

A New Lock

Connor got a new suitcase. It has a lock on it that has 3 dials. The dials have the numbers 1, 2 and 3 on them. When you turn each dial to the correct number, the lock will open. Connor has forgotten the number he needs to use to open the lock, but he remembers that each digit is used only once. How many combinations are there for Connor to try?

A New Lock

Suggested Grade Span

Grades Pre K–2

Grade(s) in Which Task Was Piloted

Grade 2

Task

Connor got a new suitcase. It has a lock on it that has 3 dials. The dials have the numbers 1, 2 and 3 on them. When you turn each dial to the correct number, the lock will open. Connor has forgotten the number he needs to use to open the lock, but he remembers that each digit is used only once. How many combinations are there for Connor to try?

Alternative Versions of Task

More Accessible Version:

Connor got a new suitcase. It has a lock on it that has 2 dials. The dials have the numbers 1 and 2 on them. When you turn each dial to the correct number, the lock will open. Connor has forgotten the number he needs to use to open the lock. How many lock combinations are there for Connor to try?

More Challenging Version:

Connor got a new suitcase. It has a lock on it that has 4 dials. The dials have the numbers 1, 2, 3 and 4 on them. When you turn each dial to the correct number, the lock will open. Connor has forgotten the number he needs to use to open the lock, but he remembers that each digit is used only once. How many lock combinations are there for Connor to try?

NCTM Content Standards and Evidence

Data Standard for Grades Pre K–2

Instructional programs from pre–kindergarten through grade 12 should enable all students to...

- Understand and apply basic concepts of probability.
 - *NCTM Evidence:* Understand and apply basic concepts of probability.
 - *Exemplars Task Specific Evidence:* This task requires students to understand the concept of finding all possible combinations.

Time/Context/Qualifiers/Tip(s) From Piloting Teacher

This is a short to medium length task.

Links

This task could link to discussions about traveling (bringing a suitcase with you). It could also link to a brainstorm of where combination locks can be found (bike locks, school lockers, safes, etc.).

Common Strategies Used to Solve This Task

Most students will use a tree diagram or an organized list to find all combinations.

Possible Solutions

Original Version:

$3 \times 2 \times 1 = 6$ different combinations (1-2-3, 2-3-1, 3-1-2, 3-2-1, 2-1-3, 1-3-2)

More Accessible Version:

$2 \times 2 = 4$ different combinations (1-1, 1-2, 2-1, 2-2)

More Challenging Version:

$4 \times 3 \times 2 = 24$ different combinations

Task Specific Assessment Notes

General Notes

Some experience with combination problems may be essential for the student to achieve at least a Practitioner level response.

Novice

Rudimentary understanding of the task may be present, but it will not lead to even a partially correct solution. The Novice will show little or no correct reasoning or justification of their work and little or no math language will be used, or it will be used incorrectly.

Apprentice

The Apprentice will achieve a partially correct solution, but omissions or incorrect reasoning will lead to an incorrect solution. For example, repeat combinations may be used, combinations omitted, or combinations that duplicate digits may be shown. They will use some math language correctly and some correct reasoning may be present. There will be an attempt at using math representations to communicate the solution and to assist with understanding.

Exemplars

Practitioner

The Practitioner will achieve a correct solution and all work will be shown and labeled. They will successfully address all parts of the task and representations will help organize and display the solution. The Practitioner will use math language to communicate the solution and mathematically relevant observations will be made.

Expert

The Expert student will clearly label and organize all of their work. Their math representations and language will clarify thinking and communicate with the audience the approach and reasoning used. They will achieve a correct solution and math connections will extend the solution.

Exemplars

Novice

The student is not able to interact mathematically with the task.

No math language is used.

you got to move the numbers.

(1)(2)(3)

No attempt is made to make a meaningful math representation.

Exemplars

Apprentice

No math language is used, and no representations are attempted.

I have to find the number of dial picks. This is my list

- | | |
|---------|---------|
| $1-2-3$ | $3-2-1$ |
| $2-2-2$ | $1-3-2$ |
| $1-1-1$ | $3-2-1$ |
| $3-3-3$ | $2-1-3$ |
| $2-3-2$ | $2-1-2$ |
| | $1-2-2$ |

Some parts of the solution are correct. The student misunderstands that the digits can only be used once, and several correct combinations are not present.

Practitioner

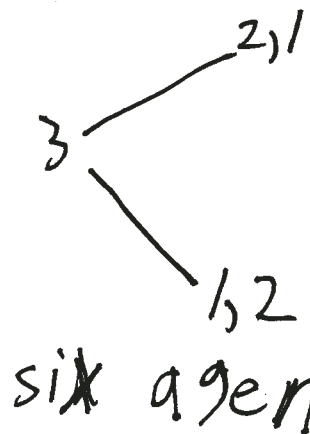
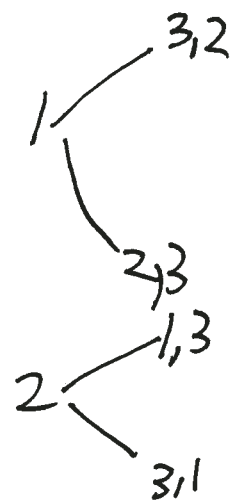
A correct answer is achieved.
All work is shown.

A math representation is used to organize information and display the solutions.

I have to find the numbers
I will make a list

0/1/2	0/1/2	0/1/2
1	2	3
1	3	2
2	1	3
2	3	1
3	1	2
3	2	1

6 combinations



The solution is demonstrated
two different ways.

Exemplars

Expert

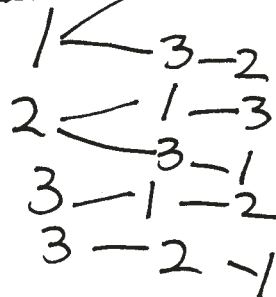
A correct answer is achieved.
All work is shown and
labeled.

I have to find the lock
numbers. I will make a organized
list the lock

dial1	dial2	dial3
1	2	3
1	3	2
2	1	3
2	3	1
3	1	2
3	2	1

6 combinations

my proof is a
tree diagram



again

The solution is demonstrated
in two different ways.

page 1

Exemplars

Expert cont.

new lock 1 2 3 4

dial 1	dial 2	dial 3	dial 4
1	2	3	4
1	4	3	2
1	3	2	4
1	4	2	3
1	3	4	2
1	2	4	3
2	4	1	3
2	3	4	1
2	1	3	4
2	3	1	4
2	1	4	3
2	4	3	1
3	1	4	2
3	2	1	4
3	4	2	1
3	4	1	2
3	2	4	1
3	1	2	4
4	3	2	1
4	3	1	2
4	2	1	3
4	2	3	1
4	1	3	2
4	1	2	3

24 combinations

The solution is extended to show for four dials.

this was better
I went 33, 22, 11

page 2