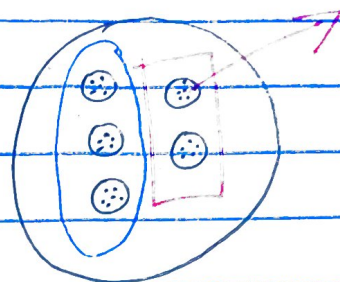


Section 3-3 Subtraction of Whole Numbers

Models for Whole # Subtraction

1. Take Away



$$5 - 2 = 3$$

2. Missing Addend

$$5 - 2 = \square$$

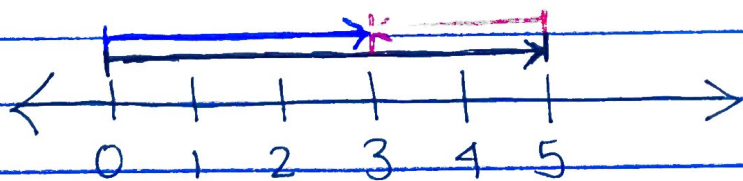
can be written as its related addition problem

$$\square + 2 = 5$$

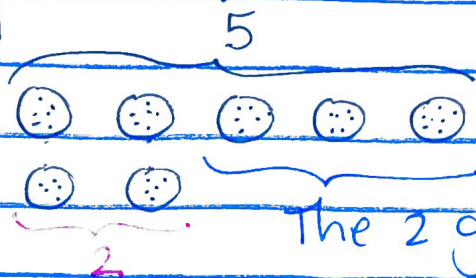
This technique is useful for easing students into subtraction by using their knowledge of addition.

3. Number Line

$$5 - 2 = 3$$



4. Comparison



The 2 groups differ by 3 cookies.

$$5 - 2 = 3$$

minuend subtrahend

difference

Properties of Whole # Subtraction

Whole Numbers are :

1. not closed for subtraction

ex: $2 - 7$ is not a whole #

2. not commutative for subtraction

ex: $2 - 7 \neq 7 - 2$

3. not associative for subtraction

ex: $2 - (7 - 3) \neq (2 - 7) - 3$

4. do not have an identity element

ex: $7 - 0 \neq 0 - 7$

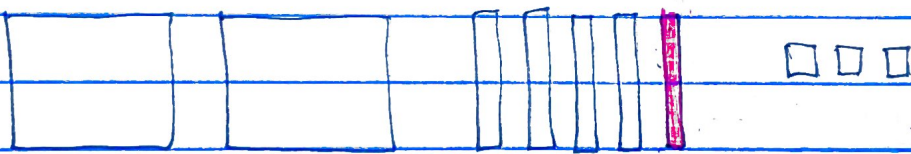
Subtraction Algorithms

1. Standard Algorithm

$$\begin{array}{r} 2 \overset{4}{\cancel{5}} 3 \\ - 26 \\ \hline 227 \end{array}$$

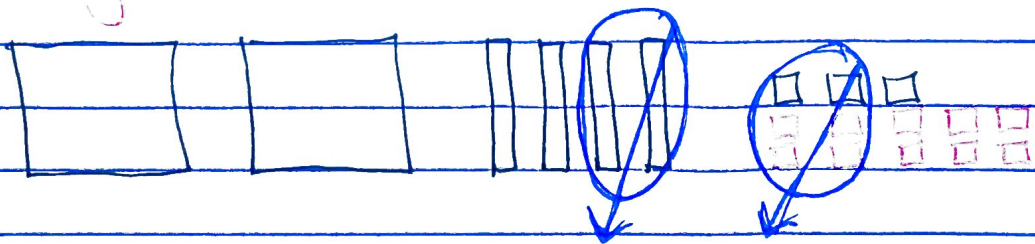
regrouping

2. Base 10 Blocks (Take Away)



Start with 253 (2 flats, 5 longs, 3 units)

In order to subtract 26 (2 longs, 6 units) we need more units. So we exchange 1 long for 10 units.



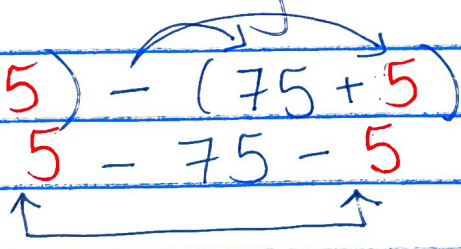
Now we can take away 26 (2 longs, 6 units) and we're left with 2 flats, 2 longs + 7 units.

3. Equal Addends Algorithm

This algorithm eliminates the need for "borrowing." It utilizes the fact that the difference of 2 numbers is the same after adding the SAME number to both the minuend + subtrahend.

$$\begin{array}{r} 184 + 5 \\ - 75 + 5 \\ \hline \end{array} \Rightarrow \begin{array}{r} 189 \\ - 80 \\ \hline 109 \end{array}$$

* The 5 that is added to the top is subtracted away in the bottom.

$$\begin{array}{l} (184 + 5) - (75 + 5) \quad \text{distributive property} \\ 184 + 5 - 75 - 5 \end{array}$$


Subtraction in Bases other than 10

ex 1 Subtract

a)

$$\begin{array}{r} \overset{3}{\cancel{3}} \overset{7}{\cancel{4}} \overset{0}{\cancel{2}} \text{ five} \\ - \quad \quad \quad \text{five} \\ \hline 3 \ 1 \ 3 \text{ five} \end{array}$$

(Note: A red cloud contains the text "2+5")

b)

$$\begin{array}{r} \overset{9}{\cancel{2}} \overset{4}{\cancel{5}} \overset{8}{\cancel{3}} \text{ seven} \\ - \quad \quad \quad \text{seven} \\ \hline 2 \ 0 \ 3 \ 3 \text{ seven} \end{array}$$

c)

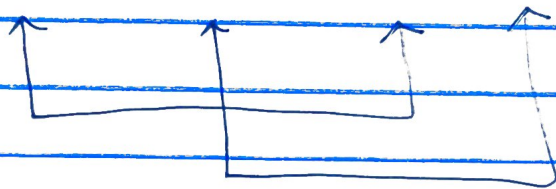
$$\begin{array}{r} \overset{2}{\cancel{0}} \overset{3}{\cancel{3}} \overset{4}{\cancel{1}} \text{ three} \\ - \quad \quad \quad \text{three} \\ \hline 1 \ 2 \ 1 \text{ three} \end{array}$$

Mental Subtraction Techniques

1. Compatible Numbers

ex 2 Subtract

$$57 - 12 - 7 - 8$$



$$\begin{array}{r} 57 \\ - 7 \\ \hline 50 \\ - 12 \} \text{same as} \\ - 8 \} - 20 \\ \hline 30 \end{array}$$

2. Breaking Up + Bridging

ex 3 Subtract

a) $163 - 46$

$$(163 - 43) - 3 = 120 - 3 = 117$$

b) $56 - 17$

$$(56 - 16) - 1 = 40 - 1 = 39$$

3. Add Up (Count On)

ex 4 Subtract $56 - 17$

$$\begin{array}{ccccccc} 17 & \longrightarrow & 20 & \longrightarrow & 50 & \longrightarrow & 56 \\ & & +3 & & +30 & & +6 \\ & & \underbrace{\hspace{1.5cm}} & & & & \\ & & & & 39 & & \end{array}$$

This uses the missing factor model.

$$17 + \boxed{} = 56$$

4. Equal Differences

This uses the equal addends model.

ex 5 Subtract

a) $90 - 22$

$$\begin{array}{rcl} 90 + 8 & \Rightarrow & 98 \\ - 22 + 8 & & - 30 \\ \hline & & 68 \end{array}$$

b) $56 - 17$

$$\begin{array}{rcl} 56 + 3 & \Rightarrow & 59 \\ - 17 + 3 & & - 20 \\ \hline & & 39 \end{array}$$

Estimating Whole # Subtraction

* Estimations are important in order to determine the reasonableness of an answer.

1. Front End Estimation

ex:
$$\begin{array}{r} 763 \\ - 420 \\ \hline \end{array}$$

$\uparrow 700 - 400 = 300$

2. Rounding

ex:
$$\begin{array}{r} 763 \\ - 420 \\ \hline \end{array} \approx \begin{array}{r} 800 \\ - 400 \\ \hline 400 \end{array}$$

end 3-3