



Pre-Algebra PoW Packet

Movie Seating

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Welcome!

This packet contains a copy of the problem, the “answer check,” our solutions, teaching suggestions, a problem-specific scoring rubric, and some samples of the student work we received in April 2006, when *Movie Seating* first appeared. |

The Problem

In *Movie Seating*, students are asked to use the clues to determine where Mom, Dad, Randy, Shelley, Noreen, and Alan sit at the movie theater.

The text of the problem is included below. A print-friendly version is available from the “Print this Problem” link on the current PreAlgPoW problem page.

Movie Seating

A family of six goes to see a movie at the downtown movie theater. The family includes Mom, Dad, and the four kids – Randy, Shelley, Noreen, and Alan. They all sit in a row.



Use the clues below to figure out the order in which they sit.

- Dad wants to sit as far away as possible from Randy because last time Randy spilled soda pop on him.
- Noreen never sits on the outside because she does not like sitting next to strangers.
- Alan and Shelley need to be separated by at least two people (and one of them has to be a parent), or else they will spend the entire show talking.
- Unfortunately, Mom does not get to sit right next to Dad.
- During the movie Alan whispers a secret about Randy into Noreen's ear. There are three seats between Alan and Randy.
- Randy is sitting at one of the ends.

Answer Check

The family was seated as follows:

Randy | Shelley | Mom | Noreen | Alan | Dad

If your answer does **not** match ours,

- did you write the names in the reverse order? That is also correct.
- did you read all of the clues before making your decisions?
- did you try using a table or chart to keep track of your thinking?

If any of those ideas help you, you might *revise* your answer, and then leave a *comment* that tells us what you did. If you're still stuck, leave a *comment* that tells us where you think you need help.

If your answer **does** match ours,

- have you clearly shown and explained the work you did?
- are you confident that you could solve another problem like this successfully?
- did you make any mistakes along the way? If so, how did you find and fix them?
- are there any hints that you would give another student?

Revise your work if you have any ideas to add. Otherwise leave us a *comment* that tells us how you think you did—you might answer one or more of the questions above.

Our Solutions

The key concept of this problem is logical reasoning.

Method 1: Read, Guess, and Check

I started by thinking of the six chairs. I tried putting names on the chairs to see if they followed the rules.

Because Randy was sitting on an end, I put him on the left end. I placed Dad on the right end because I knew that he wanted to be seated as far away from Randy as possible. I might have to move him later if it turns out that he can't be *that* far away (the clue just says he *wants* to be far away, not that he *is*).

I knew that Alan was in the fifth seat from the left because it stated in the clues that there were three seats between Alan and Randy.

I placed Noreen in the fourth seat from the left because Alan whispered a secret about Randy in her ear. I couldn't put her in the sixth seat because she doesn't like to sit on the ends (so Dad gets to stay for now).

I put Shelley in the second seat from the left because I knew that there had to be two seats between her and Alan.

I then put Mom to the right of Shelley because there had to be two people between Shelley and Alan and at least one of them had to be a parent, and Dad would rather be further away if possible.

The family sits in this order from left to right:

Randy, Shelley, Mom, Noreen, Alan, Dad

It didn't seem like that order contradicted any of the clues, but I went back through to check, since I had to guess for some of the clues.

Clue a: Dad and Randy couldn't be any farther apart.

Clue b: Noreen is not on an end.

Clue c: There are two people between Shelley and Alan, and one of them is a parent.

Clue d: Mom is not sitting next to Dad.

Clue e: There are three seats between Randy and Alan (Shelley, Mom, Noreen). Alan is next to Noreen so he can whisper to her.

Clue f: Randy is on one of the ends.

I found a solution; I know it works, and it seems like the most logical one that would work. I don't know if it's the only one that can work.

Method 2: Using Clues Out of Order → f, e, b, c, a, d

We have six people to put in a row of six (or more) seats. We read all the clues and then decided which one we should start with. At each step we wrote the name in the position we had decided would work given the information in the clue.

Clue (f): we can place Randy on one of the ends. For now we just put him on one of the ends to see what happens. For now the other five seats are represented by numbers:

Randy 2 3 4 5 6

Clue (e) tells us that Alan and Noreen are seated together, and there are three seats between Alan and Randy.

Randy 2 3 (Noreen) Alan (Noreen)

Clue (b) helps us definitely place Noreen since she doesn't want to potentially sit next to a stranger.

Randy 2 3 Noreen Alan 6

Clue (c) tells us that there are at least two people between Alan and Shelley and one of them is a parent.

Randy Shelley (Mom/Dad) Noreen Alan 6

Clue (a) tells us that Dad wants to sit as far from Randy as possible, so that helps us finalize the seating.

Randy Shelley Mom Noreen Alan Dad

We don't really need **Clue (d)**, but it does help us check since Mom and Dad didn't end up together.

This shows that if Randy sits on the left side, this is the only possible arrangement of the 6 family members in 6 seats. I think that if Randy sits on the right, we would get the same seating, just flipped around.

Method 3: Considering Each Clue in Order

I read through each clue and tried to draw a picture to show what it meant.

Clue a: I don't really know what "as possible" means in this clue, but the farthest away they could be is 4 seats between them:

R _ _ _ _ D or D _ _ _ _ R

Clue b:

_ N _ _ _ _ or _ _ N _ _ _ or _ _ _ _ N _

Clue c:

A _ _ S _ _ or _ A _ _ S _ or _ _ A _ _ S

or

A _ _ _ S _ or _ A _ _ _ S or S _ _ A _ _

or

_ S _ _ A _ or _ _ S _ _ A.

And in the between blanks at least one has to be an M or a D.

Clue d: There are too many possibilities to draw, but one thing we know is you can't have Mom and Dad being the only two people between Shelley and Alan.

Clue e: Alan is probably sitting next to Noreen, and there are three seats between him and Randy:

A N _ _ R _ or _ A N _ _ R

or R _ _ N A _ or _ R _ _ N A.

Clue f:

R _ _ _ _ _ or _ _ _ _ _ R

Clue f eliminates some of the possibilities from clue e, so we're down to:

_ A N _ _ R or R _ _ N A _

Adding in what we know from clue d, we know we can only have _ A _ _ S _ or _ S _ _ A _ , which means we're down to:

_ A N _ S R or R S _ N A _

All that's left is to place Mom and Dad. In clue a we learned that Dad wants to sit as far away from Randy as he can, which I thought meant both of them on the ends, and it seems like that'll work. Then there's only one place left for Mom. Putting Dad in the middle would probably violate clue a, since he could be farther away. So the only two possibilities must be:

D A N M S R or R S M N A D

Teaching Suggestions

One idea that I've used with students is to provide cut-outs but I've done that more with logic problems that involve more "things" than just people. For example, the problems that involve the people and their sporting equipment and the house they live in and you have to try to match who has what and at the same time determine where they live. In comparison, perhaps colored markers or just recording as we've demonstrated in the sample solutions might be enough of a visual to help students think about what's happening in the problem.

Another fun idea that came to mind is to make necklaces to display the name of the six characters in the problem and have six students "act out" each of the clues.

For this particular problem there is a fine line between "explaining the process" versus providing a "check" that something worked. Using manipulatives or drawing diagrams or acting out the seating arrangements might help focus students back to the information that each clue provides which in turn could help them explain the process. Once they've decided on their answer, checking and verifying that it worked could be their last step.

Resist the urge to give direct instructions on a specific approach. Ask students to paraphrase the problem to check on their understanding before they begin working on it. Ask questions that help them understand the language of the problem, visualize it, and discover patterns. Good questions help students clarify their thinking and give you useful information as well.

The questions in the Answer Check, above, might serve as good prompts to help students make progress. Encourage students to use a strategy that works for them. You can see from the various methods that we have thought to use for this problem that there are many ways to approach this problem. And, we may not have thought of them all!

Scoring Rubric

On the last page is the **problem-specific rubric**, to help in assessing student solutions. We consider each category separately when evaluating the students' work, thereby providing more focused information regarding the strengths and weaknesses in the work.

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Sample Student Solutions
Focus on Completeness

In the solutions below, we've focused on students' "completeness" of the problem, meaning that the student has explained all the steps taken to solve the problem. Because this problem focuses on logical reasoning, students might think that all they have to explain is how their solution fit the clues without discussing how they reasoned through the problem. Deciding which clue to follow next turned out to be an important part of solving this problem. If the clues were read and used in the order they were given it was also important to make sure one of the placements didn't contradict another clue.

Gian
age 11
Completeness
Novice

The order is (from left to right) Dad, Alan, Noreen, Mom, Shelley and Randy (or vice versa)

I read each step one at a time and added it into the order:

Step 1: Dad Randy

And so on.....

I notice that Gian has started an organized way to explain his thinking. I wonder if I can get him to say more about the main body of the problem.

I might ask him to say which clue led him to write his statement in step 1 and ask him what his next step might be.

Adam
age 10
Completeness
Novice

The seating at the theater was Randy, Shelley, Mom, Noreen, Alan, and Dad.

First I read the clues. these are the steps...

1. First Randy and Dad are separated as far as possible.
2. then, Noreen has to sit in the middle of the two end seats.
3. Alan and Shelley need to be seperated by two people.
4. Mom and Dad don't get to sit next to each other.
5. Alan and Noreen sat next to each other. Alan is three seats from Randy.

By stating the clues in his own words Adam has given us some idea about what he was thinking which is a good first step.

I wonder why he hasn't considered the last clue and I wonder what seating possibilities he considered as he read each clue.

Morgan
age 13
Completeness
Apprentice

The order goes Dad Alan noreen mom shelly and randy.

At first I started to do a chart but then I relized that would not work. So I made this type of visual D _ _ _ _ R because It says that Randy and Dad want to be as far apart as possible. Then I figured that since Alan and Shelly had to be two spaces apart so..

D _ _ _ _ _ R then The problem said that noreen sat next to a s A s

Alan and that there were three seats between Alan and Randy

D _ _ _ _ _ R then only mom was left so she had to sit in the empty a n s seat

It's great that Morgan included the fact that she tried to make a chart but then changed her mind. Interestingly other students used charts to help them think about the problem. I wonder what she'd think about if shown those charts after she has had time to work more on her solution.

She has a good start and with some questions, I think she will be able to add in more of her thinking. For example, why does she have A and S in two places? How did she finally decide?

Maureen and Rachel
age 13

Completeness
Apprentice

This is the order that the family sits in at the movies...Dad, Alan, Noreen, Mom, Shelley, then Randy.

To solve this problem we first read the information many times to get an idea in our head about the order that they sat in. Then we drew a picture of six movie seats in a row and started to work out the clues into the picture. We did this by using the first letter of each name and writing the letter of that person on each movie seat that we thought it went in. Then once we had all the letters in a seat we checked it by reading the clues and making sure each one fit our picture. At the end we figured out that the order was... Dad, Alan, Noreen, Mom, Shelley, then Randy!

Maureen and Rachel have described their general process but I would love to know some of the details.

I would start by asking them to say more about how they decided where to put the names the first time around. For example, who did they seat first? Who was second? Could they keep going?

Lindsey
age 12

Completeness
Apprentice

Dad sits on the left end, Alan sits next to him, Noreen sits next to Alan and in one of the middle seats, the Mother sits next to her also in one of the middle seats, Shelley sits next to mom, and Randy sits on the last right side of the seats. (or on the right side end)

- 1) I figured out that Dad doesn't like to sit next to Randy so I put them on the 2 ends.
- 2) Alan and Shelley need to be seperated so I put Alan next to Dad, and Shelley next to Randy.
- 3) Mom doesn't sit next to Dad so she is by Shelley.
- 4) Alan whispers a secret into Noreen's ear so Noreen is next to Alan.

Here is what they would look like at the movies:

(D)(A)(N)(M)(S)(R)

D=Dad

A=Alan

N=Noreen

M=Mom

S=Shelley

R=Randy

Lindsey has done a nice job paraphrasing the clues. I wonder if she could add details to explain how she accounted for her decisions.

For example, how did she decide to put Alan next to Dad? Why not put him near Randy?

Melanie
age 13

Completeness
Practitioner

Randy is in seat one, Shelly is in two, Mom is in three, Norreen is in four, Alan is in five, and Dad is in six.

To solve this problem I used logical reasoning. I started by putting Randy in seat one. That would mean that Alan had to be in seat 5 because there has to be three seats between Alan and Randy. If Alan whispers a secret into Norreen's ear then they have to be sitting next to each other. Norreen doesn't like to sit on the end so she would have to be in seat four. There are two seats between Alan and Shelly so Shelly has to be in seat two. Shelly and Alan have to have an adult between them. Dad wants to be as far as possibel from Randy so he can't be the adult to sit between Alan and Shelly. That puts Dad in seat six. This means Mom has to sit in seat three. This is a diagram of what the seating will look like.

/ Randy / Shelly / Mom / Norreen / Alan / Dad
/ _____ / _____ / _____ / _____ / _____ / _____ /

I like the diagram that Melanie has included.

She has explained most of her process although I wonder a little why she put Randy in seat one. I would ask her to include something about that.

Andrew
age 10

Completeness
Practitioner

My answer is Randy, Shelly, Mom, Noreen, Alan, Dad or Dad, Alan, Noreen, Mom, Shelly, Randy.

You are given that Randy sits on one end. Dad wants to sit as far away from Randy as possible so he is probably on the other end. You are also given that Alan whispers a secret in Noreen's ear and that there are 3 seats between Alan and Randy. Alan must therefore be sitting next to Dad. Since Alan can whisper to Noreen she must be next to him.

So far the seating could look like this:

R ? ? N A D or this D A N ? ? R. Since 2 people (at least one must be an adult) must be between Alan and Shelly Mom must be next to Noreen and Shelly must be next to Randy. The arrangement would look like this R S M N A D, or this D A N M S R. Notice that these are mirror images of each other.

P.S. There was a lot of extra info in this problem. All the clues that was really needed were a, c and e.

Andrew uses "probably" to indicate that he was careful as he read and considered that clue.

As he moved to clues that he could make more definite conclusions, he used the word "must" in his statements.

Aspen
age 12

Completeness
Practitioner

From left to right the seating order is Randy, Shelley, mom, Noreen, Alan, and dad. It could also be from left to right Dad, Alan, Noreen, Mom, Shelley, and Randy.

1.) First I read the problem and figured out there were six seats and six family members so I drew six empty seats on my paper.

2.) Then the clue A said that Randy and dad sat as far away as they could from each other because of prior incidences so I drew both of them at opposite ends.

3.) Clue B said that Noreen didn't sit on the outside because she didn't like sitting next to strangers but since Randy and dad were sitting on the ends that information didn't matter to me.

4.) Clue C said that Alan and Shelley had to be separated by 2 people, at least one a parent, I figure that I would put Shelley next to Randy or dad and the same for Alan so I made each of those seats a possibility for each

5.) Clue D said Mom and Dad weren't able to sit next to each other so I gave mom a possibility for one of the two seats in between Alan and Shelley since they needed a parent in between them and mom couldn't sit next to dad.

6.) Clue E said Alan whispers a secret about Randy into Noreen's ear so I figured that Noreen and Alan sat next to each other in order to be able to whisper to each other so I made the two seats in between Alan and Shelley either mom or Noreen. Noreen being the one next to Alan. It also said that there are three seats in between Randy and Alan. I knew that Alan had to be sitting next to dad for there to be 3 seats in between them.

7.) Since I knew where Alan sat I had to put Shelley two seats away from him because of what clue C said which was that Alan and Shelley had to be separated by 2 seats.

8.) The only two people without seats now were Noreen and mom. I put Noreen next to Alan on his left because it says that Alan whispers a secret to her which means that obviously there right next to each other.

9.) The seat for mom worked out because since Shelley and Alan had to be separated by 2 people, one being a parent. Mom was the parent

Some students, like Aspen, have a very complete explanation but can be encouraged to work on clarity. Although her misspellings and typos don't really create a misunderstanding of what she means, if she has time to correct them, that would improve the clarity of her solution.

between both of them.

*My answer to the question can also be in reverse because the order will not be changed.

Joseanne

age 13

Completeness

Expert

The order in which the family sits is: Dad, Alan, Noreen, Mom, Shelley, Randy.

To solve this problem I made an organized list of clues, then I used the trial and error method to finish solving the problem.

Here is an example of my organized list.

1. Dad and Randy must be seated far away from each other.
2. Noreen never sits on the outside.
3. Two people must separate Alan and Shelley, one being a parent.
4. Mom does not get to sit next to dad.
5. Alan is sitting next to Noreen.
6. There are three seats between Alan and Randy.
7. Randy is sitting at one of the ends.

Then I began to use the trial and error method.

Instead of writing their whole names each time I just used the first letter.

Dad = D
Mom = M
Randy = R
Noreen = N
Alan = A
Shelley = S

Since Randy is sitting at one of the ends I put Dad at the other end.

D R

Since there are six people in the family, and there are three seats separating Randy and Alan I put Alan right next to Dad so that the three remaining people could separate Randy and Alan.

DA R

Since two people must separate Alan and Shelley I put Shelley next to Randy.

DA SR

Now only Mom and Noreen are left.

Since Alan whispered something into Noreen's ear that means he was sitting right next to her.

DAN SR

There is only person and one seat left so Mom goes in-between Noreen and Shelley.

DANMSR

After I figured out a seating arrangement I went back to my organized list and checked if I skipped any requirements. Noreen was sitting not sitting at any of the ends and Mom was not sitting next to Dad. All of the requirements were fulfilled. So the order of the seating was Dad, Alan, Noreen, Mom, Shelley, Randy.

Joseanne has done a nice job of paraphrasing the clues, explaining her trial and error method and then went back and checked her answer to make sure that she hadn't ignored any of the requirements.

Briana
age 12

Completeness
Expert

The final order in which they sit at the movie theater is:
Randy, Shelley, Mom, Noreen, Alan, and Dad.
The other order would be that Randy sits in seat one, Shelley in two,
Mom in three, Noreen in four, Alan in five, and Dad in seat six.

In this problem, I was looking for the seating arrangement of a family
of six. In order to find the arrangement, I had to follow the clues.
I used logical thinking and came up with the idea of making a table
to figure out the order/seating.

Step 1. You need to look at the problem, "A family of six goes to
see a movie at the downtown Movie Theater. The family includes Mom,
Dad, and the four kids – Randy, Shelley, Noreen, and Alan. They all
sit in a row. Use the clues below to figure out the order in which
they sit.

- a. Dad wants to sit as far away as possible from Randy because
last time Randy spilled soda pop on him.
- b. Noreen never sits on the outside because she doesn't like
sitting next to strangers.
- c. Alan and Shelley need to be separated by at least two people
(and one of them has to be a parent), or else they will
spend the entire show talking.
- d. Unfortunately, Mom does not get to sit right next to Dad.
- e. During the movie Alan whispers a secret about Randy into
Noreen's ear. There are three seats between Alan and Randy.
- f. Randy is sitting at one of the ends."

You take out all of the important information, like the fact that
they sit in a row with six seats, there are clues in the letters a-f,
and they all have names.

Step 2. You draw a grid that is seven by seven.

Step 3. On the first grid row that goes across, you skip the first
box, and then you write down the names of all the people going
across.

	Mom	Dad	Randy	Shelley	Noreen	Alan

Step 4. You go down the first row, skipping the first box, and you

*I must confess that the
completeness of Briana's
explanation is over the top. I
just couldn't help include it
here because the charts that
she uses are so neatly
presented.*

write the numbers one through six in the boxes that are the number of seats.

	Mom	Dad	Randy	Shelley	Noreen	Alan
1						
2						
3						
4						
5						
6						

Step 5. Then you look at clue a. Dad wants to sit as far away as possible from Randy, because last time Randy spilled soda on him. So you know that the furthest away that they could be would be in seats one and six. So you write y for yes in Dad's seat one row, and put an X for no in the rest of the seats, so that you know that he is already sitting.

	Mom	Dad	Randy	Shelley	Noreen	Alan
1		Y				
2		X				
3		X				
4		X				
5		X				
6		X				

Step 6. Next, you put X's in the rest of the seat one row, so that you know that no one else can sit there, because Dad is already sitting in that seat.

	Mom	Dad	Randy	Shelley	Noreen	Alan
1	X	Y	X	X	X	X
2		X				
3		X				
4		X				
5		X				
6		X				

Step 7. Using those same steps as used in steps five and six, you're going to do Randy's column. You're going to put him in seat 6, by writing a Y in there for yes, and an X for no, in all of the other boxes in Randy's and seat sixes rows.

	Mom	Dad	Randy	Shelley	Noreen	Alan
1	X	Y	X	X	X	X
2		X	X			
3		X	X			
4		X	X			
5		X	X			
6	X	X	Y	X	X	X

Step 8. You now look at clue b. Noreen never sits on the outside because she doesn't like to sit by strangers. There is nothing to do in this, because the two outside seats are already taken by Dad and Randy.

Step 9. You now look at clue c. Alan and Shelley need to be separated by at least two people (and one of them must be a parent), or else they will spend the entire show talking. So you know that one of them will sit in seat five and the other in seat two, because these are the only two seats not taken that have two seats in between. So you can put X's in the slots three and four, because neither one of them can sit there.

	Mom	Dad	Randy	Shelley	Noreen	Alan
1	X	Y	X	X	X	X
2		X	X			
3		X	X	X		X
4		X	X	X		X
5		X	X			
6	X	X	Y	X	X	X

Step 10. You know that Mom and Noreen aren't going to be able to sit in seats two and five, because Alan and Shelley will be sitting there. So you can cross those boxes off for them, because they have to sit in either three or four.

	Mom	Dad	Randy	Shelley	Noreen	Alan
1	X	Y	X	X	X	X
2	X	X	X		X	
3		X	X	X		X
4		X	X	X		X
5	X	X	X		X	
6	X	X	Y	X	X	X

Step 11. Look at the next clue d. Unfortunately, Mom does not get to sit next to Dad. We can already tell this, because either Alan or Shelley will be sitting there, so nothing changes.

Step 12. Look at the next clue e. During the movie, Alan whispers a secret about Randy into Noreen's ear. There are three seats between Alan and Randy. So you now know that Alan has to sit in seat two, so you put a Y there and an X in row five for Alan.

	Mom	Dad	Randy	Shelley	Noreen	Alan
1	X	Y	X	X	X	X
2	X	X	X	X	X	Y
3		X	X	X		X
4		X	X	X		X
5	X	X	X		X	
6	X	X	Y	X	X	X

Step 13. You now know that Shelley has to be in seat five, so you put a Y there, and an X in two.

	Mom	Dad	Randy	Shelley	Noreen	Alan
1	X	Y	X	X	X	X
2	X	X	X	X	X	Y
3		X	X	X		X
4		X	X	X		X
5	X	X	X	Y	X	X
6	X	X	Y	X	X	X

Step 14. You know that Alan had to sit next to Noreen to tell her the secret. So Noreen had to sit in seat three, so you put a Y in there, and an X in seat four.

	Mom	Dad	Randy	Shelley	Noreen	Alan
1	X	Y	X	X	X	X
2	X	X	X	X	X	Y
3		X	X	X	Y	X
4		X	X	X	X	X
5	X	X	X	Y	X	X
6	X	X	Y	X	X	X

Step 15. Mom is left to sit in seat four, because all of the other seats are taken, and that she has to be between Shelley and Alan. So you put a Y in four, and an X in three.

	Mom	Dad	Randy	Shelley	Noreen	Alan
1	X	Y	X	X	X	X
2	X	X	X	X	X	Y
3	X	X	X	X	Y	X
4	Y	X	X	X	X	X
5	X	X	X	Y	X	X
6	X	X	Y	X	X	X

When I went back through to check the problem/seating arrangement, I saw that I could have used other problem solving methods such as: guess and check, pictures, and using manipulatives (cubes to represent the people). All of these are ways you can go back and double-check the seating order.

Then you come out with the answer that Dad sits in seat one, Alan sits in seat two, Noreen sits in seat three, Mom sits in seat four, Shelley sits in seat five, and Randy sits in seat six. This is the order they sit in at the movies that night. The order may also be reversed because the problem did not specifically say which end dad or Randy were to sit on. With clue f, it just states that Randy should be on the end, which we already knew, so there could actually be two answers, and two or more ways of working it. The other order would be that Randy sits in seat one, Shelley in two, Mom in three, Noreen in four, Alan in five, and Dad in seat six. So either way, you have the answer. The only difference is where you put Dad and Randy.

Pre-Algebra Scoring Rubric for *Movie Seating*

For each category, choose the level that *best describes* the student's work

	Novice	Apprentice	Practitioner	Expert
Problem Solving				
Interpretation	does none or one of the things listed under Practitioner	does two of the things listed under Practitioner	Attempts to figure out where each of the six family members will sit in the theater understands that the clues constrain where the family members might sit	There is no Extra on this problem, so there is no way to achieve Expert in this category
Strategy	does not have any ideas about how to solve the problem	has some ideas about how to solve the problem, but isn't quite there	has a strategy that relies on skill, not luck might use the method of working through all the clues OR might use a guess and check method where they show guesses and explain how the clues are violated and then move to another guess that seems motivated by the last incorrect guess	an Expert might try two different paths to the answer
Accuracy	has made many errors	makes a few errors that lead to an incorrect answer	accounts for six seats and uses the clues logically	[not normally available for this category]
Communication				
Completeness	has written nothing that tells you how they found their answer	shows work without an explanation or explains everything without showing the numbers	attempts to explain how they found the correct seating and not just showing how one works	adds in useful extensions and further explanation of some ideas involved
Clarity	explanation is very difficult to read and follow	doesn't include enough information for another student to follow another student wouldn't be able to follow their explanation entirely long and written in one paragraph lots of spelling errors/typos	explains all of the steps mentioned in such a way that another student would understand makes an effort to check their formatting, spelling, and typing (a few errors are fine)	formats things exceptionally clearly answer is very readable and appealing
Reflection	<i>The items in the columns to the right are considered reflective, and could be in the solution or the comment they leave after viewing our answer:</i> does nothing reflective	checks their answer (not the same as viewing our "answer check") reflects on the reasonableness of their answer does one reflective thing	connects the problem to prior knowledge or experience explains where they're stuck summarizes the process they used does two reflective things	comments on and explains the ease or difficulty of the problem revises their answer and improves anything does three or more reflective things or an great job with two