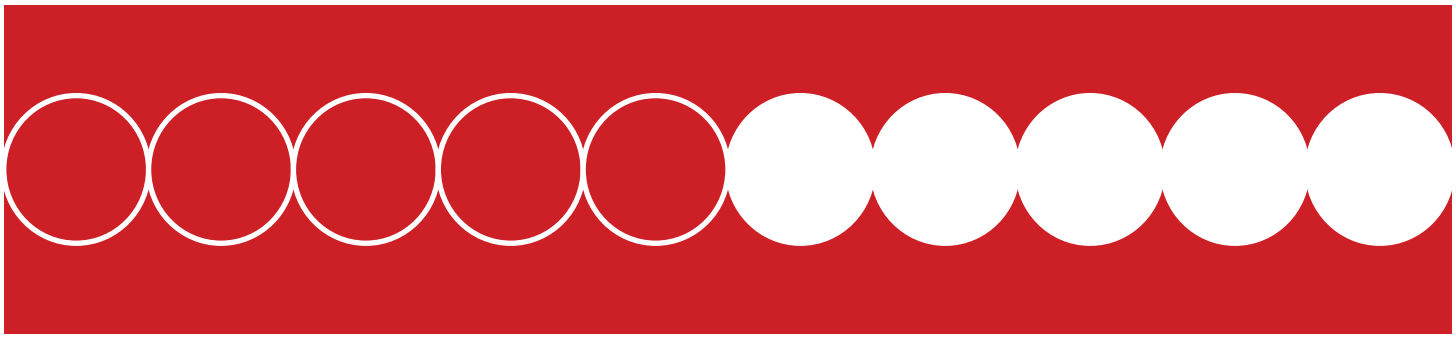
therekenrek



Learning to Think Mathematically with the Rekenrek

Supplemental Activities

Jeffrey Frykholm, Ph.D.

Learning to Think Mathematically with the Rekenrek, Supplemental Activities
A complementary resource to the *Learning to Think Mathematically* series
by Jeffrey Frykholm, Ph.D.

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The Math Learning Center is a nonprofit organization serving the education community.
Our mission is to inspire and enable individuals to discover and develop their mathematical
confidence and ability. We offer innovative and standards-based professional development,
curriculum, materials, and resources to support learning and teaching.

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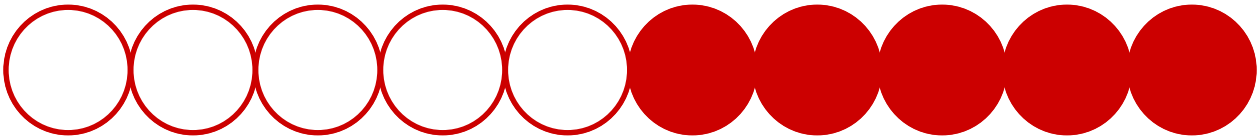
Learning to Think Mathematically with the Rekenrek

Supplemental Activities

Authored by
Jeffrey Frykholm, Ph.D.



A complementary resource to the *Learning to Think Mathematically* series

Book Overview

This compilation of activities has been developed as a supplemental resource to the ***Thinking Mathematically*** series independently published by Cloudbreak Publishing (www.thinkingmathematically.com). The activities in the book are intended to build upon the contexts and learning objectives found in the series book entitled: *Learning to Think Mathematically with the Rekenrek*.

Departing somewhat from the first book, these activities are less about the mechanics of using the rekenrek itself, and more about the application of the model to solve problem contexts that are imaginable and accessible to students. The purpose of this book, then, is to provide teachers with student-ready activities that can be printed, projected or modeled for immediate use in the classroom setting.

The problems highlight contexts (e.g., ice cream cones, trains, and busses) that motivate the key mathematical principles that are readily accessed through the rekenrek model (e.g., cardinality, one-to-one relationships, part-part-whole relationships, subitizing, etc.). The illustrations in the problems match the structure of the rekenrek, particularly its groupings of 5, 10, and 20. The problems themselves do not feature a rekenrek model per se; however, the problems have been designed such that teachers and students can use a rekenrek to model the problems, discuss thinking strategies, and make connections between key mathematical insights that arise in the flow of classroom conversation. Therefore, while the rekenrek manipulative is not featured in the problems explicitly, the intention of this supplemental resource is to provide teachers with exercises for which the rekenrek model can be used very easily to represent the problem, model thinking and contribute to students' solution strategies.

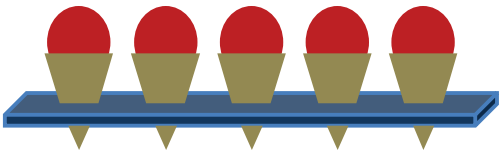
If you are new to the Rekenrek manipulative, we recommend that you explore the ***Learning to Think Mathematically with the Rekenrek*** book (http://www.thinkingmathematically.com) before using these activities with your students, as it provides a thorough introduction and orientation to the rekenrek manipulative. After using the rekenrek as a teaching tool for many years, we are convinced that within a short period of time, both teachers and students that are new to the model quickly gravitate to it, and reap the rewards (toward the development of mathematical understanding in young children) that are inherently available in the model.

We recommend that each child in your classroom have his or her own rekenrek model not only for the exercises in the ***Thinking Mathematically*** series, but also as a tool that will be instrumental in helping your students develop mathematical reasoning strategies, even as young children. There is no more powerful mathematical model for young children who are actively developing their mathematical insights and intuitions – the foundation upon which they will base the framework for their understandings and explorations of mathematics throughout their lives. If you do not have rekenrek manipulatives for your students, you may purchase inexpensive rekenreks for your children on the thinkingmathematically.com website.

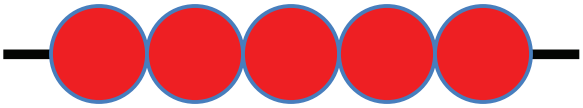
How to Teach The Activities in this Book

The problem sets in this resource are intended to be stand-alone activities. While the exercises grow in complexity in general from the start to the end of the book, it is not necessary to begin with the first set of problems, and progress sequentially to the last. There are 14 sets of exercises in the book, clustered into 3 organizing levels of complexity. The first set deals with numbers in the rage of 0 - 5. The second problem set contains contexts that engage students with number relationships between 0 - 10. Finally, the last set of problems challenges students to extend their thinking to number relationships between 0 - 20.

You will immediately see the connection between the problem illustrations and the rekenrek model itself. The first 4 activities are designed to help children develop cardinality and one-to-one relationships for numbers between 0-5. A tray of 5 ice cream cones is used to motivate the mathematical thinking behind the problems. We recommend that you use a rekenrek model for these problems that contains 5 beads of the same color. (Unlike most commercial models, the rekenreks that we have made available on the Thinking Mathematically website are adaptable – one can easily change the number of beads on the strings to model problems in the range of 0-20.)

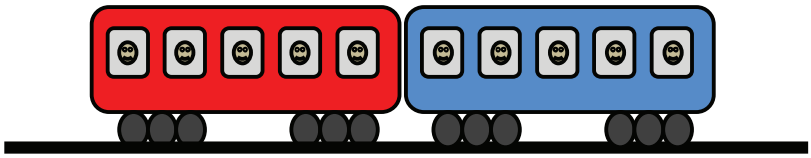


Tray of 5 ice cream cones



Corresponding Rekenrek Model

The second set of exercises (Activities 5-8) focus on number relationships in the range of 0-10. Again, we recommend that students have a 10-bead rekenrek model readily available as they engage these problems. The design of these problems, as well as the 10-bead rekenrek itself, are intended to help children *subitize* – i.e., to recognize the number of items present in a group without having to count each individual item. This is a critical, and powerful, strategy that young children must master early in their mathematics pathway. The context that is used to motivate these fundamental ideas in the range of 0-10 is that of two train cars, each with 5 passenger windows of a different color.

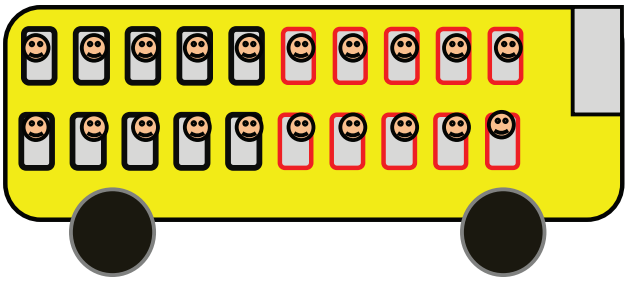


Two train cars, five windows in each car

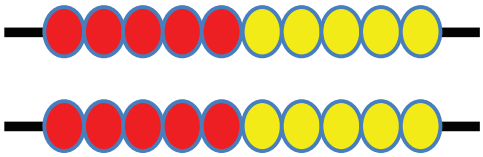
Corresponding Rekenrek Model

The final set of problems (Activities 9-14) focus on numbers in the range of 0-20. Much like the previous problem sets, the mathematical content emphasized in these activities includes subitizing on groups of 5 and 10, as well as part-part-whole relationships to 20. Students have numerous opportunities to work with number combinations to 20, as well as to explore the comparison model of subtraction.

Again, the importance of the rekenrek model in solidifying these fundamental mathematical concepts can not be emphasized enough. If children become comfortable with numbers and their relationship to others in the range of 0-20, they will be able to extend their understanding and strategy use to numbers in a much larger range. The success children have in conceptualizing, modeling, and solving the problems in this set of activities will be an indication of how well each child will be able to later engage and succeed in developing strong number sense and computational fluency. These problems make use of a double-decker bus as the motivator for these essential mathematical concepts. Use of the corresponding rekenrek model (20 beads, two strings of 10) is fundamental to the development of fluency in this range of numbers.



Double-Decker Bus, 2 rows of 10 (5+5)



Corresponding Rekenrek Model

Our recommendation for the teaching of these problems is that both teacher and student model each problem with a rekenrek to begin the solution strategy process. Recall the importance of encouraging children not to count every person in the window… every bead. With the right encouragement and practice, students should began rather readily to recognize the groups of 5 and 10 that are inherent in the problems, and then build from that recognition. Seven is seen as (5+2)… Seventeen may be seen as (10 + 5 + 2)… Students should be able to see groups of 10 on the rekenrek model both horizontally (5 red, plus 5 yellow), or vertically (5 red, plus 5 red). As you model these problems, take every opportunity to encourage children to subitize – to avoid counting every bead (or ice cream cone, or person in the window, etc.) whenever possible.

We hope that these activities will provide teachers with powerful contexts for learning, and that children will enjoy the confidence that comes from a solid understanding of these fundamental number relationships.

Rekenrek: Supplemental Activities
Content Focus

Problem Set 1: Developing number relationships, 0-5

The activities in this section help students form relationships and understanding of numbers in the range of 0-5. This includes cardinality, and beginning part-part-whole relationships. Students should become comfortable with number combinations up to five.

Problem Set 2: Developing number relationships, 0-10

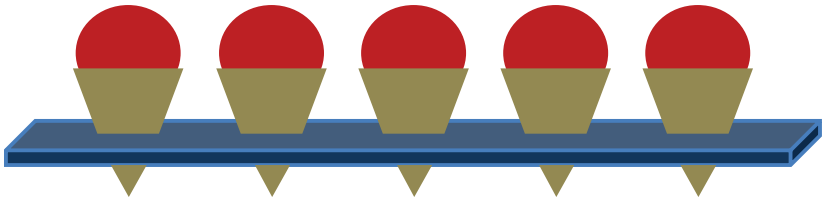
The activities in this section help students form understandings of number relationships and combinations in the range of 0-10. The activities in this section make use of two passenger train cars that have 5 windows each. By exploring how many passengers are in the windows, students explore mathematical concepts including cardinality, one-to-one relationships, part-part-whole relationships, and number combinations to 10. The primary goal in these activities is to encourage students to subitize… to recognize a group of 5 or 10 objects (beads) without having to count each bead. For example, the number 7 might be thought of as the quantity of ***five***, and ***two*** more.

Problem Set 3: Developing number relationships, 0-20

The activities in this section extend the previous learning to include numbers in the range of 0-20 by using a double-decker bus as the motivating context. Number combinations to 20 are highlighted, as well as part-part-whole relationships, doubles, near doubles, and the comparison model of subtraction. The process of ***subitizing*** is, again, a vital component of this problem set.

Activity 1: How Many Ice Cream Cones?

The Scoop ice cream store sells single scoop cones, with strawberry ice cream. The store has a tray that **can hold 5 cones at a time**.



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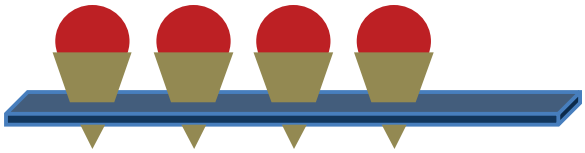
1. How many ice cream cones in the tray? ANSWER_____



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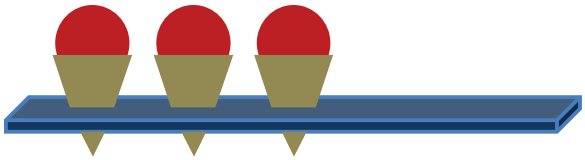
2. How many ice cream cones in the tray? ANSWER_____

---

3. How many ice cream cones in the tray? ANSWER_____



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4. How many ice cream cones in the tray? ANSWER_____

Activity 2: Make 5… How Many More?

5 friends want ice cream cones.
How many more ice cream cones must be made to have 5 ice cream cones?

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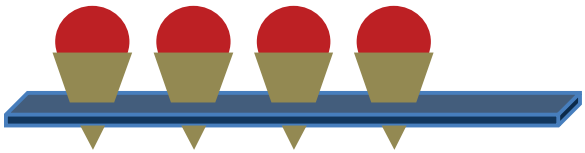
1. How many more to make 5 cones? ANSWER _____



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2. How many more to make 5 cones? ANSWER _____

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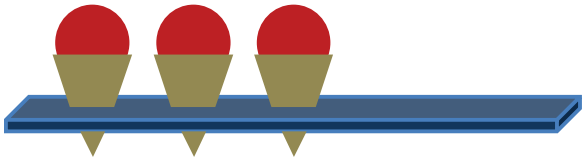
3. How many more to make 5 cones? ANSWER _____



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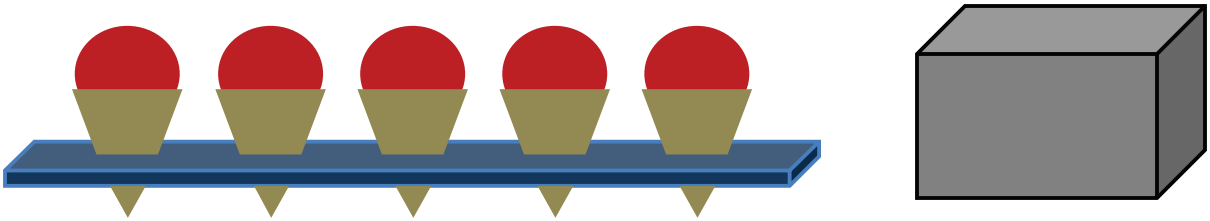
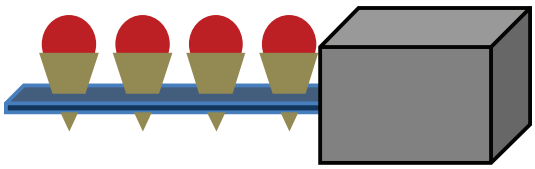
4. How many more to make 5 cones? ANSWER _____

Activity 3: How Many are Behind the Box?

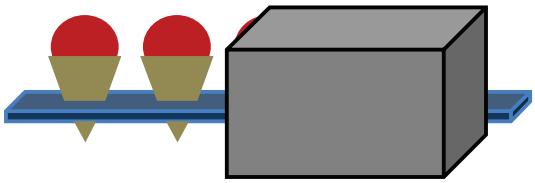
A worker puts a box on the counter in front of the tray of 5 cones. How many cones are behind the box?



1. How many ice cream cones are behind the box? ANSWER _____

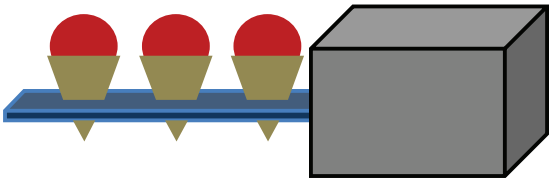


2. How many ice cream cones are behind the box? ANSWER _____

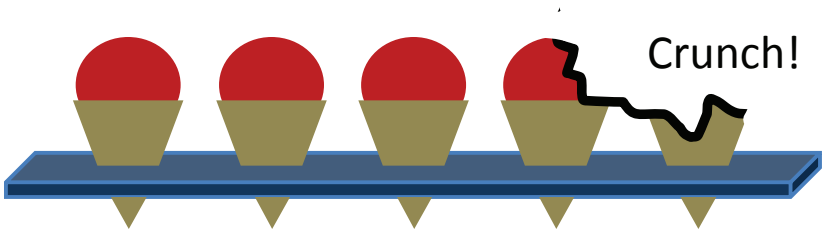


3. How many ice cream cones are behind the box? ANSWER _____

4. How many ice cream cones are behind the box? ANSWER _____



Activity 4: The Dog Ate my Ice Cream!



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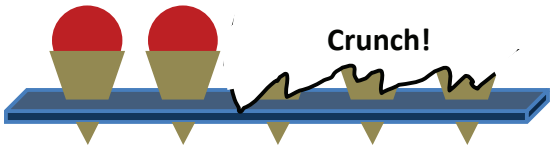
1. **How many cones did the dog eat?** **ANSWER _____**



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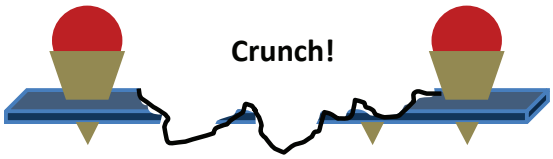
2. **How many cones did the dog eat?** **ANSWER _____**



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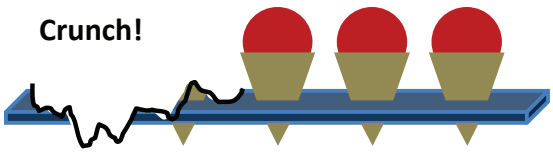
3. **How many cones did the dog eat?** **ANSWER _____**



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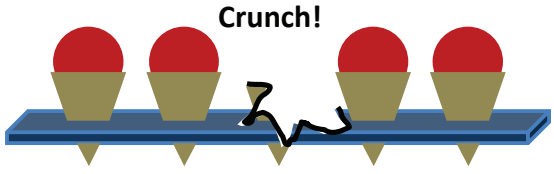
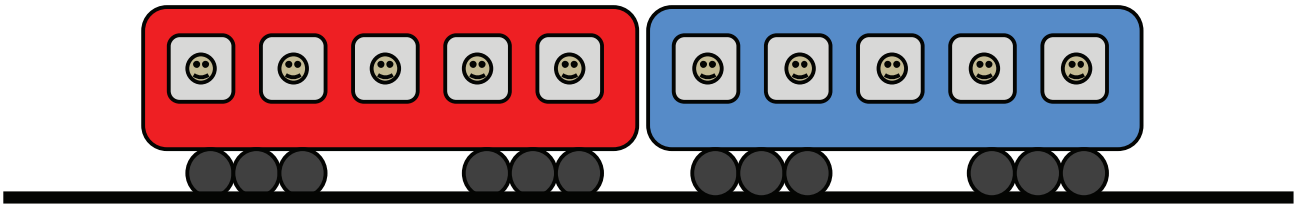
4. **How many cones did the dog eat?** **ANSWER _____**

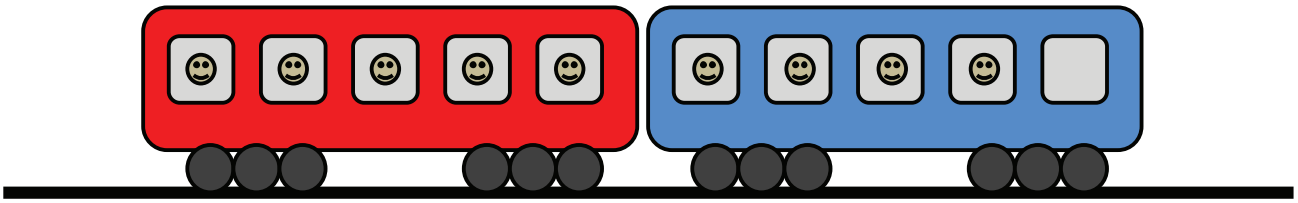


Activity 5: How Many on the Train?

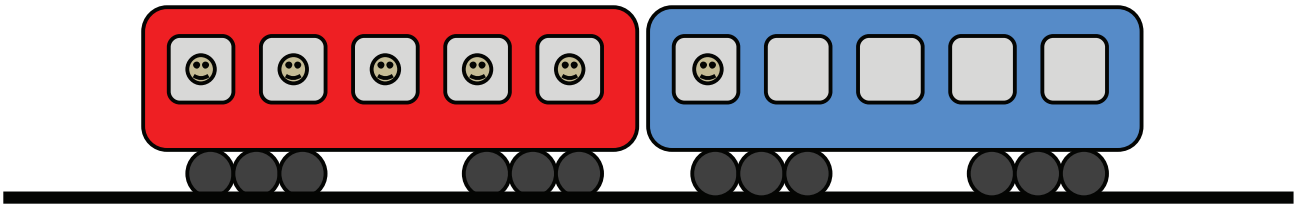
1. How many people are on the train? ANSWER: _____



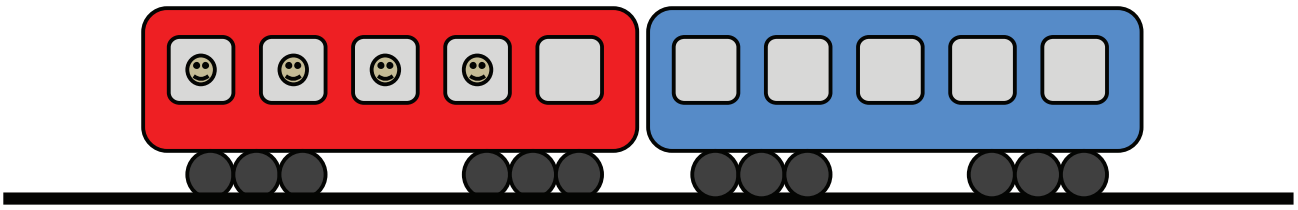
2. How many people are on the train? ANSWER: _____



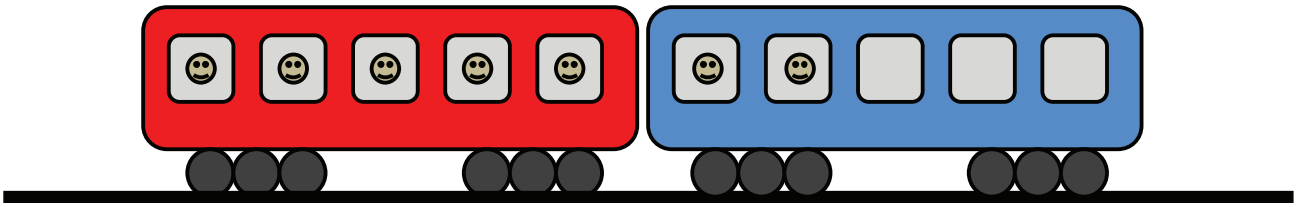
3. How many people are on the train? ANSWER: _____



4. How many people are on the train? ANSWER: _____

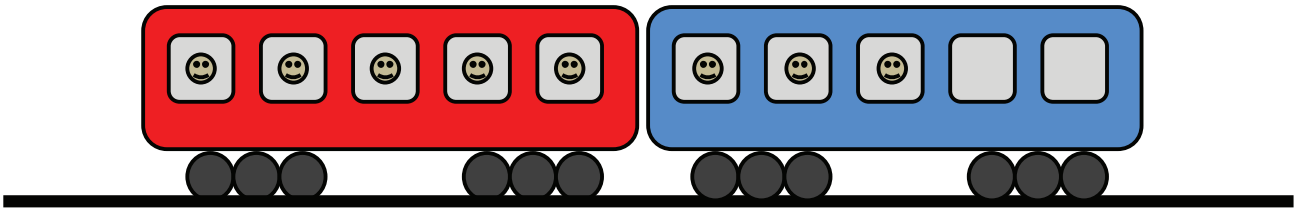


5. How many people are on the train? ANSWER: _____

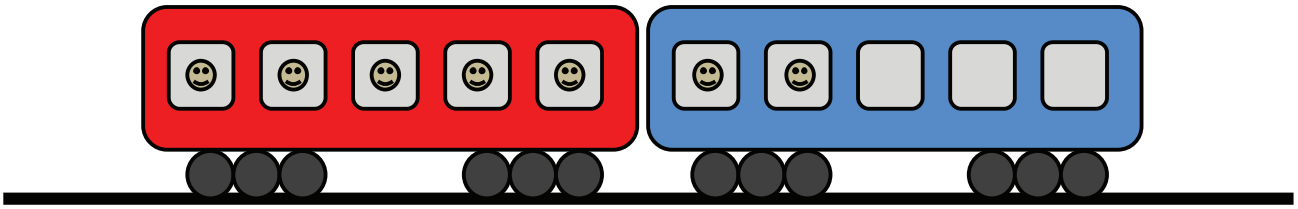


Activity 5 (Continued): How Many on the Train?

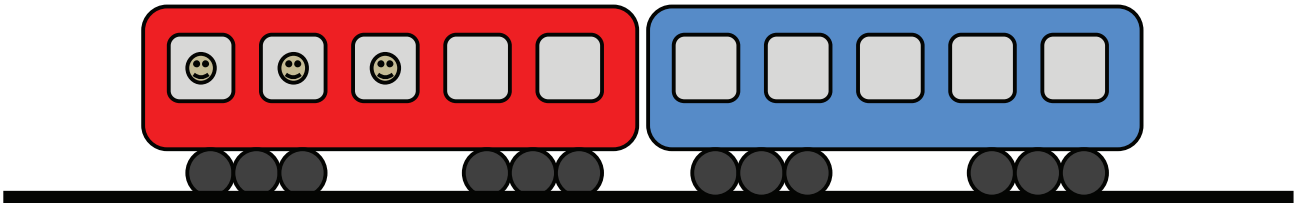
6. How many people are on the train? ANSWER: _____



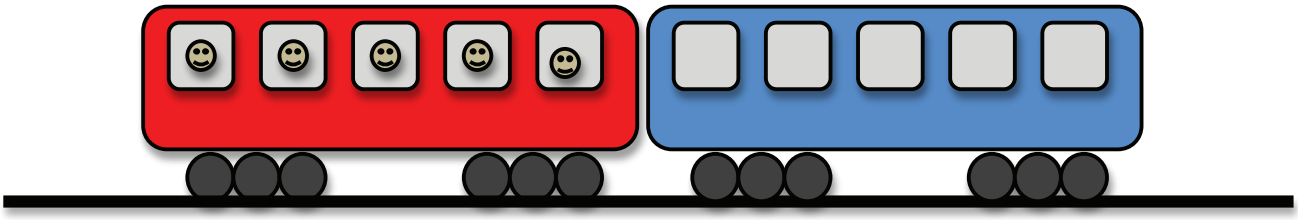
7. How many people are on the train? ANSWER: _____



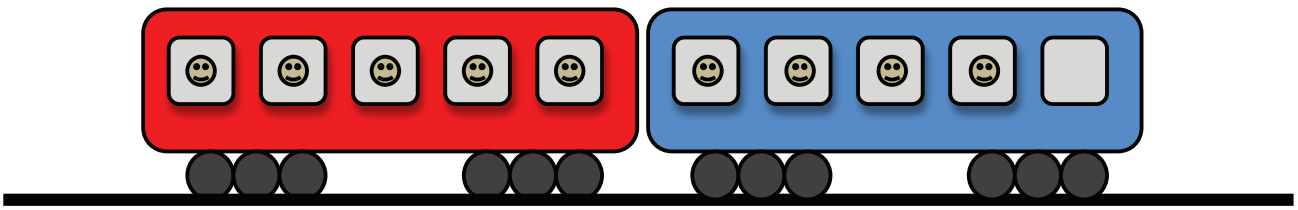
8. How many people are on the train? ANSWER: _____



9. How many people are on the train? ANSWER: _____

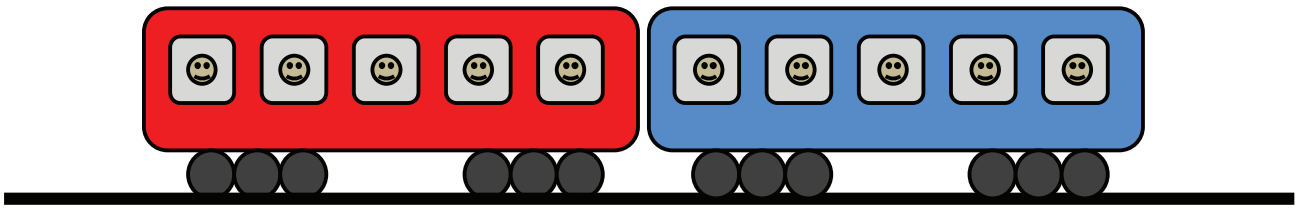


10. How many people are on the train? ANSWER: _____

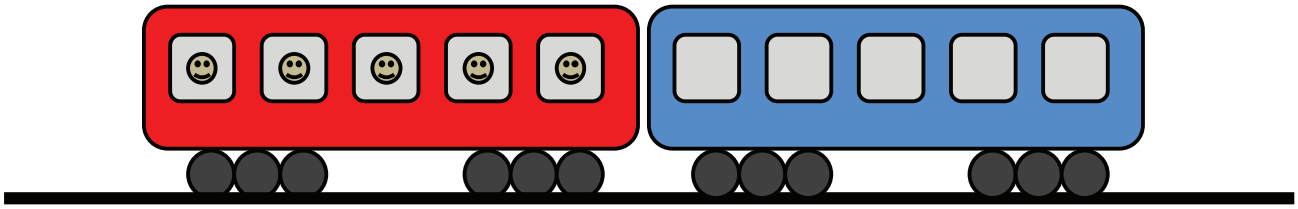


Activity 6: How Many More to Make 10?

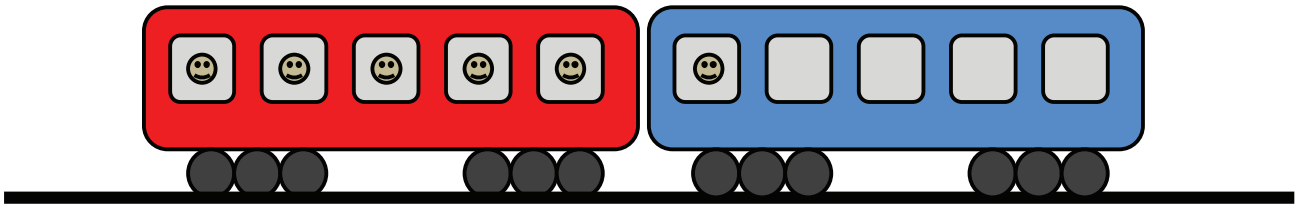
1. How many people on the train? ANSWER_____
   How many more to make 10? ANSWER_____



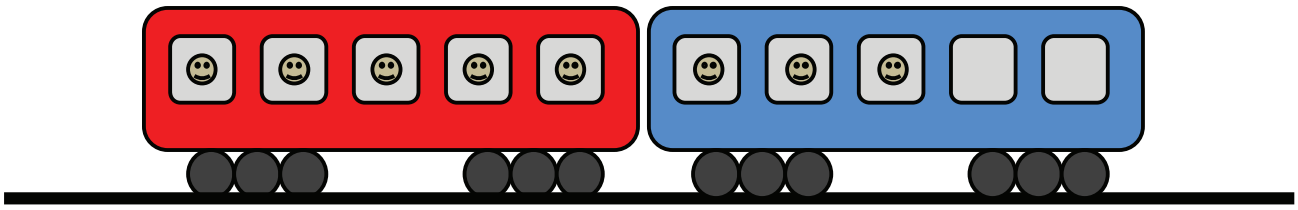
2. How many people on the train? ANSWER_____
   How many more to make 10? ANSWER_____



3. How many people on the train? ANSWER_____
   How many more to make 10? ANSWER_____

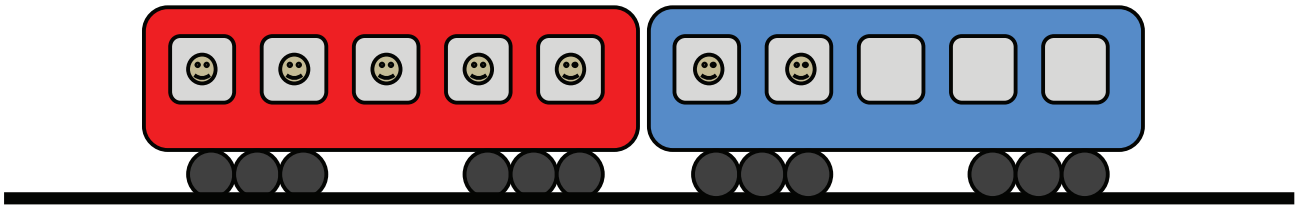


4. How many people on the train? ANSWER_____
   How many more to make 10? ANSWER_____

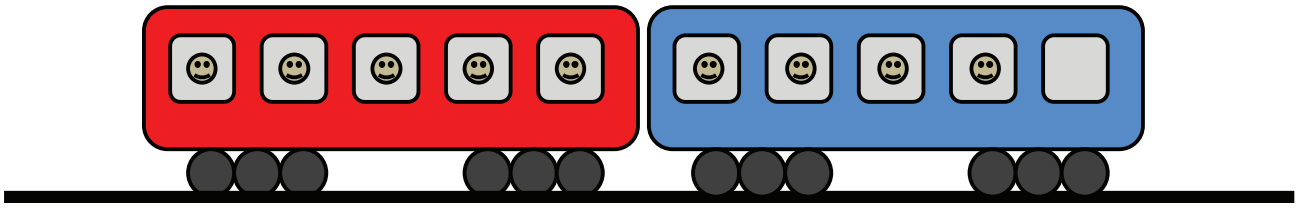


Activity 6 (Continued): How Many More to Make 10?

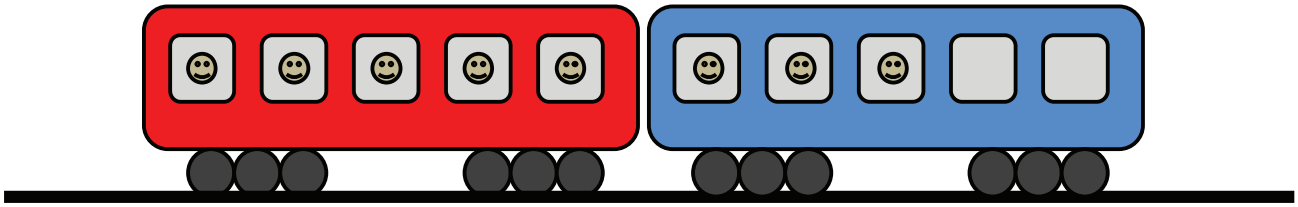
5. How many people on the train? ANSWER_____
How many more to make 10? ANSWER_____



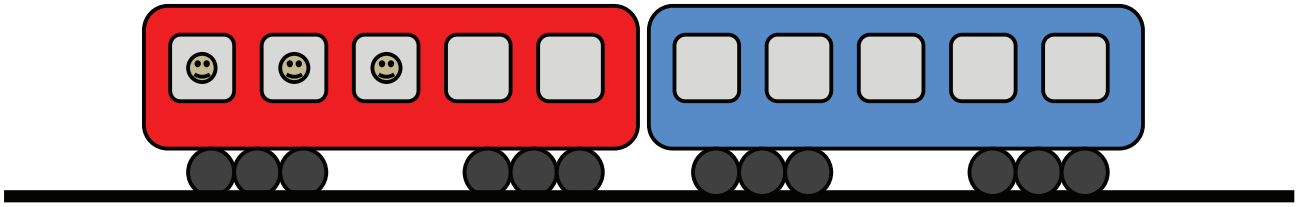
6. How many people on the train? ANSWER_____
How many more to make 10? ANSWER_____



7. How many people on the train? ANSWER_____
How many more to make 10? ANSWER_____

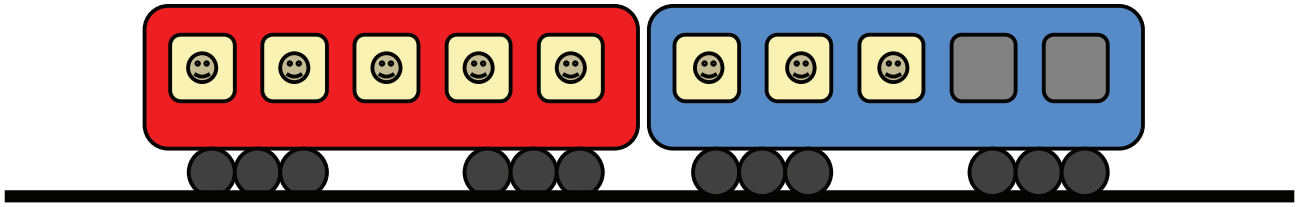


8. How many people on the train? ANSWER_____
How many more to make 10? ANSWER_____

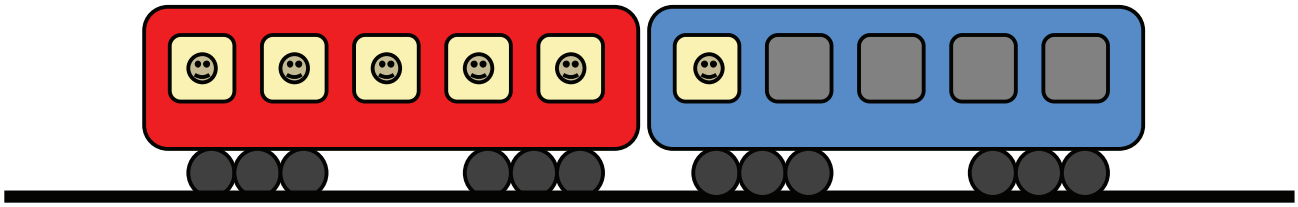


Activity 7: How Many People Sleeping?

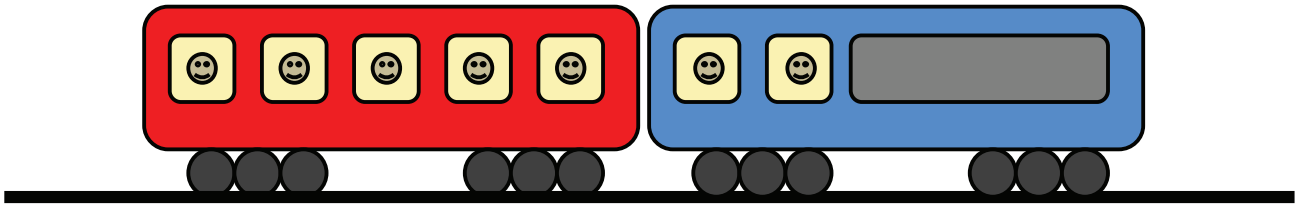
1. How many people are awake? ANSWER_____
   How many people are sleeping? ANSWER_____



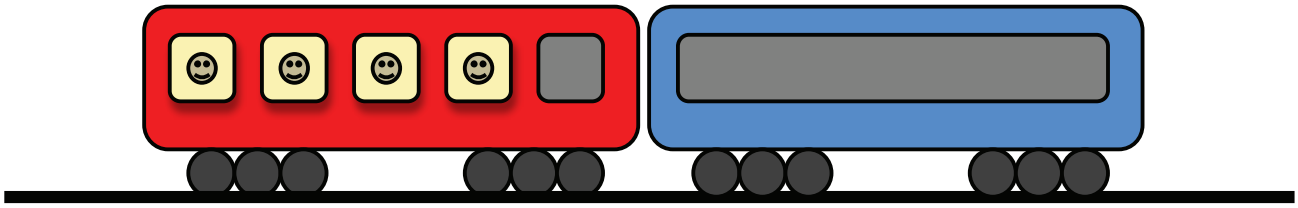
2. How many people are awake? ANSWER_____
   How many people are sleeping? ANSWER_____



3. How many people are awake? ANSWER_____
   How many people are sleeping? ANSWER_____



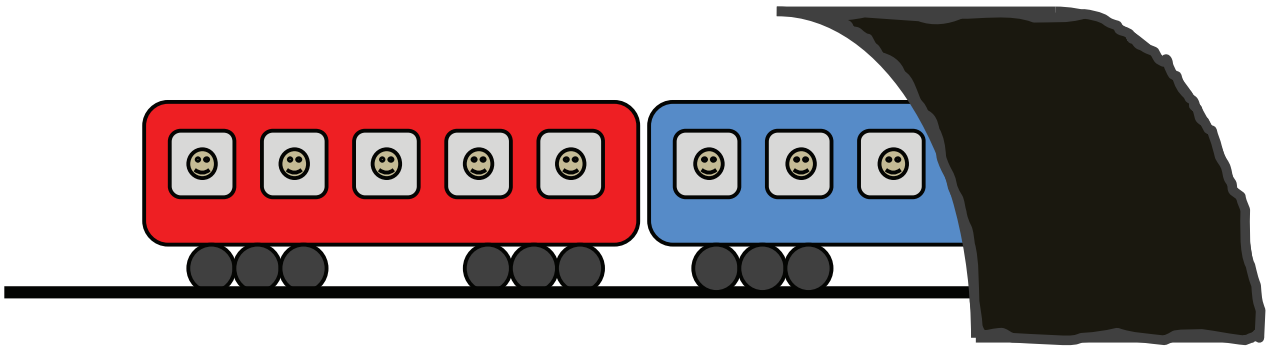
4. How many people are awake? ANSWER_____
   How many people are sleeping? ANSWER_____



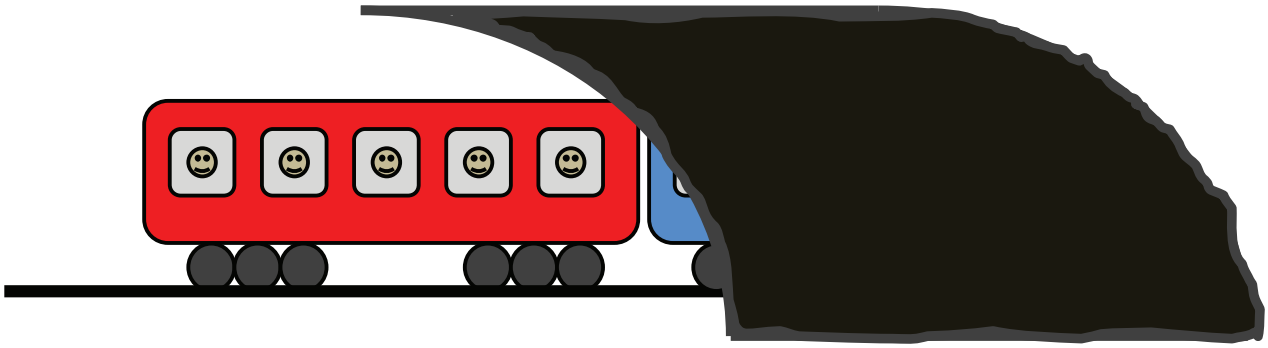
Activity 8: How Many People in the Tunnel?

The train is full with 10 people. How many are already in the tunnel?

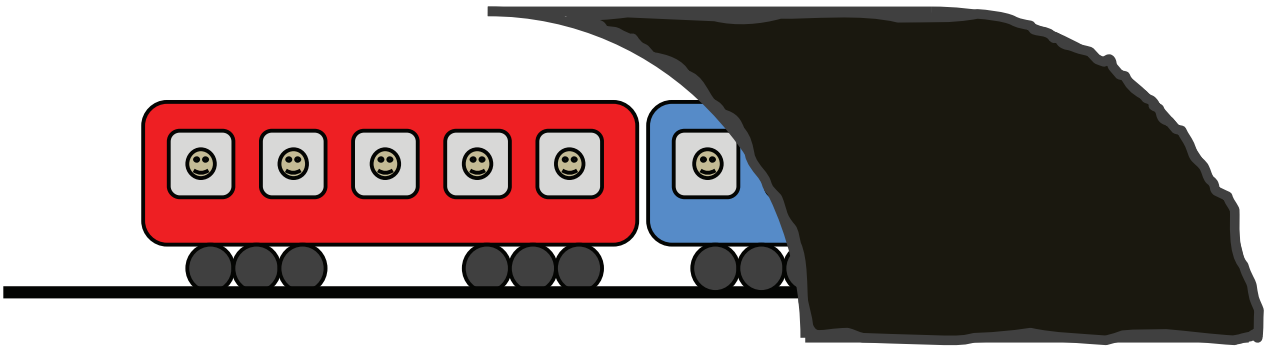
1. How many people are in the tunnel? ANSWER: _____



2. How many people are in the tunnel? ANSWER: _____

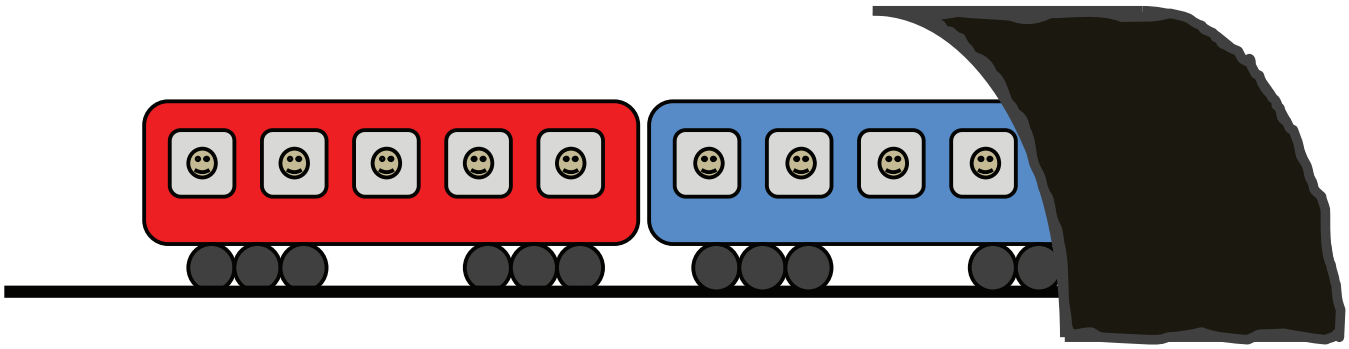


3. How many people are in the tunnel? ANSWER _____



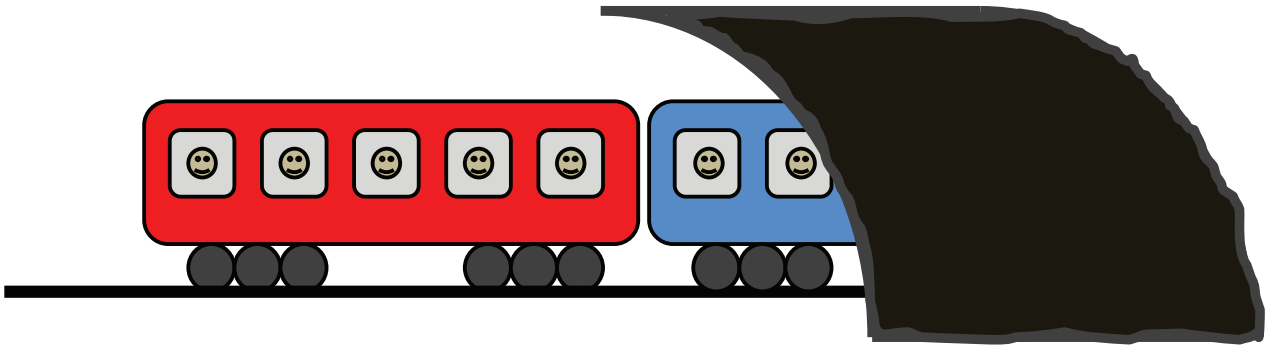
Activity 8 (Con't): How Many People in the Tunnel?

4. How many people are in the tunnel? ANSWER _____



5. How many people are in the tunnel? ANSWER _____

6. How many people are in the tunnel? ANSWER _____



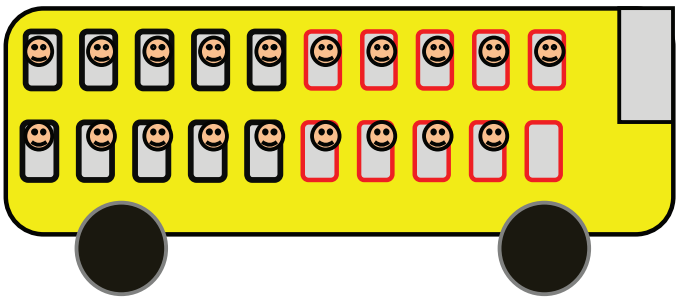
7. **Model with your own rekenrek:** Six people on the train are in the tunnel.

How many are outside the tunnel? ANSWER _____

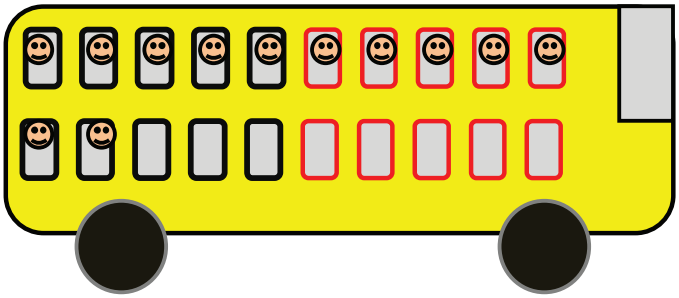
Activity 9: How Many People are on the Double Decker Bus?

The Double Decker Bus has 20 seats – 10 up on top, and 10 down below.

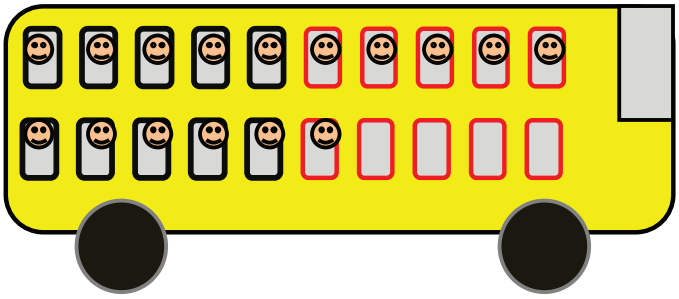
1. How many people are on the bus? ANSWER _____



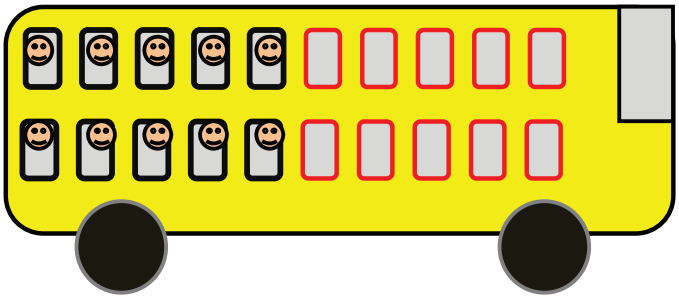
2. How many people are on the bus? ANSWER _____



3. How many people are on the bus? ANSWER _____

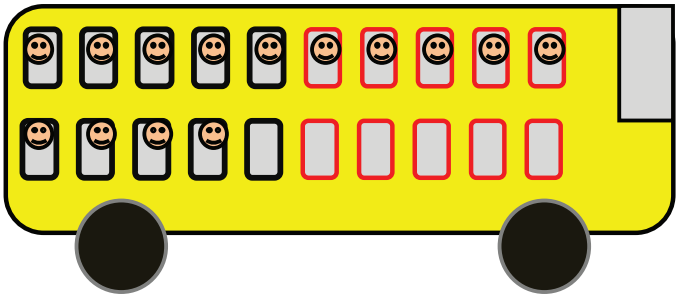


4. How many people are on the bus? ANSWER _____

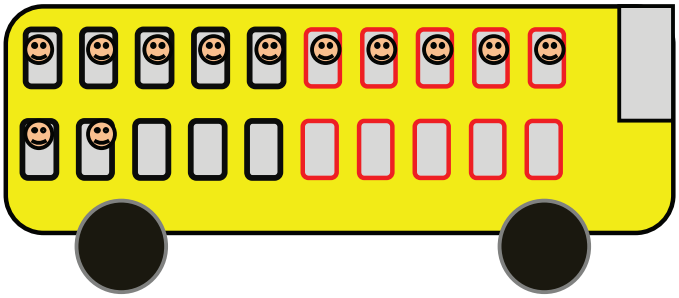


Activity 9 (Con't): How Many People are on the Double Decker Bus?

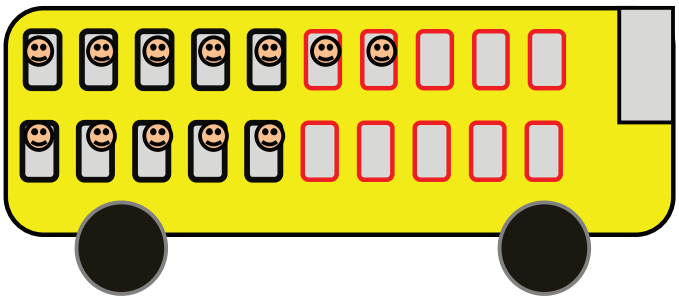
5. How many people are on the bus? ANSWER _____



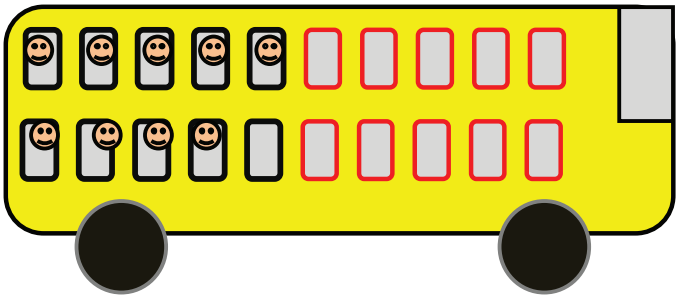
6. How many people are on the bus? ANSWER _____



7. How many people are on the bus? ANSWER _____



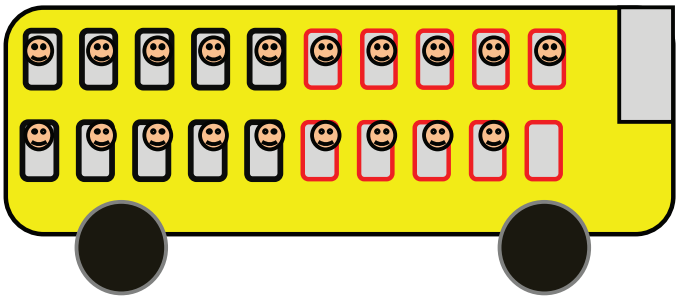
8. How many people are on the bus? ANSWER _____



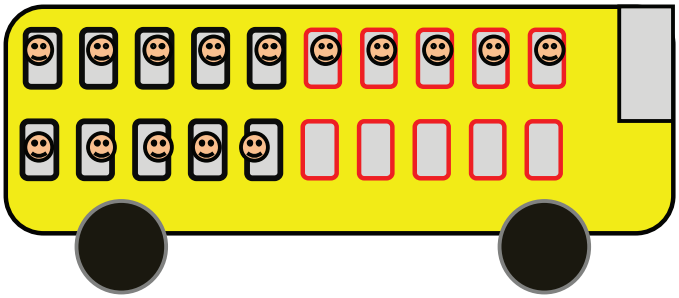
Activity 10: How Many Seats are Left? Make 20.

The Double Decker Bus has 20 seats – how many more people can get on?

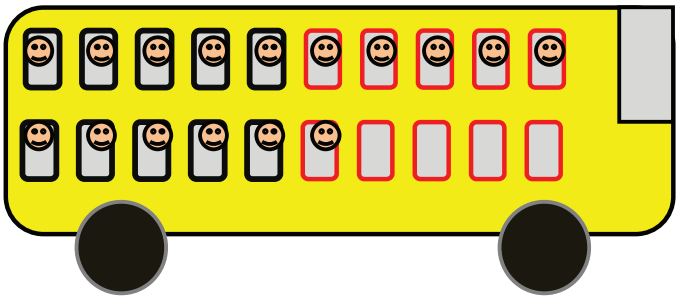
1. How many more people can get on the bus? ANSWER _____



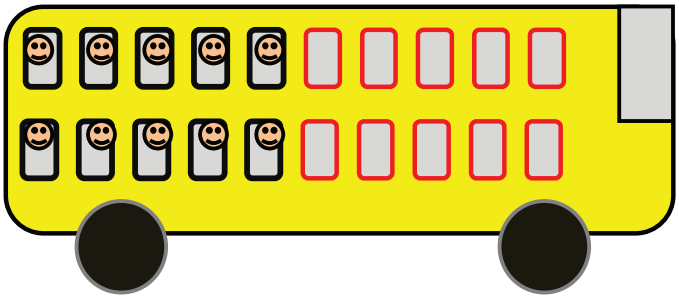
2. How many more people can get on the bus? ANSWER _____



3. How many more people can get on the bus? ANSWER _____

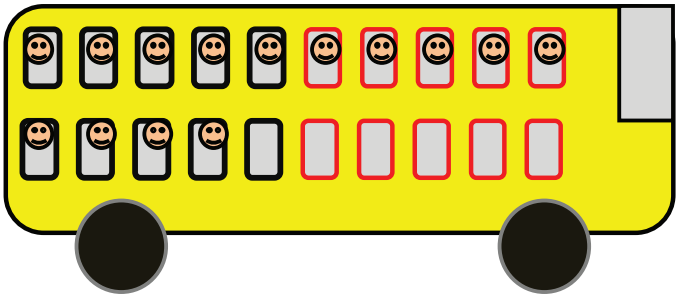


4. How many more people can get on the bus? ANSWER _____

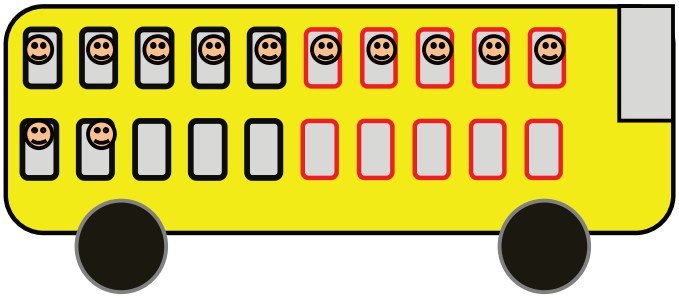


Activity 10 (Con't): How Many Seats are Left? Make 20.

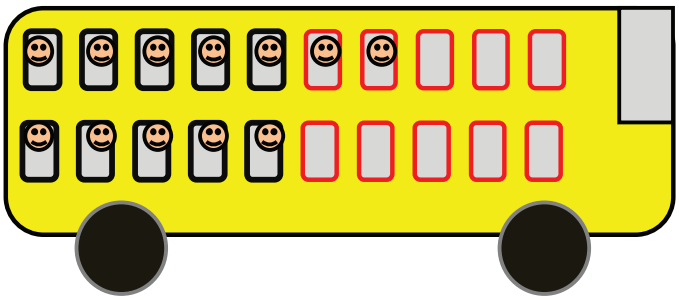
5. How many more people can get on the bus? ANSWER _____



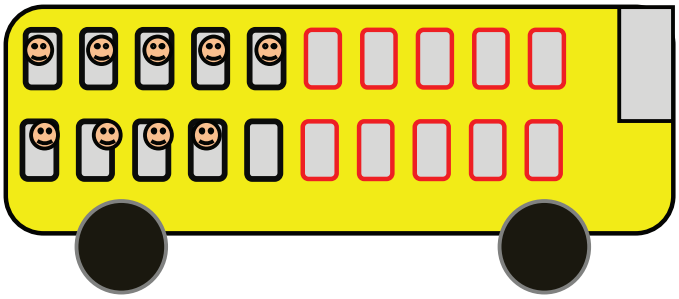
6. How many more people can get on the bus? ANSWER _____



7. How many more people can get on the bus? ANSWER _____



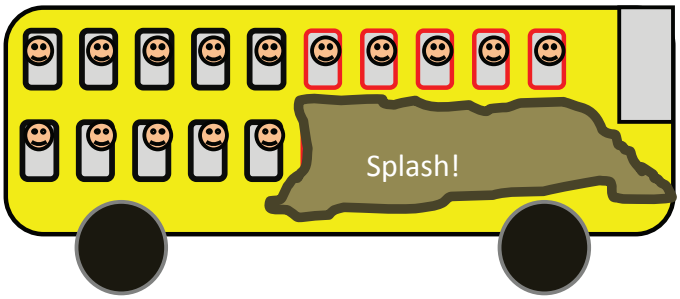
8. How many more people can get on the bus? ANSWER _____



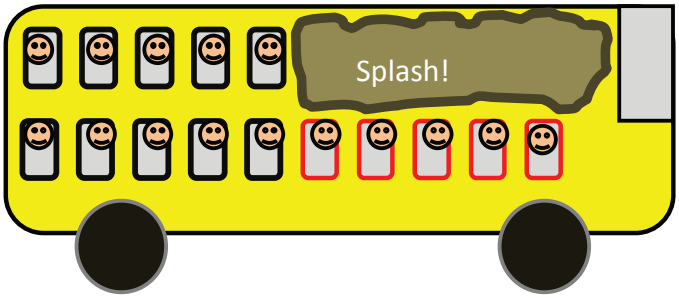
Activity 11: How many windows under the mud?

The mud splashed the bus. How many windows are under the mud?

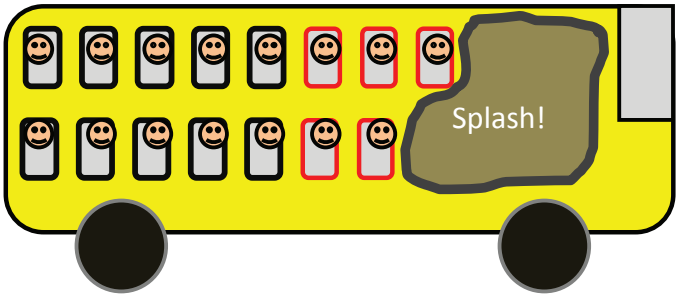
1. How many windows under the mud? ANSWER _____



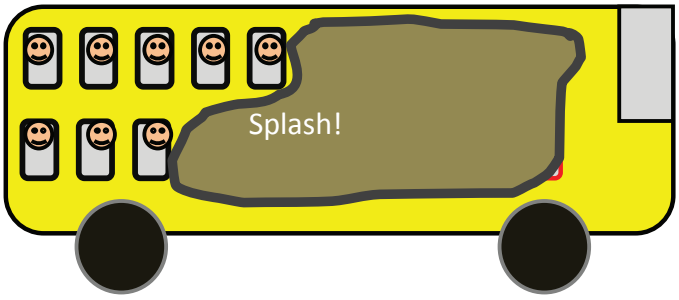
2. How many windows under the mud? ANSWER _____



3. How many windows under the mud? ANSWER _____

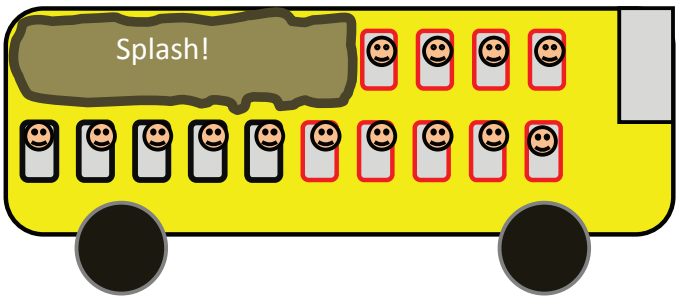


4. How many windows under the mud? ANSWER _____

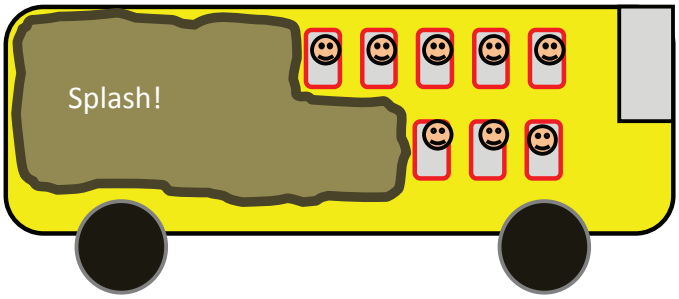


Activity 11 (Con't): How many windows under the mud?

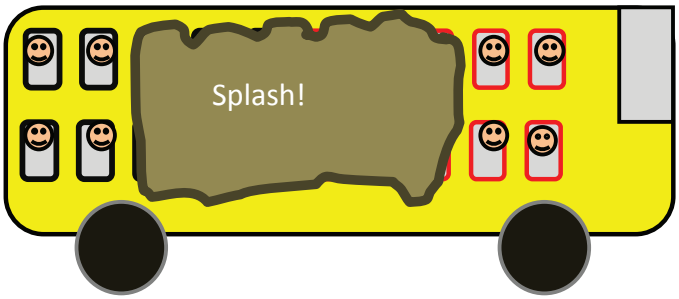
5. How many windows under the mud? ANSWER _____



6. How many windows under the mud? ANSWER _____



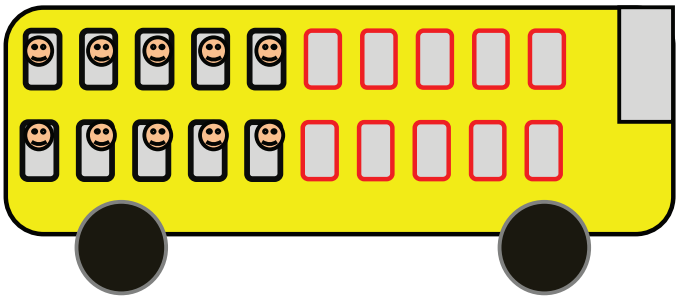
7. How many windows under the mud? ANSWER _____



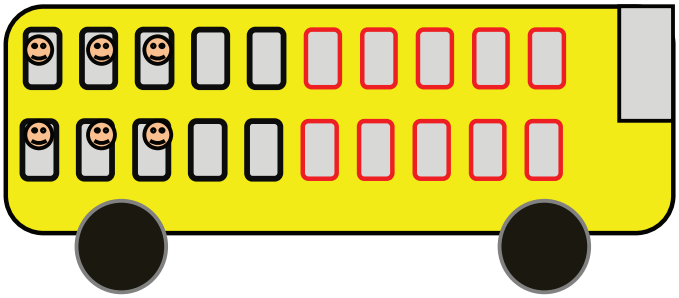
8. How many windows under the mud? ANSWER _____

Activity 12: Doubles

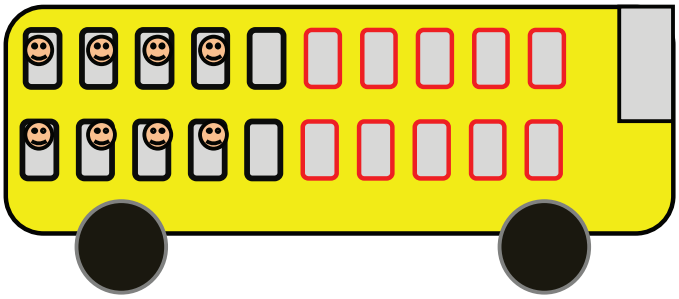
1. How many people are on the bus? ANSWER _____



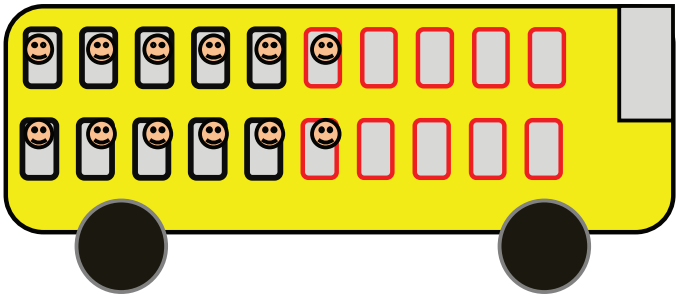
2. How many people are on the bus? ANSWER _____



3. How many people are on the bus? ANSWER _____

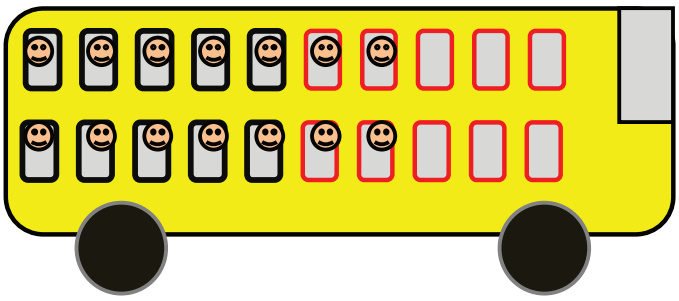


4. How many people are on the bus? ANSWER _____

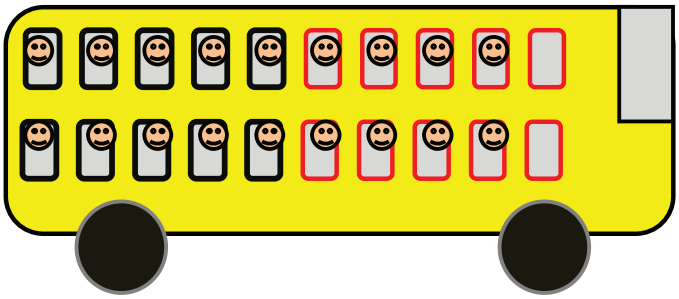


Activity 12 (Con't): Doubles

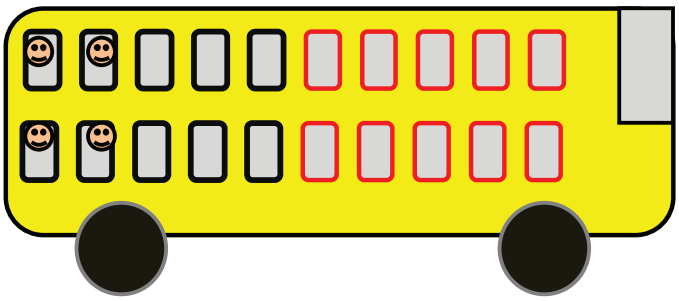
5. How many people are on the bus? ANSWER _____



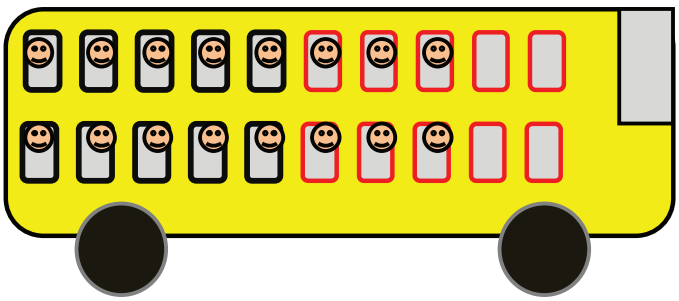
6. How many people are on the bus? ANSWER _____



7. How many people are on the bus? ANSWER _____

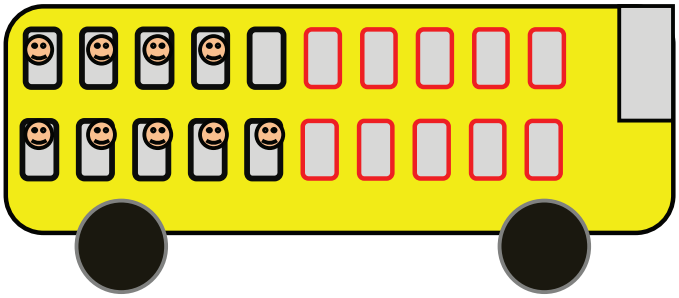


8. How many people are on the bus? ANSWER _____

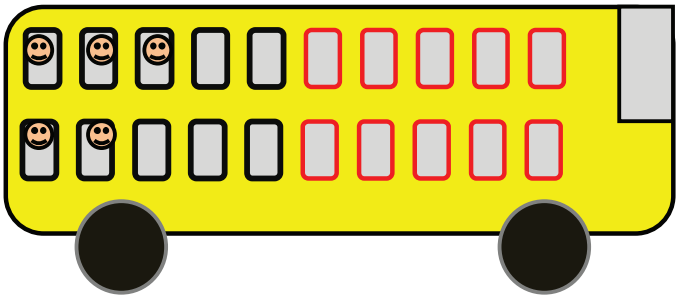


Activity 13: Near Doubles

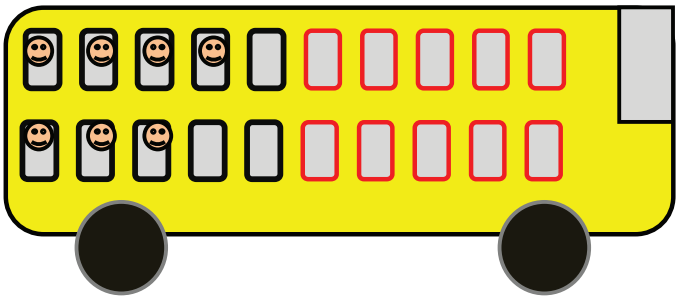
1. How many people are on the bus? ANSWER _____



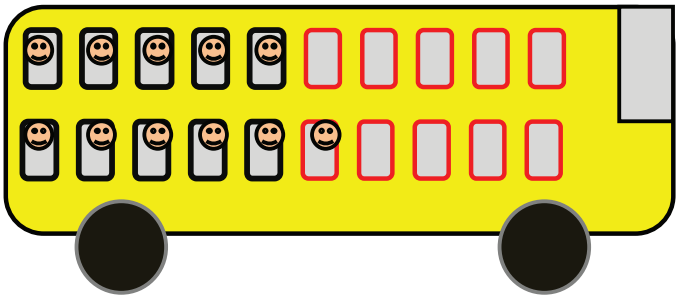
2. How many people are on the bus? ANSWER _____



3. How many people are on the bus? ANSWER _____

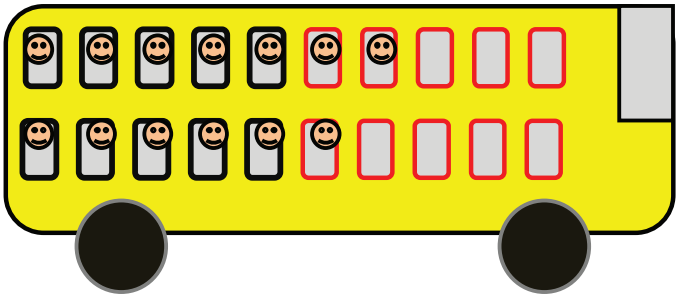


4. How many people are on the bus? ANSWER _____

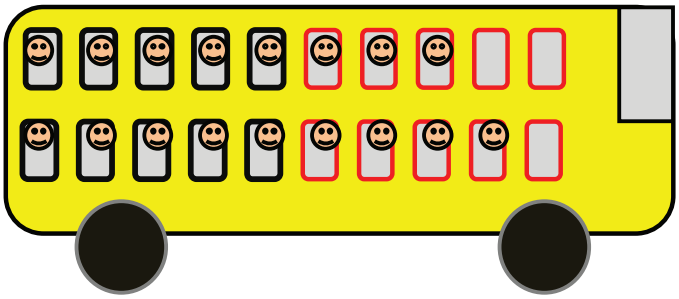


Activity 13 (Con't): Near Doubles

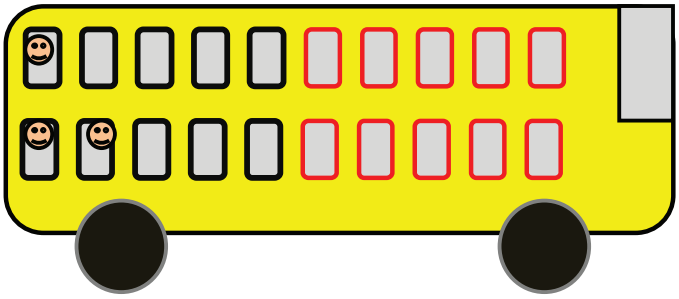
5. How many people are on the bus? ANSWER _____



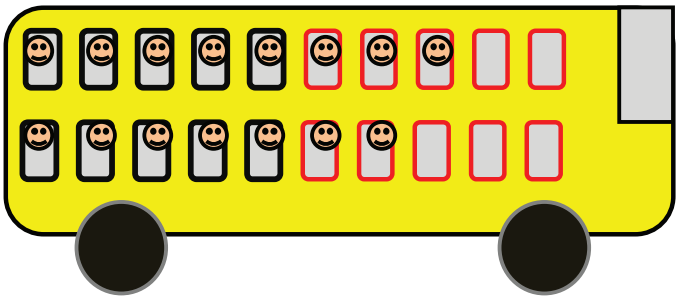
6. How many people are on the bus? ANSWER _____



7. How many people are on the bus? ANSWER _____



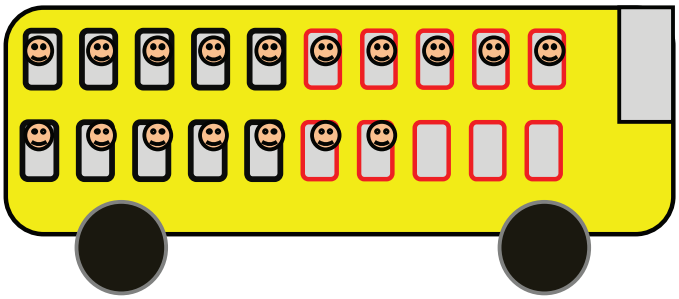
8. How many people are on the bus? ANSWER _____



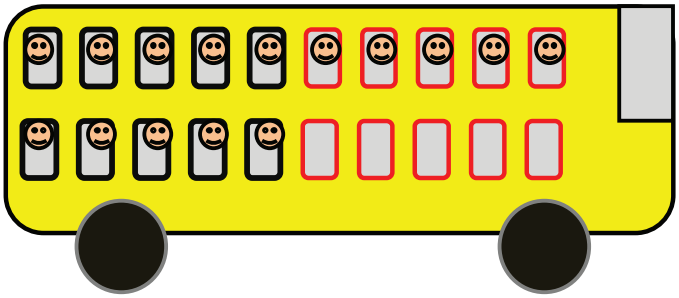
Activity 14: How Many More on the Top Row?

How many ***more*** people are on the ***top row*** of the bus?

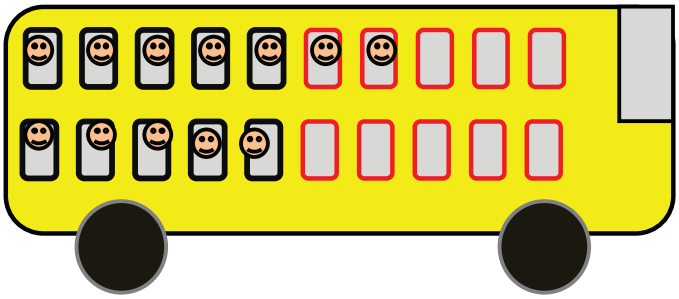
1. How many ***more people*** are there on the top row of the bus? ANSWER _____



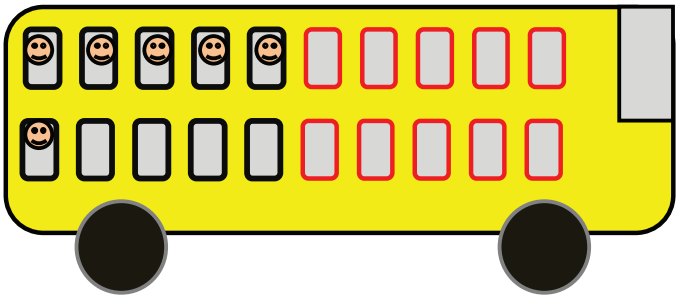
2. How many ***more people*** are there on the top row of the bus? ANSWER _____



3. How many ***more people*** are there on the top row of the bus? ANSWER _____

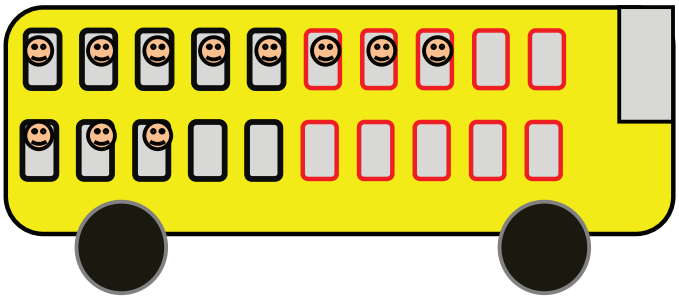


4. How many ***more people*** are there on the top row of the bus? ANSWER _____

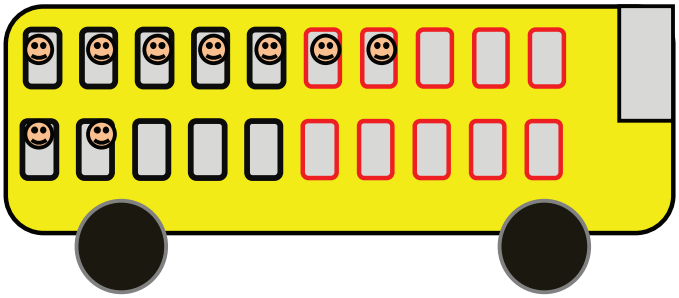


Activity 14: How Many More on the Top Row?

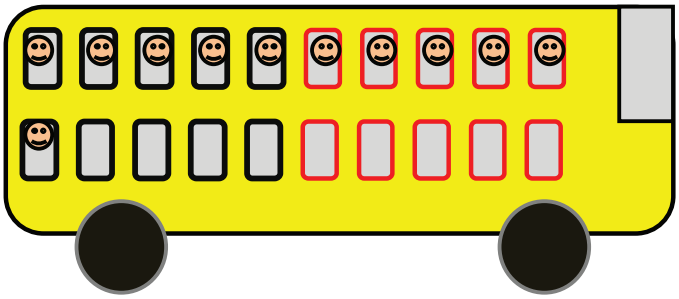
5. How many ***more people*** are there on the top row of the bus? ANSWER _____



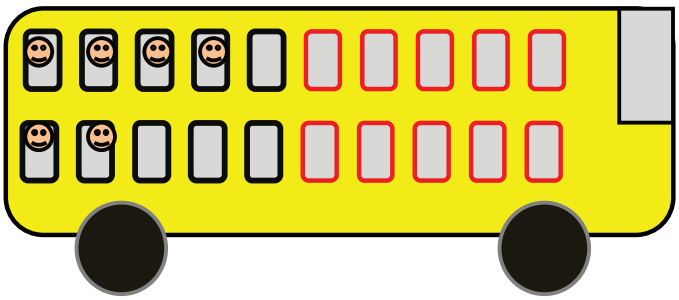
6. How many ***more people*** are there on the top row of the bus? ANSWER _____



7. How many ***more people*** are there on the top row of the bus? ANSWER _____

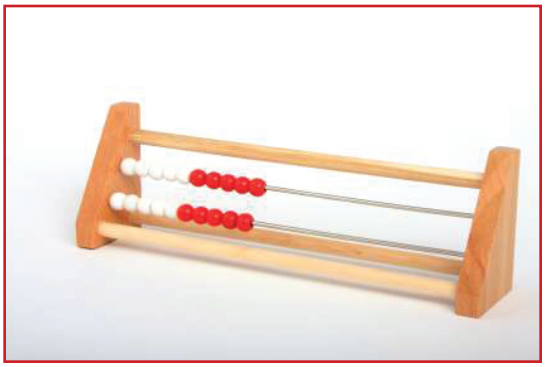


8. How many ***more people*** are there on the top row of the bus? ANSWER _____



The primary goal for elementary level mathematics education is to help children develop a rich understanding of numbers – their meanings, their relationships to one another, and how we operate with them. With the Rekenrek, children…

- develop one-to-one number relationships;
- develop a solid understanding of fives and tens;
- recognize the structure of our base-ten number system;
- "decompose" numbers based on number groups that are easily combined;
- see "inside" numbers, recognizing, for example, that seven is "5 and 2 more";
- develop powerful, intuitive strategies for addition and subtraction;
- become adept at using strategies like doubling, halving, adding on, etc.



Jeffrey Frykholm, Ph.D.

An award winning author, Dr. Jeffrey Frykholm is a former classroom teacher who now focuses on helping teachers develop pedagogical expertise and content knowledge to enhance mathematics teaching and learning. In his Learning to Think Mathematically series of textbooks for teachers, he shares his unique approach to mathematics teaching and learning by highlighting ways in which teachers can use mathematical models (e.g., the rekenrek, the ratio table, the number line, etc.) as fundamental tools in their classroom instruction. These books are designed with the hope that they will support teachers' content knowledge and pedagogical expertise toward the goal of providing a meaningful and powerful mathematics education for all children.