Branch by Branch

When can one product count every outcome?

FM.AC.A.7.a "Use various counting models (including tree diagrams and lists) to identify the distinguishing factors of a context in which the Fundamental Counting Principle can be applied."

NAME _____ DATE _____

SAME NUMBER OF CHOICES

At each step, the number of choices is the same no matter what you picked earlier. Multiply the number of choices at each step to count all outcomes.

Pick tea or cocoa, then add honey or sugar. Either sweetener can go in either drink.

CHANGING NUMBER OF CHOICES

At a later step, the number of choices depends on an earlier choice. A single product of the step counts will not work. Use a list or tree to count each branch, then add.

Pick a collar for a cat or a dog. The store has 2 cat collar sizes and 3 dog collar sizes.

1 SORT

8 items

Circle FIXED or CHANGES for each situation, then choose two items and explain how you knew.

1.	Pick 1 of 3 bus routes, then 1 of 2 songs to play. Any song works on any route.	FIXED	CHANGES
2.	Pick soup or salad. Soup has 2 toppings to choose from, and salad has 4.	FIXED	CHANGES
3.	Pick a regular or late ticket. A regular ticket offers 3 entry times, and a late ticket offers 1.	FIXED	CHANGES
4.	Pick 1 of 2 cameras, then 1 of 3 straps. Every strap fits both cameras.	FIXED	CHANGES
5.	Make a two-digit code using 1, 2, or 3 for each digit. The digits must differ.	FIXED	CHANGES
6.	Pick chess or robotics club. Chess meets on 2 possible days, and robotics meets on 4.	FIXED	CHANGES
7.	Pick 1 of 4 cover colors, then 1 of 2 page layouts. Both layouts come with every color.	FIXED	CHANGES
8.	Pick 1 of 3 test sites, then 1 of 2 times. Both times are open at every site.	FIXED	CHANGES

2 PROVE IT

Explain your thinking

Pick two items from Part 1. For each one, tell how you knew where it belonged.

ITEM # _____ **HOW I KNEW** _____

ITEM # _____ **HOW I KNEW** _____

3 MAKE YOUR OWN

One of each

Write one new two-step situation for FIXED and one for CHANGES. State how many second-step choices follow each first-step choice.

FIXED

CHANGES

CHALLENGE

A shop offers spiral and stitched notebooks. Spiral notebooks come in 2 sizes, and stitched notebooks come in 3 sizes. Every notebook can have 1 of 4 labels. How many different notebooks are possible? Explain why you cannot use one product of the three step counts.

Branch by Branch

PART 1 · SORT

#	ITEM	CATEGORY	WHY
1	Pick 1 of 3 bus routes, then 1 of 2 songs to play. Any song works on any route.	**FIXED**	Both songs are available after each route choice.
2	Pick soup or salad. Soup has 2 toppings to choose from, and salad has 4.	**CHANGES**	The number of topping choices depends on the first choice.
3	Pick a regular or late ticket. A regular ticket offers 3 entry times, and a late ticket offers 1.	**CHANGES**	The number of entry times differs by ticket type.
4	Pick 1 of 2 cameras, then 1 of 3 straps. Every strap fits both cameras.	**FIXED**	Each camera has three strap choices.
5	Make a two-digit code using 1, 2, or 3 for each digit. The digits must differ.	**FIXED**	Each of the three first digits leaves exactly two choices for the second digit.
6	Pick chess or robotics club. Chess meets on 2 possible days, and robotics meets on 4.	**CHANGES**	The number of meeting-day choices depends on the club.
7	Pick 1 of 4 cover colors, then 1 of 2 page layouts. Both layouts come with every color.	**FIXED**	Each cover color has two layout choices.
8	Pick 1 of 3 test sites, then 1 of 2 times. Both times are open at every site.	**FIXED**	Each site has two time choices.

PART 2 · PROVE IT

Accept any explanation that names the deciding feature from the rule box for the chosen item.

PART 3 · MAKE YOUR OWN (SAMPLE ANSWERS)

- **FIXED**: Pick a star or heart sticker, then pick a small or large size. Each shape has 2 size choices.
- **CHANGES**: Pick tennis or swimming, then pick a practice slot. Tennis has 2 slot choices, while swimming has 3.

Challenge: There are 2 spiral size choices and 3 stitched size choices, giving 5 type-and-size pairs. Each pair has 4 label choices, so there are 5 × 4 = 20 notebooks. The size count changes with the notebook type, so the three steps do not each have one fixed count.

Item 5 is FIXED even though the second digit is restricted: every first digit leaves two choices. In the challenge, students can group each notebook type and size as one choice before multiplying by 4.