simplify.**

$$= 0 + 256 + 0 + 64 + 0 + 16 + 8 + 4 + 2 + 1$$

**Step 3: Add.**

$$= 351$$

So,  $(0101011111)_2 = (351)_{10}$ .

## Part B: Easier Practice

Convert the binary number  $(1011)_2$  into decimal. Show all steps.

**Answer:**  $(1011)_2 = (11)_{10}$ .

## Part C: Harder Practice

Convert the binary number  $(11011010101)_2$  into decimal. Show all steps.

## Part D: Reflection

Why do we write binary expansions as sums of powers of 2? How does this compare to base 10?