Solutions: Octal Expansion (Example 4)

Part A — Worked Example

Already shown in worksheet:

$$12345 \div 8 \Rightarrow 1543\, r1$$

$$1543 \div 8 \Rightarrow 192\, r7$$

$$192 \div 8 \Rightarrow 24\, r0$$

$$24 \div 8 \Rightarrow 3\, r0$$

$$3 \div 8 \Rightarrow 0\, r3$$

Digits: $(30071)_8$.

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Part B — Easier Practice Solutions

1. $(25)_{10}$:

$$25 = 8 \cdot 3 + 1 \quad \Rightarrow r1$$

$$3 = 8 \cdot 0 + 3 \quad \Rightarrow r3$$

Answer: $(25)_{10} = (31)_8$.

2. $(64)_{10}$:

$$64 = 8 \cdot 8 + 0$$

$$8 = 8 \cdot 1 + 0$$

$$1 = 8 \cdot 0 + 1$$

Digits: $(100)_8$.

3. $(255)_{10}$:

$$255 = 8 \cdot 31 + 7$$

$$31 = 8 \cdot 3 + 7$$

$$3 = 8 \cdot 0 + 3$$

Digits: $(377)_8$.

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Part C — Harder Challenge Solution

Convert $(54321)_{10}$:

$$54321 \div 8 = 6790\, r1$$
$$6790 \div 8 = 848\, r6$$
$$848 \div 8 = 106\, r0$$
$$106 \div 8 = 13\, r2$$
$$13 \div 8 = 1\, r5$$
$$1 \div 8 = 0\, r1$$

Digits (bottom-to-top): $1, 5, 2, 0, 6, 1$.

$$(54321)_{10} = (152061)_8.$$

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Teaching Notes

- Emphasize writing quotients and remainders in columns.
- Students often forget to read remainders bottom-to-top.
- Always check by converting octal back to decimal.