3.1 & 3.2 Whole Number Addition and Subtraction

Addition & Subtraction--binary operations

Properties of Addition (with Whole numbers):

1. Closure--
2. Commutativity--
3. Associativity--
4. Additive Identity--

Set Model

Measurement Model

Addition Thinking Strategies:

1. Doubles
2. Add zero
3. Commutativity/associativity
4. Counting by 2s or 5s
5. Doubles +/- 1
6. Grouping by tens
7. Counting on

Ex Find three different ways to add:

$5 + 9$

$14 + 28 + 36$

$51 + 89$

$5_6 + 2_6$

$17_8 + 32_8$

Subtraction

Take-away approach

Missing addend approach

Four-fact families:

TABLE 4.1. A Taxonomy of Addition and Subtraction Word Problems

CHANGE-ADD-TO with	. . . UNKNOWN OUTCOME	. . . UNKNOWN CHANGE	. . . UNKNOWN START
	Alexi had 5 candies. Barb gave him 3 more. How many candies does he have altogether now?	Alexi had 5 candies. Barb gave him some more. Now he has 8 altogether. How many candies did Barb give him?	Alexi had some candies. Barb gave him 3 more. Now he has 8 altogether. How many candies did he start with?
CHANGE-TAKE-AWAY with	. . . UNKNOWN OUTCOME	. . . UNKNOWN CHANGE	. . . UNKNOWN START
	Alexi had 8 candies. He gave 5 to Barb. How many candies does he have left?	Alexi had 8 candies. He gave some to Barb. Now he has 3 left. How many candies did he give to Barb?	Alexi had some candies. He gave 5 to Barb. Now he has 3 left. How many candies did he start with?
PART-PART-WHOLE with	. . . UNKNOWN WHOLE	. . . UNKNOWN SECOND PART	. . . UNKNOWN FIRST PART
	Alexi had 5 fireballs and 3 lollipops. How much candy did he have altogether?	Alexi had 5 fireballs and some lollipops. He had 8 candies altogether. How many were lollipops?	Alexi had some fireballs and 3 lollipops. He had 8 candies altogether. How many were lollipops?
EQUALIZE with	. . . UNKNOWN DIFFERENCE	. . . UNKNOWN SECOND PART	. . . UNKNOWN FIRST PART
	Alexi had 8 candies. Barb had 5. How many more does Barb have to buy to have as many as Alexi?	Alexi had 8 candies. Barb had to get 3 more candies to have the same number as Alexi. How many candies did Barb start with?	Alexi had some candies. Barb, who had 5 candies, had to get 3 more to have the same number as Alexi. How many candies did Alexi have?
COMPARE with	. . . UNKNOWN DIFFERENCE	. . . UNKNOWN SECOND PART	. . . UNKNOWN FIRST PART
	Alexi had 8 candies. Barb had 5. How many more candies did Alexi have than Barb?	Alexi had 8 candies. He had 3 more than Barb. How many candies did Barb have?	Alexi had some candies. He had 3 more than Barb who had 5. How many candies did Alexi have?

Note. The examples shown above for EQUALIZE and COMPARE problems are the "more" versions. "Less" versions could also be written for each. For example, the less version of the EQUALIZE with UNKNOWN DIFFERENCE would read: Alexi had 8 candies. Barb had 5. How many does Alexi have to give up to have as many as Barb?

Algorithm--

Addition

(a) base pieces

(b) chip abacus

(c) place-value representation

(d) intermediate algorithm

(e) lattice method

(f) standard algorithm

Subtraction

(a) base pieces

(b) chip abacus

(c) place-value representation

(d) intermediate algorithm

(e) standard algorithm

More examples:

1. $423_5 + 143_5$

2. $301_7 - 265_7$

3. $225_6 + 341_6$

4. $3214_5 - 242_5$

5. $2120_3 + 212_3$

6. $12210_3 - 201_3$

7. $3112_4 - 331_4$

8. $101010001_2 + 111111_2$

5. $2120_3 + 212_3$

6. $12210_3 \times 201_3$

7. $3112_4 - 331_4$

8. $101010001_2 + 111111_2$

What are these kids thinking?

$$\begin{array}{r} 23 \\ -15 \\ \hline 12 \end{array}$$

$$\begin{array}{r} {\scriptstyle 4\ 15} \\ 562 \\ -237 \\ \hline 325 \end{array}$$

$$\begin{array}{r} {\scriptstyle 3\ 14} \\ 562 \\ -287 \\ \hline 185 \end{array}$$

$$\begin{array}{r} 25 \\ +37 \\ \hline 125 \end{array}$$

$$\begin{array}{r} 25 \\ +37 \\ \hline 53 \end{array}$$