

1. Begin by solving the following arithmetic problems for yourself.

(a) $2 + 4 = \underline{\quad}$

(b) $2 * 3 + 9 = \underline{\quad}$

(c) $8 - 2 * 3 = \underline{\quad}$

(d) $2 = \underline{\quad} - 4$

(e) $\underline{\quad} = 8 + 4$

(f) $5 + 6 = \underline{\quad} + 3$

(g) $5 + 6 = \underline{\quad} + 6$

(h) $109 + 3 = 105 + \underline{\quad}$

2. Now go back and decide, for each problem, how you would say the question out loud. How would you describe what the students' task is? What are some different strategies you anticipate students using for each type of question? Was there anything different about how *you* solved each one? Remember for your descriptions that these are just arithmetic problems, prior to any mention of variables.

3. Suppose the students get all problems of the form:

$$2 + 4 = \underline{\quad}$$

$$6 + 9 = \underline{\quad}$$

$$3 * 4 = \underline{\quad}$$

$$5 * 4 = \underline{\quad}$$

What's the difference? What specifically is each different statement from the first problem supposed to challenge in students' perspectives?

4. In each of the following examples of student work, what do you think the student was thinking? How would you help them understand?

(a) $8 - 2 * 3 = \underline{18}$

(b) $6 + 7 = \underline{13} + 5$

(c) $6 + 7 = \underline{18} + 5$

(d)
$$\begin{aligned} 3 + 6 &= 9 + 2 \\ &= 11 - 5 \\ &= 14 \end{aligned}$$

5. Are the following equations true? What do they mean? Do they mean anything? Are they useful? How would you explain them?

(a) $4 + 3 = 3 + 4$

(b) $5 * (4 + 2) = 5 * 4 + 5 * 2$

(c) $(2 + 7) + 3 = 2 + (7 + 3)$