Permutations
ID: 12732

Time required
45 minutes

Activity Overview

In this activity, students explore the possible number of permutations of various real-world scenarios.

Topic: Permutations

- *Simple scenarios are presented to count the number of arrangements of objects when order is important and the set is exhausted.*

- *The scenarios that are presented include a group of objects where not all items are chosen, but in which order is important.*

Teacher Preparation and Notes

- *The program **PERMS** is another way for students to calculate a permutation. It is not needed to complete the activity, but may be helpful for some students as it asks for the number of objects and then the number at a time. It outputs the number of ways.*

- *TI-Navigator is not required for this activity, but an extension is given for those teachers that would like to use it.*

- ***To download the student worksheet and calculator program, go to education.ti.com/exchange and enter "12732" in the quick search box.***

Associated Materials

- *MGAct28_Permutations_worksheet_TI73.doc*

- *PERMS.73p (program)*

Suggested Related Activities

To download the activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Counting Principle, Combinations, and Permutations (TI-73 Explorer) — 2110*

- *Perms and Combs? (TI-84 Plus family) — 12644*

- *Probability and Fundamental Counting Principle (TI-84 Plus family) — 1906*

Problem 1 – Concert Seats

In this problem, students explore the possible permutations of selecting sets of concert tickets. There are 4 cousins selecting 4 sets of tickets.

Questions 1–3

Students begin the activity by finding all the possible orders in which the cousins can select tickets. They start by placing one cousin first and then finding how all the other cousins can line up.

In this situation, help students see how important an organized list can be to help solve problems.

Questions 4–6

Students can find the **nPr** function under the MATH menu. To evaluate the command, students are to press ⎡4⎤ ⎡MATH⎤ ⎡▶⎤ ⎡▶⎤ ⎡3⎤ ⎡4⎤ ⎡ENTER⎤. The total number of objects should be entered first, then the function, and then the number of objects being selected.

Problem 2 – Postponed Pop Quiz?

Questions 7–8

In this problem, students will see that the number of possible permutations can get very large, very quickly.

Students should have exposure to writing probabilities already. Help students see that there is only one possible combination that will put the 4 students with the best grades in math class in order by their grades. So, the probability is 1 over the total number of possibilities.

Problem 3 – Road Trip

Question 9–11

If students have little experience with tree diagrams, you may want to give extra guidance to get started.

The number of possibilities from the diagram should match the number students get on the calculator.

Problem 4 – Using the Formula

Questions 12–14

Students will use the formula for calculating the number of permutations to solve the final 4 problems. For the calculation at the right, press ⎡UNIT⎤ ⎡1⎤ ⎡4⎤ ⎡MATH⎤ ⎡▶⎤ ⎡▶⎤ ⎡5⎤ ⎡▼⎤ ⎡(⎤ ⎡1⎤ ⎡–⎤ ⎡9⎤ ⎡)⎤ ⎡MATH⎤ ⎡▶⎤ ⎡▶⎤ ⎡5⎤ ⎡ENTER⎤.

Solutions – student worksheet

Problem 1

1. Jeremie, Kate, Lane, Miya; Jeremie, Kate, Miya, Lane; Jeremie, Lane, Kate, Miya; Jeremie, Lane, Miya, Lane; Jeremie, Miya, Lane, Kate; Jeremie, Miya, Kate, Lane

2. Kate, Jeremie, Lane, Miya; Kate, Jeremie, Miya, Lane; Kate, Lane, Jeremie, Miya; Kate, Lane, Miya, Jeremie, Kate, Miya, Lane, Jeremie; Kate, Miya, Jeremie, Lane;

    Lane, Jeremie, Miya, Kate; Lane, Jeremie, Kate, Miya; Lane, Miya, Jeremie, Kate; Lane Miya, Kate, Jeremie; Lane, Kate, Jeremie, Miya; Lane, Kate, Miya, Jeremie,

    Miya, Jeremie, Lane, Kate; Miya, Jeremie, Kate, Lane; Miya, Lane, Jeremie, Kate; Miya, Lane, Kate, Jeremie; Miya, Kate, Lane, Jeremie; Miya, Kate, Jeremie, Lane

3. 24 options

4. Yes, this matches 4nPr4 on the calculator.

5. 24

6. 4**nPr**3

Problem 2

7. 255,024 ways

8. $\dfrac{1}{255,024}$ chance

Problem 3

9.
```
         Sam ──→ Chloe          Trey ─→ Chloe            Trey ──→ Sam
      ↗                      ↗                        ↗
Trey                    Sam                      Chloe
      ↘                      ↘                        ↘
         Chloe ─→ Sam           Chloe─→ Trey             Sam ─→ Trey
```

10. 6

11. 6, It's the same as the tree diagram.

Problem 4

12. 726,485,760   13. 720   14. 1.22×10^{12} 15. 3,315,312,000

Extension – TI-Navigator^{TM}

1. Use **Screen Capture** to monitor student progress throughout the lesson.

2. Send **PERMS.73p** to students for use during the lesson. Running the program may make it slightly easier to enter **nPr** calculations (instead of accessing the command from the MATH menu).

3. Use **Quick Poll** to gauge student understanding throughout the lesson. You can also gather student input on what they expect a specific permutation calculation to equal. This may be particularly interesting to students in Questions 12–15.