

# Solutions: Decimal Expansion from Octal (Example 2)

## Part A — Worked Example

**Problem.**  $(7016)_8$ .

**Solution** (place value).

$$\begin{aligned}(7016)_8 &= 7 \cdot 8^3 + 0 \cdot 8^2 + 1 \cdot 8^1 + 6 \cdot 8^0 = 7 \cdot 512 + 0 \cdot 64 + 1 \cdot 8 + 6 \cdot 1 \\ &= 3584 + 0 + 8 + 6 = \mathbf{3598}.\end{aligned}$$

**Alternative (Horner).**

$$(((7) \cdot 8 + 0) \cdot 8 + 1) \cdot 8 + 6 = 3598.$$

Therefore,  $\boxed{(7016)_8 = (3598)_{10}}$ .

## Part B — Easier Practice

**Problem.**  $(52)_8$ .

**Solution.**

$$(52)_8 = 5 \cdot 8^1 + 2 \cdot 8^0 = 5 \cdot 8 + 2 \cdot 1 = 40 + 2 = \boxed{42}.$$

Horner check:  $(5) \cdot 8 + 2 = 42$ .

## Part C — Harder Practice

**Problem.**  $(574321)_8$ .

**Solution.**

$$\begin{aligned}(574321)_8 &= 5 \cdot 8^5 + 7 \cdot 8^4 + 4 \cdot 8^3 + 3 \cdot 8^2 + 2 \cdot 8^1 + 1 \cdot 8^0. \\ 8^5 &= 32768, \ 8^4 = 4096, \ 8^3 = 512, \ 8^2 = 64, \ 8^1 = 8, \ 8^0 = 1. \\ &= 5 \cdot 32768 + 7 \cdot 4096 + 4 \cdot 512 + 3 \cdot 64 + 2 \cdot 8 + 1 \cdot 1 \\ &= 163,840 + 28,672 + 2,048 + 192 + 16 + 1 = \boxed{194,769}.\end{aligned}$$

Horner check:

$$(((((((5) \cdot 8 + 7) \cdot 8 + 4) \cdot 8 + 3) \cdot 8 + 2) \cdot 8 + 1) = 194,769.$$

## Teaching Notes

- Emphasize base- $b$  place value:  $\sum d_i b^i$  mirrors decimal exactly.
- Encourage Horner's method for speed and fewer big intermediate sums.
- Common pitfalls: mis-ordering powers, forgetting  $8^0 = 1$ , and dropping a digit.