

## COMPUTER PASSWORDS

### Performance Standard (6B/6C/10C).I

Determine the approximate time it takes a computer to test all the possible passwords of a certain length accordingly:

- *Mathematical knowledge:* Use fundamental counting principles to determine correctly the time a computer will take to test all possible 10-character passwords composed of letters and/or numbers; use terms correctly.
- *Strategic knowledge:* Use fundamental counting principles correctly; show all strategies used completely and clearly.
- *Explanation:* Explain what was done and why to complete the performance task.

### Procedures

1. *In order to investigate, represent, and solve problems using number facts, operations and their properties, algorithms, and relationships (6B), compute and estimate using mental mathematics, paper-and-pencil methods, calculators and computers (6C), and determine, describe, and apply the probabilities of events (10C),* students should experience sufficient learning opportunities to develop the following:
  - Determine an appropriate numerical representation of a problem situation, including roots and powers, if applicable.
  - Determine an appropriate number of digits to represent an outcome.
  - Develop fluency in operations with real numbers and matrices using mental computation or paper-and-pencil calculations for simple cases and technology for more-complicated cases.
  - Develop an understanding of permutations and combinations as counting techniques.
2. Provide each student a copy of the “Computer Passwords” recording sheet. Have student review and discuss the task to be completed and how the rubric will be used to evaluate it.
3. Ask students to determine how many years it will take a home computer to test all the possible 10-character passwords if it can test 300,000 passwords per second. Remind students that they have to show all the steps they used to solve the problem and write what they did and why for each step.
4. Evaluate each student’s work using the rubric. Use the guide on the rubric to determine the performance level. Minor calculation errors would consist of rounding errors in the computation even though the strategy was appropriate. A 4 in mathematical knowledge would require an answer of 386.45 or 386.18 years or the equivalent in years and days. A 4 in mathematical strategy would require the use of  $36^{10}$  converted to years or years and days. A 4 in explanation would require a complete description of the steps taken and the reason for each step.

### Examples of Student Work follow

### Time Requirements

- 25 minutes

### Resources

- Copies of the “Computer Passwords” recording sheet
- Calculator
- Mathematics Rubric

### ASSESSMENT (6B/6C/10C).I

NAME \_\_\_\_\_ DATE \_\_\_\_\_

### **COMPUTER PASSWORDS**

Computers store large amounts of information that must be protected from unauthorized access through the use of passwords. Computers deny access by testing all attempted passwords rapidly in order to discover unknown passwords.

If a home computer can test 300,000 passwords per second, how many years would it take the computer to test all possible passwords of ten characters if both letters and numbers can be used in the password?

Show all work used to answer the question. Write down what you did and why you did each step.

Adapted from "Math for a World that Rocks", St. Ignatius College Prep, Chicago, 1995, pp. 26-27.



Passwords

Name \_\_\_\_\_

Date 5/7/01

Computers store large amounts of information and must be protected from unauthorized access. Passwords are created to provide that protection. There are also programs which allow computers to test password attempts rapidly in order to discover an unknown password.

If a home computer can test 300,000 passwords per second, how long would it take the computer to test all possible passwords of ten characters if both letters and numbers can be used in the password?

Show all work used to answer the question and write in words what you did and why you did each step.

do  $26$  to the tenth power first and you end up with  $3.656158448 \times 10^{10}$  then divide by  $300,000$  because the computer can test  $300,000$  passwords per second you should get  $1.21871948 \times 10^5$  which equals  $121,871.948$  per second. now you turn seconds into minutes so you divide by  $60$  you get  $2,031.199133$  minutes then turn minutes into hours so divide by  $24$  and you get  $84.63331.829$  now divide by  $365.25$  because that's how many days there are in a year including leap year and you get  $231.829$  years & that's your answer.

Adapted from "Math for a World that Rocks", St. Ignatius College Prep, Chicago, 1995, pp. 26-27.

$1.21871948 \times 10^{10}$   
 $12187194800 \text{ sec} \div 60$   
 $203119913.3 \text{ min.} \div 60$   
 $3385331.829 \text{ hours} \div 24$   
 $141055.4954 \text{ days} \div 365.25$   
 $386.1829 \text{ yrs.}$