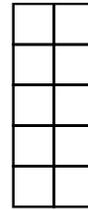


Ten-Frames

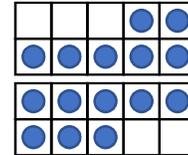
- Components:
 - Ten-frame – 2×5 grid of squares, each square can be 1inch \times 1inch or 3cm \times 3cm, big enough for the counters to fit in, any thin card can be used
 - Counters – bottle caps, pebbles, buttons – any (ideally round) counters
- Orientations
 - Landscape: 2×5 i.e. two rows and five columns
 - Portrait: 5×2 i.e. five rows and two columns
- Versions:



Child version:

- Same as above i.e. empty frames and counters, at least 10-11 frames and at least 55 counters
- ✓ Counters are essential for children to develop eye-hand coordination and practice counting
- ✓ Allows automatization of various addition-subtraction facts

1. Compliments of 10: no. of counters + no. of empty cells = 10 e.g. $4 + 6 = 10$, $7 + 3 = 10$ etc.
2. Consequently, $9 = 10 - 1$, $8 = 10 - 2$, $7 = 10 - 3$ and $6 = 10 - 4$
3. Also $6 = 5 + 1$, $7 = 5 + 2$, $8 = 5 + 3$ and $9 = 5 + 4$
[which is the same as the new abacus]
4. Use of 3 for automatization of addition facts with 5, 6, 7, 8 and 9 – e.g.
 $7 + 8 = (2 + 5) + (5 + 3) = 2 + 10 + 3 = 15$ as shown here

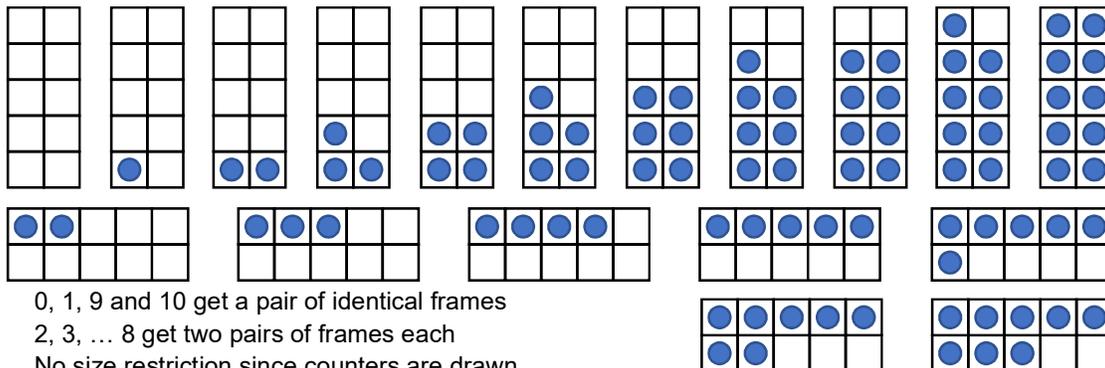


Therefore, very useful for Class 1, additions summing up to 20

- ✓ Allows pattern recognition of even-odd
 1. Connects with the names “even” with the top being even or level, and “odd” with an odd counter at the top
 2. Paves the way to think of even as $2n$, where n = the common height, and odd as $2n + 1$ where n = common height or $2n - 1$, where n = total height
 3. Explains the addition facts:
 - a. Addition of even number doesn't change the parity
 - b. Addition of odd number changes the parity
 4. That every number is made of tens (even) and a number less than ten (i.e. the unit's digit), so based on 3a, the parity of the number = the parity of its unit's digit
 5. Helps justify why 0 is even
 6. Can be used with colored counters (i.e. counters in two contrasting colors representing positive and negative) to discuss parity of integers

Teacher version:

- 36 frames needed to get 2 sets of the following

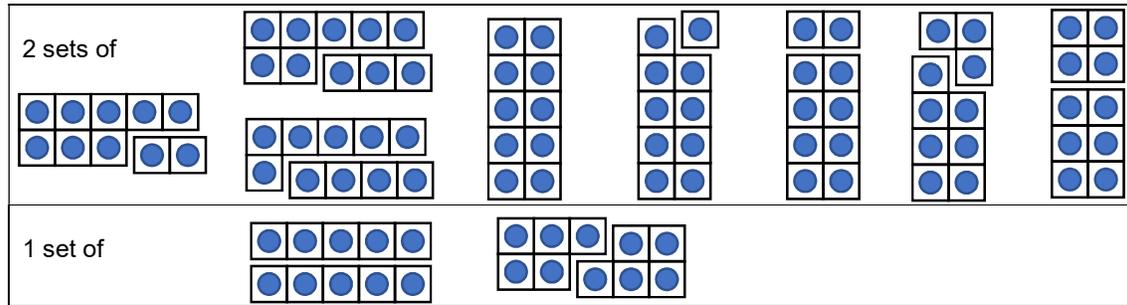


- 0, 1, 9 and 10 get a pair of identical frames
- 2, 3, ... 8 get two pairs of frames each
- No size restriction since counters are drawn

- ✓ Allows quick display of addition possibilities with the 5+ versions
- ✓ Allows pattern recognition of even and odd and the rationale for unit's digit test for parity

Teacher educator version:

- 18 frames needed as follows



- Each frame (other than the full frame for ten) needs to be cut as shown
- There are two of each type
- Note the absence of a frame for zero (Why?)
- No size restriction since counters are drawn
- ✓ Allows quick display of addition possibilities with the 5+ versions
- ✓ Allows pattern recognition of even and odd
- ✓ Allows addition of even-odd combinations especially that odd + odd = even