

24 x 21 = 42 x 12

Generating more examples

Students often have difficulty generating more examples using a trial and improvement method. While it is relatively easy to find examples that involve doubling and halving, equations that combine both doubling and halving and reversing digits are elusive. With some classes I have 'planted' one of the following algorithms with a pair of students who then explain it to the class. Alternatively, I have tried to 'co-construct' an algorithm in whole-class discussion.

FOUR ALGORITHMS to generate examples

3-step algorithms

$$(10a + b) \times 2(10b + a) = (10b + a) \times 2(10a + b)$$

Gives all examples with ratio 2:1, 1:2

(1) Halve, reverse, double

Start with 42, halve 42 gives 21, reverse 21 to give 12 and double for 24.

$$42 \times 12 = 21 \times 24$$

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|-----|---|---------|
| (1) | → | halve |
| (2) | ← | reverse |
| (3) | → | double |

(2) Double, reverse, halve

$$42 \times 48 = 84 \times 24$$

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|-----|---|---------|
| (1) | → | double |
| (2) | ← | reverse |
| (3) | → | halve |

(3) Reverse, halve, reverse

$$42 \times 12 = 24 \times 21$$

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|-----|---|---------|
| (1) | → | reverse |
| (2) | ← | halve |
| (3) | → | reverse |

(4) Reverse, double, reverse

$$42 \times 48 = 24 \times 84$$

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|-----|---|---------|
| (1) | → | reverse |
| (2) | ← | double |
| (3) | → | reverse |