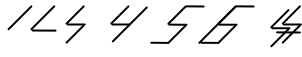


Workshop in 1digit Mathematics, Cup-writing & Decimal-counting

Avoiding 10, a Cognitive Bomb

Allan Tarp, MATHeCADEMY.net, Allan.Tarp@gmail.com, November 2011

<p>A: Counting by bundling and stacking. Re-counting</p> <p>A0. Place a total T of ten sticks on a table.</p> <p>A1. Rearrange the sticks in icons for 1, 2, etc. What about ten?</p> <p>A2. Count T in 2s. Write the result with units as $T = __2s$; and as a stack as $T = __ * 2$</p> <p>A3. Recount T in 3s. Write the result with units as $T =$ Write the result as a double stack $T =$</p> <p>A4. Use the icon / to describe the recount process</p> <p>A5. Can the result of recounting from 2s to 3s be predicted on a calculator?</p> <p>A6. Predict the result of recounting from 2s to 4s</p> <p>A7. Perform the recounting to 4s</p> <p>A8. Predict the result of and perform recounting from 2s to 5s</p> <p>A9. Predict the result of and perform recounting from 2s to 6s</p> <p>A10. Predict the result of and perform recounting from 2s to 7s</p>	<p>Expected answers</p> <p> </p> <p></p> <p>Ten has no icon</p> <p>$T = 5 \text{ 2s}$, $T = 5 * 2$</p> <p>$T = 3 \text{ 3s} + 1$ $T = 3 * 3 + 1$ $T = T / 3 * 3$</p> <p><i>The Recount Formula</i> $T = (5 * 2) / 3 * 3$ $T = 3 * 3 + R$ $R = 5 * 2 - 3 * 3 = 1$ $T = (5 * 2) / 4 * 4 = 2 * 4 + 2$</p> <p>$T = (5 * 2) / 5 * 5 = 2 * 5$</p> <p>$T = (5 * 2) / 6 * 6 = 1 * 6 + 4$</p> <p>$T = (5 * 2) / 7 * 7 = 1 * 7 + 3$</p>
<p>B. Cup-writing using decimals</p> <p>B1. Count ten sticks in 6s and place the sticks in two cups, a left bundle-cup and a right single-cup. Write down the result using real 'cup-writing'.</p> <p>B2. Change a bundle to a stick. Write down the result with symbolized 'cup-writing'.</p> <p>B3. Change the sticks to icons.</p> <p>B4. Change to decimal-writing including the unit, using the dot to separate the left cup from the right.</p>	<p>$T = \text{ } \text{) } \text{ l}$</p> <p>$T = \text{l} \text{) } \text{ l}$</p> <p>$T = \text{1} \text{) } \text{ 4}$</p> <p>$T = 1.4 \text{ 6s}$</p>
<p>C. Decimal Recounting</p> <p>C1. Recounting 1.3 6s to 5s, de-bundling Transform 1.3 6s to cup-writing Transform cup-writing to symbolized cup-writing Transform symbolized cup-writing to real cup-writing Transform real cup-writing to a total T of sticks</p> <p>C2. Recounting 1.3 6s to 5s, re-bundling Transform the total T of sticks to real cup-writing Transform the real cup-writing to symbolized cup-writing Transform the symbolized cup-writing to cup-writing Transform the cup-writing to 5 s</p> <p>C3. Predict the result when recounting 1.3 6s to 5s Use a calculator and the recount-formula to predict the result</p> <p>C4. Predict the result when recounting 1.3 6s to 4s</p> <p>C5. Perform the recounting of 1.3 6s to 4s</p> <p>C6. Predict the result of and perform recounting 1.3 6s to 3s</p>	<p>$T = 1.3 \text{ 6s} = \text{1} \text{) } \text{ 3}$ $T = \text{l} \text{) } \text{ l}$ $T = \text{ } \text{) } \text{ l}$ $T = \text{ } \text{) } \text{ l}$</p> <p>$T = \text{ } \text{) } \text{ l}$ $T = \text{l} \text{) } \text{ l}$ $T = \text{1} \text{) } \text{ 4}$ $T = 1.4 \text{ 5s}$</p> <p>$(1 * 6 + 3 * 1) / 5 = 1.R$ $R = 1 * 6 + 3 * 1 - 1 * 5 = 4$ $T = 1.3 \text{ 6s} = 1.4 \text{ 5s}$ $(1 * 6 + 3 * 1) / 4 = 2.1$</p> <p>$(1 * 6 + 3 * 1) / 3 = 3.0$</p>

D. Selling from a stock I D1. From a stock of 3.2 5s is sold 1.4 5s. What is left? Transform 3.2 5s to cup-writing Transform cup-writing to symbolized cup-writing Move a stick form the bundle-cup to the single cup as 5 1s Remove the 1.4 5s and count the rest in decimals Write down the subtraction result	$T = 3.2 \text{ 5s} = 3) \ 2)$ $T = \text{ } \ \text{ }$ $T = \text{ } \ \text{ } \ \text{ }$ $T = \text{ } \ \text{ } \ + \ \text{ } \ \text{ }$ $3.2 \text{ 5s} - 1.4 \text{ 5s} = 1.3 \text{ 5s}$
E. Selling from a stock II E1. From a stock of 4.2 5s is sold 1.3 5s. What is left? Transform 4.2 5s to cup-writing Move 1 5s from the bundle-cup to the single-cup as 5 1s Remove the 1.3 5s and count the rest in decimals Write down the subtraction result	$T = 4.2 \text{ 5s} = 4) \ 2)$ $T = 4-1) \ 2+5) \ = 3) \ 7)$ $T = 1) \ 3) \ + \ 2) \ 4)$ $4.2 \text{ 5s} - 1.3 \text{ 5s} = 2.4 \text{ 5s}$
F. Adding stocks I F1. To a stock of 2.3 5s is bought 1.4 5s. What is the Total? Transform 2.3 5s and 1.4 5s to cup-writing Transform cup-writing to symbolized cup-writing Move 1.4 5s to the 2.3 5s as 3.7 5s Move 5 1s from the single-cup to the bundle-cup as 1 5s Write down the addition result	$2.3 \text{ 5s} + 1.4 \text{ 5s} = 2)3) + 1)4)$ $T = \text{ } \ \text{ } \ + \ \text{ } \ \text{ }$ $T = \text{ } \ \text{ } \ \text{ }$ $T = \text{ } \ \text{ } \ \text{ } \ \rightarrow \ \text{ } \ \text{ }$ $2.3 \text{ 5s} + 1.4 \text{ 5s} = 3.7 \text{ 5s}$
G. Adding stocks II G1. Add the two stocks 2.3 5s and 3.2 4s as 4s. Recount the 2.3 5s in 4s Add 3.1 4s and 3.2 4s Perform the addition	$T = (2*5+3)/4 * 4 = 3.1 * 4$ $3.1 \text{ 4s} + 3.2 \text{ 4s} = 6.3 \text{ 4s}$
H. Adding stocks III H1. Add the two stocks 2.3 5s and 3.2 4s as 5s. Recount the 3.2 4s in 5s Add 2.3 5s and 2.4 5s Perform the addition	$T = (3*4+2)/5 * 5 = 2.4 * 5$ $2.3 \text{ 5s} + 2.4 \text{ 5s} = 4.7 \text{ 5s}$ $\quad\quad\quad = 5.2 \text{ 5s}$
I. Adding stocks as integration I1. Add the two stocks 2.3 5s and 3.2 4s as 9s (integration). Recount the 2.3 5s in 9s Recount 3.2 4s in 9s Perform the addition	$T = (2*5+3)/9 * 9 = 1.4 * 9$ $T = (3*4+2)/9 * 9 = 1.5 * 9$ $1.4 \text{ 9s} + 1.5 \text{ 9s} = 2.9 \text{ 9s}$ $\quad\quad\quad = 3.0 \text{ 9s}$
J. Handling overloads J1. In 7.3 5s introduce a new cup to the left meant for bundles of bundles J2. Remove the overload in 9.5 8s, 7.3 4s and 45.2 3s	$T =) \ 7) \ 3) = 1) \ 7-5) \ 3)$ $= 1) \ 2) \ 3) = 12.3 \text{ 5s}$
K. Multiplying and dividing with the bundle-size K1. Multiply 3.2 5s with 5 K2. Divide 14 5s with 5	$T = 3.2 \text{ 5s} = 3)2)*5 = 3*5)2*5)$ $= 3)2)0) = 32.0 \text{ 5s}$ $T = 14 * 5 = 1)4)0) = 1*5) 4*5)$ $= 1)4) * 5 = 1.4 \text{ 5s} * 5$
L. Solving equations L1. Solve the equation $2*x = 7$ by rebundling L2. Solve the equation $2*x+1 = 7$ by rebundling L3. Solve the equations by bundling and stacking	$2*x = 7 = (7/2)*2, x = 7/2$ $2*x+1 = 7-1+1 = (7-1)/2*2 + 1,$ $\text{so } x = (7-1)/2$

1. Discuss the advantages and disadvantages of Cup-writing & Decimal-counting.
2. Discuss the advantages and disadvantages of 1digit mathematics.
3. Discuss if 10 is a cognitive bomb to be introduced as the last bundle-size.