

Lab CC 2.1 Opening Locks



Name _____

Date _____ Period _____

Clever Counting Unit



Materials: Pencil and paper, calculator

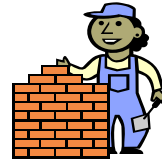


Key Learning: To further explore a variety of counting situations in which multiplication provides an answer to counting problems.

To uncover patterns that help in counting the outcomes of complex processes.

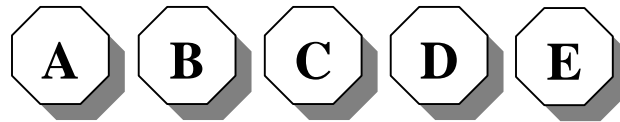


Guided Directions



this is an
INDIVIDUAL
ACTIVITY

Some push-button locks consist of five lettered buttons, like this:



Pressing the buttons in the correct sequence opens the lock.

1. A lock combination sequence may have two, three, four, or five letters. For this particular lock, a letter may **NOT** occur more than once in a sequence, in other words, there are **NO REPEATS ALLOWED**.

a) How many two-letter sequences (combinations) are possible?

$$\underline{\quad} \cdot \underline{\quad} = \underline{\quad}$$

b) How many three-letter sequences are possible?

c) How many four-letter sequences are possible?

d) How many five-letter sequences are possible?

e) If a lock sequence could consist of two, three, four, or five letters, how many different lock sequences are possible? **Write the details below** of the numbers you added or multiplied to get your answer:

2. Some locks are combination locks with a specific number of marks (numbers), usually starting at 0. For example, a combination lock could have ten marks from 0-9, twenty marks from 0-19, or thirty marks from 0-29.



A typical combination lock sequence consists of three numbers selected from forty marks, from 0 - 39 in a specific order. In other words, the sequence 13-27-4 is different from the sequence 4-27-13.

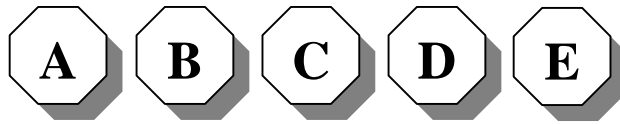
- a) How many possible combinations are there for a 40-mark lock like the one above? Assume that a number may **NOT** appear more than once in a combination.

- b) How long do you think it would take to try all of the different combinations? Write your answer in days, hours, minutes and seconds. Explain how you made your estimate.

- c) Jason has a 40-mark lock, numbered from 0-39, on his garden shed. He has forgotten the combination, but he does remember that the first number was 36, the second was a single digit number, and the third was a two-digit number that ended with a 4. Assuming that his memory is correct, how many possible combinations are there for Jason's lock?



5. Tina has a 5-button lock on her toolbox. She has forgotten the combination, but she knows that the fourth letter was a “B”. There were no repeats allowed in the combination.



- a. How many lock sequences are possible?

- b. If it takes Tina 5 seconds to try each combination, what is the longest amount of time it should take her to open the lock? Show your work.

6. Some bicycle locks have numbered wheels. To open the lock, you align the correct sequence of numbers with a mark or arrow. **Numbers can be repeated** in a sequence.



Suppose a bicycle lock has five wheels with the numbers 0 to 9 on each wheel.

- a. List five possible combinations for this lock.
- b. In total, how many combinations are possible?
- c. How many combinations are there if the last three numbers are all greater than 6? Show how you arrived at this answer.