

Mental computation strategies

It is critical that students develop **trusted**, **efficient** and **flexible** methods for multiplying and dividing whole numbers and decimals. Students' ability to solve multiplication and division problems confidently and efficiently will often rely on their use of a mental strategy.

Students need to develop fluency with mental strategies, prior to the introduction of formal written methods. Students are at risk of developing misconceptions in computation when formal written methods are introduced before they are confident in solving problems mentally.

A feature of mental computation is that a problem can often be worked out in a variety of ways. The most appropriate strategy will depend on the numbers involved, the context of the problem, the age of the user and the range of methods that they are confident with. Students with a deep and flexible understanding of the relationship between multiplication and division, whole number place value, partitioning and basic facts are well-equipped to develop efficient personal strategies.

There are numerous mental strategies for multiplication and division. Curriculum into the Classroom will refer to these strategies as:

- Split
- Compensate.

Teaching mental computation

Mental computation strategies should be taught explicitly, however the goal is for students to develop preferred personal strategies, suited to different number contexts.

In teaching mental computation strategies, the following principles are a sound guide for teachers:

- Commit regular time to teaching mental computation strategies.
- Provide practice time with frequent opportunities for children to choose and use familiar strategies.
- Encourage the use of structured materials and models to represent mental strategies.
- Model the use of informal jottings to support mental computation. Encourage students' use of jottings as they calculate mentally.
- Provide opportunities for students to discuss and explain their methods and strategies.
- Delay the introduction of formal written methods (standard algorithms) until students can confidently demonstrate the use of appropriate mental computation strategies.

Multiplying and dividing with the SPLIT strategy

The Split strategy requires the user to:

- partition (break up) one or both numbers
- multiply or divide the parts
- recombine the parts to make the product or quotient.

Multiplication

46 X 8

A student might think:

$$40 \times 8 + 6 \times 8$$

and recombine as

$$320 + 48 = 368$$

25 X 28

A student might think:

$$25 \times (4 \times 7)$$

$$25 \times 4 = 100$$

$$7 \times 100 = 700$$

15 X 24

A student might think:

$$(3 \times 5) \times (4 \times 6)$$

and rearrange as

$$12 \times 30 = 360$$

36 X 23

A student might think:

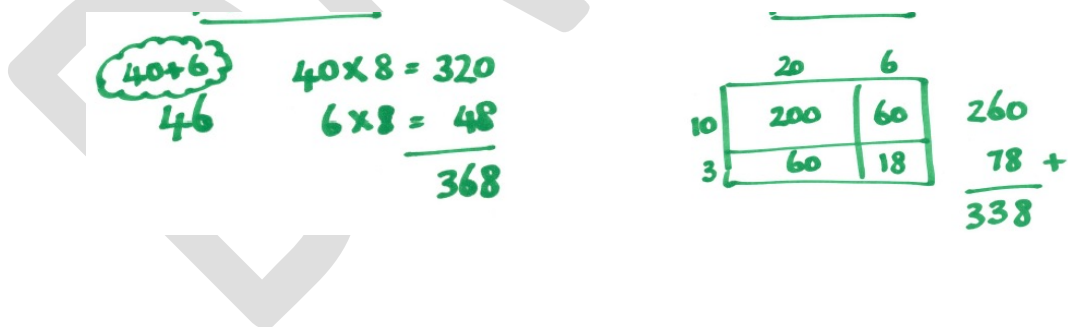
$$(30 \times 20) + (30 \times 3) +$$

$$(6 \times 20) + (6 \times 3)$$

adding the parts as

$$600 + 90 + 120 + 18$$

The Split strategy can be represented with structured materials and visual models. Students' use of informal jottings and diagrams should be encouraged, e.g.



Division

84 ÷ 4

A student might think:

$$(80 \div 4) + (4 \div 4)$$

and recombine as

$$20 + 1 = 21$$

720 ÷ 6

A student might think:

$$(600 \div 6) + (120 \div 6)$$

and recombine as

$$100 + 20 = 120$$

The Split strategy includes situations involving doubling and halving.

These may require the user to:

- partition (break up) one or both numbers into multiples of 2, 4 or 8
- double or halve as required
- recombine the parts to make the product or quotient.

Multiplication

27×8

A student might think:

Double 27 is 54,
double again is 108
double again is 216

53×13

A student might think:

4×53 is 212 (double double)
 8×53 is 424 (double again)
 $424 + 212 + 53 = 689$

Doubling and Halving can be represented with structured materials and visual models. Students' use of informal jottings and diagrams should be encouraged, e.g.

27×8

$2 \times 27 = 54$
 $4 \times 27 = 108$
 $8 \times 27 = 216$

53×13

$2 \times 53 = 106$
 $4 \times 53 = 212$
 $8 \times 53 = 424$
 $424 + 212 + 53 = 689$

Division

$128 \div 4$

A student might think:

Half of 128 (64), half of
64 (32)

$500 \div 8$

A student might think:

Half of 500 (250), half of 250
(125), half of 125 (62.5)

Multiplying and dividing with the COMPENSATE strategy

The Compensate strategy requires the user to:

- adjust one number (building up or building down)
- multiply or divide the parts
- adjust the product (or quotient).

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|----------------|--|---|
| Multiplication | 7×68 <i>A student might think:</i> $(7 \times 70) - (7 \times 2)$ $490 + 14 = 476$ | 399×6 <i>A student might think:</i> $(6 \times 400) - 6$ $2400 - 6 = 2394$ |
| Division | $96 \div 4$ <i>A student might think:</i> 25 fours in 100 Less one. So, 24 fours in 96. | $419 \div 7$ <i>A student might think:</i> $420 \div 7 = 60$ So $419 \div 7$ will be 59 rem. 6 |

Representing the Compensate strategy for multiplication and division relies more heavily on the use of symbolic recordings. Students' use of informal jottings and diagrams should be encouraged, e.g.

$$\boxed{7 \times 68}$$
$$7 \times 70 = 490$$
$$490 - 7 - 7 = 476$$

$$\boxed{419 \div 7}$$
$$7 \times 60 = 420$$
$$\text{So } 7 \times 59 = 413$$
$$419 \div 7 = 59 \text{ rem } 6$$