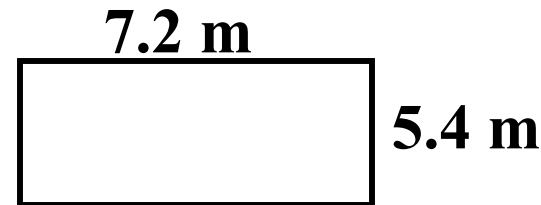# WHAT DO YOU NEED TO KNOW TO SOLVE THE TILE PROBLEM?

Step 3: Solution Planning and Monitoring

Strategic Knowledge - need general strategies that can be used to devise and monitor a solution plan

For the tile problem:

7.2 m

5.4 m

- *draw a picture*

- *work backwards from goal:* goal is to find total cost of tiling floor, so you need to know the # of tiles that cover the floor

- *divide into subgoals:* change dimensions into # of tiles, then determine how many tiles cover the floor, then determine the cost of all the tiles

*** *general strategies are italicized*

KEY QUESTION IN SOLUTION PLANNING:
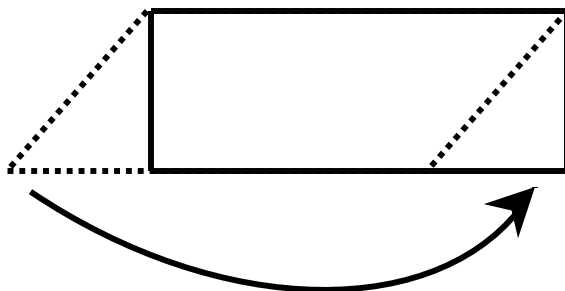## DO I KNOW A RELATED PROBLEM?

Find the area of the figure below:
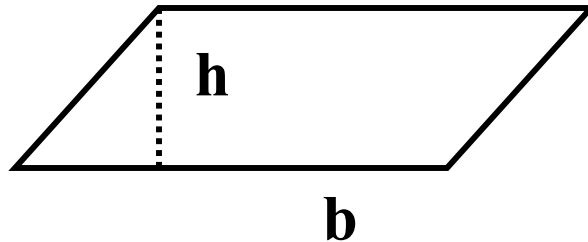
Givens:

the height and base of the figure

h

b

Do I know a related problem?

I know how to find the area of a rectangle. Perhaps I can transform the parallelogram into a rectangle?

Insight:

All parallelograms can be changed into rectangles

"SEEING" PARALLELS ACROSS PROBLEMS

How many lbs of peanuts ($1.65 per lb) and almonds ($2.10) do you need to produce a 30 lbs mixture worth $1.83 a lb?

X = lbs of peanuts

Y = lbs of almonds

X + Y = 30   X = 30 - Y

X(165) + Y(210) = 30(183)

(30 - Y)165 + 210Y = 5490

4950 - 165Y + 210Y = 5490

45Y = 540   Y = 12   X = 18

How much of a 6% boric acid solution and a 12% boric acid solution do you need to produce 4.5 pints of a 8% solution?

X = pints of 6% solution

Y = pints of 12 % solution

X + Y = 4.5   X = 4.5 - Y

X(6) + Y(12) = 4.5(8)

(4.5 - Y)6 + 12Y = 36

27 - 6Y + 12Y = 36

6Y = 9   Y = 1.5   X = 3

FAULTY BELIEFS ABOUT MATH THAT UNDERMINE EFFECTIVE PROBLEM SOLVING

1) **_Ordinary students_ cannot expect to understand math, they have to memorize it, and just apply what they have learned mechanically and without understanding.**

2) **All story problems can be solved by applying operations suggested by key words in the story (*in all* suggests addition, *left* suggests subtraction, *share* suggests division - 3rd graders)**

3) **Any assigned problem should be solved within five minutes or less. (High school students estimated the typical problem should take about 2 minutes)**

4) **Math is not particularly useful or sensible. Math is mostly a set of rules and mathematics learning means memorizing the rules (54% of 4th graders and 40% of eighth graders; females' attitudes toward math more negative).**

ATTRIBTUTION STYLE UNDERMINES EFFECTIVE MATH PROBLEM SOLVING

Researchers gave 10 year old children a questionnaire asking about their likely reactions to hypothetical failures.

They identified two attribution styles:

Mastery-oriented: likely to think they should work harder in the face of failure/difficulty

Helpless: likely to respond to difficulty with negative attributions about ability

*** *There were no IQ differences between these two groups.*

*** *Many more girls were categorized as "helpless."*

ATTRIBTUTION STYLE UNDERMINES EFFECTIVE MATH PROBLEM SOLVING - CONTINUED

Researchers next gave the children a series of confusing math problems (difficult to solve), and then a batch of easy math problems (that all children should be able to solve).

What happened?

Mastery-oriented children: These children were able to recoup from the negative experience and solved the easy problems with ease.

Helpless: These children were thrown by the confusing problems and didn't try very hard on the easy problems, getting many of them wrong.

ATTRIBTUTION STYLE UNDERMINES EFFECTIVE MATH PROBLEM SOLVING - CONTINUED

Researchers wanted to know why girls were more likely to adopt a "*helpless"* attribution style.

What happens in the classroom?

Boys and girls receive the same amount of negative comments. But the nature of these comments differ.

***Boys:* Criticisms sometimes focus on intellectual quality, sometimes on neatness, conduct, or effort. Boys and girls both think teachers like girls better.**

***Girls:* Teacher criticisms focus consistently on the intellectual quality of the work.**

<u>*End Result:*</u> *Boys attribute failure to any number of factors, girls are left with negative attributions concerning their ability.*

WHAT DO YOU NEED TO KNOW TO SOLVE THE TILE PROBLEM?

Step 4: Solution Execution

    Procedural Knowledge - **computational procedures from simple procedures (e.g., single digit addition or subtraction) to more complex procedures (e.g., subtraction of multiple digit numbers)**

    For the tile problem:

      540/30 = 18 tiles   720/30 = 24 tiles   18 x 24 = 432 tiles

      432 times $ .72 = $ 311.04

    *** Key Point: able to do computations with no difficulty, fast and accurate (achieve automaticity, direct retrieval from long-term memory)

THE TRANSITION TO AUTOMATICITY: SIMPLE ADDITION

<u>Step 1:</u> Count 1st number and then the 2nd on your fingers

<u>Step 2:</u> Move on to the most efficient counting strategy, the "min" strategy

    e.g., 2 + 4

    raise four fingers and then count up by 2

<u>Step 3:</u> Be strategic

    when you get a problem, retrieve an answer from long term memory

    if you're not sure, use your counting strategy or use some known facts (I know 2 + 2 is 4, so 2 + 3 must be 5)

*** *by selecting the best strategy for coming up with the correct answer, children move toward automaticity more quickly*