Worksheet: Octal Expansion (Example 4)

Part A — Worked Example

Problem. Find the octal expansion of $(12345)_{10}$.

Step 1: Recall. To convert from decimal to base 8, divide repeatedly by 8 and record the remainders. The remainders (read bottom-to-top) give the digits.

Step 2: Divide 12345 **by** 8**.**

$$12345 = 8 \cdot 1543 + 1.$$

Remainder = 1, quotient = 1543.

Step 3: Divide 1543 **by** 8**.**

$$1543 = 8 \cdot 192 + 7.$$

Remainder = 7, quotient = 192.

Step 4: Divide 192 **by** 8**.**

$$192 = 8 \cdot 24 + 0.$$

Remainder = 0, quotient = 24.

Step 5: Divide 24 **by** 8**.**

$$24 = 8 \cdot 3 + 0.$$

Remainder = 0, quotient = 3.

Step 6: Divide 3 **by** 8**.**

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

Remainder = 3, quotient = 0. Stop here.

Step 7: Collect remainders. Reading bottom-to-top: $3, 0, 0, 7, 1$.

$$(12345)_{10} = (30071)_8.$$

$\boxed{(12345)_{10} = (30071)_8}$

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Part B — Easier Practice Problems

1. Convert $(25)_{10}$ into octal. 2. Convert $(64)_{10}$ into octal. 3. Convert $(255)_{10}$ into octal. Show all division steps!

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Part C — Harder Challenge

Convert $(54321)_{10}$ into octal.

Hint: Write each division step clearly and check by converting back.