1. The text typifies high-cognitive-demand tasks of the relational type as requiring the use of mathematical operations in ways likely to build deeper conceptual understanding. This implies that no memorized algorithmic response is available to the student that will satisfy the requirements. Relatedly, such tasks explicitly or implicitly entail use of relatively broad mathematical reasoning. This reasoning will have a tight connection to the underlying mathematics and that connection can be explicit or implicit, such that student is driven to realize the existence of such a connection themselves. Further, tasks of this sort often represent information or process in a variety of equivalent forms. Such presentation not only allows students to approach a problem in different ways, but also gives students chances to deduce deeper mathematical truths by noticing and abstracting from analogies or commonalities between forms.

Such tasks require a relatively high degree of time and effort, given the above. It is to be expected that a typical student will struggle with such tasks to an extent. Indeed, that is a key feature of their design.

2. Implementation of a task can change its level of demand in a variety of ways and to a variety of extents. Often, this alteration takes the form of the lowering of the level of demand by removal of certain aspects. Teachers can remove parts of a task by providing hints or cues. If the aspects obviated are those requiring higher-level thinking,

the cognitive demand of the task is likely to decrease, up to and including the working out all the high-level functions of the task for the student, such that it is reduced to a much lower-level task.

To illustrate the possible extent of alteration by implementation, our text cites the example of a teacher who, when some students seem to struggle with a task, responds by showing the whole class how to solve the given problem by resort to a pat method. This practice clearly drastically lowers the task's demand by providing ready-made for the students what could and should be the fruits of higher thinking required by the initial steps of the task. The book uses the vivid language "taking over the thinking for [the] students" to describe this practice, which seems accurate.

On the other hand, teachers can increase the demands of a task by, for example, withholding certain pieces of information, like a recommended procedure for solution. A particularly elegant method to raise the demand of a task is to "invert" a straightforward task, as exemplified by the cited problem "Create a real-world situation modeled by [the multiplication of two fractions.]"

3. Our recent task to determine the nature of and then missing values in a "diamond factoring" worksheet was on an instrumental level, at least for this student and, I suspect, for the class as a whole. This task has some higher-level potential, given

the open nature of the initial step. However, I have seen such "diamond factoring" worksheets often before and I suspect I am not alone in this. In my case, I taught middle schoolers to find roots using this technique quite recently. Consequently, for me, this task reduced to recognition of a very familiar problem and then application of fairly simple known algorithms for solving said problem. If we can imagine that my experience was fairly typical, we can deem the task instrumental for the class as a whole.

It seems difficult on its face to boost the level of demand in this task. After all, it is a fairly basic task suitable for middle- or high-schoolers presented to a room of college students. However, even in this case, there do exist strategies suited to that purpose. If I am correct that the familiarity of the task contributes to its instrumentality, one strategy to raise its level of demand would be to present an analogous task in an unfamiliar form, rather than the familiar one used. By doing this, the teacher can compel students familiar with the underlying principle to make a connection to that principle before proceeding, rather than allowing access to a readymade connection attached to a familiar form. Indeed, a high degree of familiarity with a given form may increase the struggle needed to make such a connection in light of a different form.

Another strategy to raise the demand of this task is to include some items that cannot be successfully completed, corresponding in this case to non-factorable quadratics. Students applying familiar methods would find that they fail and would then be required to think again about the underlying problem and principles. Such struggle could and hopefully would lead students to consider why their known methods succeeded for the diamonds corresponding to factorable quadratics but failed for others, exposing and measuring the partial applicability of those methods. Students may also apply or even devise new methods that work more generally. Usefully, this second strategy can be used simultaneously with the first for an additional increase in demand.

4. Dr. Meyer recommends setting a task of allowing students to guess numbers and check by hand computation if they are roots to a given polynomial. The goal of this is to provoke a "headache" in the form of the realization that the trial-and-error method of solution is cumbersome and unreliable, providing the need for the "aspirin" of a better solution like factoring. We can consider that for Dr. Meyer, two tasks are posed: at surface, to find roots of a given quadratic, but more deeply, to independently arrive at the realization that some reliable method is needed to do the surface task.

Considering the hallmarks of higher-level tasks, we can note that several are present in these tasks. Both tasks are unpredictable. The surface task requires some minor effort, while the deeper task is likely to require a good deal, much of it in the proper realization that a deeper task exists in the first place. Assuming, as we reasonably must, that the factoring of quadratics is new to these students, they lack access to a known method for solving either problem. Further, in order to realize the existence of the underlying task, students will need to monitor the time, effort, and results of the presented method for the surface task and independently sense that it's not up to snuff. Students may even independently deduce some more reliable, algorithmic methods to perform the surface task in light of their realization of the inadequacies of the presented method.

All that said, the surface task itself is highly instrumental and archetypally low-demand. No connections to deeper principles are drawn for students or likely to present themselves initially. Moreover, a method is prescribed, and that method, while chancy, is stultifying mechanical. Indeed, those are the exact characteristics of the prescribed method for the surface task that we're relying on to provoke engagement with the deeper task. Any student who fails to catch on to the existence of a deeper task will have to be led to that realization and will participate in a low-demand, instrumental task until that happens.

Given the above, it's difficult for me to argue that Dr. Meyer's tasks can be easily categorized on any of the text's presented levels of cognitive demand, at least in the phase when students are working quasi-independently at the guess-and-check method of root finding. Rather, the tasks elegantly differentiate in demand by student, adapting under the student's control as a function of the student's analysis of the surface task and their metacognition. On the whole, this may be a desirable feature, depending on the nature of the students.

5. In this security camera task, it seems unlikely that a known method of solution is will present itself to a student. Rather, the student must deduce independently what mathematical principles would allow one to say what the camera can see, first from a specified point, and then from any point. It is likely that the student will need to access and apply knowledge of the workings of vision to solve this problem. No part of the problem is trivial and the student is likely to expend a good deal of time and effort devising and checking a method of attack. The student must avoid blind alleys and likely carefully check to arrive at a good solution even for Problem 1, especially with respect to person E. A full answer to problem 3 is especially demanding, requiring a fairly thorough understanding of the underlying principles and some geometric insight. Multiple forms are presented to a degree as, Problem 2 and any full answer to Problem 3 will require engagement with a numerical representation of coverage by the camera, in addition to the pictorial one presented by the data. Overall, this task seems likely to make high cognitive demands from a typical high school student. I assess that it fits best under the “doing mathematics” heading of the book’s taxonomy of levels of demand.

All that said, I'd like to add that the higher-level character of this task seems partly spoiled by the presentation of Problem 2. This problem strikes me as a low-level appendage to Problem 1, but its providence of a numerical answer to verify is likely to allow the student to guess at the method of general solution of Problem 1, and therefore the start of the method for Problem 3, without working out the underlying principle for themselves. A more demanding form of Problem 2 would ask the student to compute and demonstrate the floor area not covered, without the anchoring figure of 15%.