

## Product Rule for Counting

### Starter

1. **(Review of last lesson)** A tetrahedron has the numbers 1, 3, 4 and 4 written on its faces. A coin has the numbers 2 and 5 on its sides. The tetrahedron and coin are both tossed and the sum of the result is found.

- (a) Draw a probability space diagram to show the possible outcomes.  
 (b) Find the probability that the sum is:  
 (i) 6                      (ii) 6 or 7                      (iii) greater than 4.

**Working:** (a)

SUM		Tetrahedron			
		1	3	4	4
Coin	2	3	5	6	6
	3	4	6	7	7

- (b) (i)  $P(6) = \frac{3}{8}$   
 (ii)  $P(6 \text{ or } 7) = \frac{5}{8}$   
 (iii)  $P(> 4) = 1 - P(\leq 4) = 1 - \frac{6}{8} = \frac{2}{8} = \frac{1}{4}$

2. A password has one entry. The password can be made up of letters (upper or lower case) and digits. How many different passwords are there?

**Working:** Digits = 10, lower case letters = 26, capital letters = 26  
 So  $10 + 26 + 26 = 62$  entries

3. If you have two entries, how many different passwords are there?

**Working:**  $62^2 = 3844$

**E.g. 1** A code has 3 entries — the first is the letter b or g (depending on whether the person is a boy or girl), the second is an odd digit and the third is a lower case letter from the alphabet.

**Working:** Three entries so 3 boxes: 

--	--	--

1st entry (box): b or g so 2 ways 

2		
---	--	--

2nd entry: odd digit (i.e. 1, 3, 5, 7, 9) so 5 ways 

2	5	
---	---	--

3rd entry (box): lower case letter so 26 ways 

2	5	26
---	---	----

Total number of ways =  $2 \times 5 \times 26 = 260$       *product of numbers in boxes*

**E.g. 2** A password has 6 entries. The first 2 entries must be a capital letters but a letter cannot be repeated. The next 2 entries must be digits, again without repeat. The last 2 letters can be lower case letters, capital letters or digits with repeats allowed. How many different passcode are there?

**Working:** 6 entries so 6 boxes 

--	--	--	--	--	--

1st entry: capital letter so 26 ways

2nd entry: capital letter but no repeat so 25 ways

3rd entry: digit so 10

4th entry: digit but no repeat so 9

5th and 6th entries: lower case letters, capital letters or digits so 62

26	25	10	9	62	62
----	----	----	---	----	----

 $26 \times 25 \times 10 \times 9 \times 62^2 = 224, 874, 000$

**E.g. 3** A code has 3 entries. Each entry must be a digit 0-9 and the overall code must be odd. How many different codes are there if the first entry cannot be zero?

**Working:** 3 entries so 3 boxes 

--	--	--

1st entry: digit but not 0 so 9 ways

2nd entry: digit so 10 ways

3rd entry: code must be odd so last digit must be odd so 5 ways

9	10	5
---	----	---

 $9 \times 10 \times 5 = 450$  ways *product of numbers in boxes*

**E.g. 4** Peter looks in his freezer and sees 12 microwave meals. Assuming he eats one microwave meal per day, Monday-Friday, how many possible combinations are there?

**Working:** 5 days so 5 boxes 

--	--	--	--	--

Monday: 12 meals to choose from so 12 ways

Tuesday: 1 meal has been eaten so now 11 ways

Wednesday: 10 ways etc.

12	11	10	9	8
----	----	----	---	---

 $12 \times 11 \times 10 \times 9 \times 8 = 95040$  (No repeats)

**E.g. 5** A restaurant has a menu with 3 choices for a starter, 5 choices for the main dish and 4 choices for dessert.

(a) How many possible 3-course meals are there?

(b) Given that all customers must choose a main meal, how many 2-course meals are there?

**Working:** (a) 3 courses so 3 boxes 

--	--	--

1st box: starter so 3 ways

2nd box: main meal so 5 ways

3rd box: dessert so 4 ways

3	5	4
---	---	---

 $3 \times 5 \times 4 = 60$  meals

(b) Starter/main meal: 2 boxes 

3	5
---	---

 $3 \times 5 = 15$  ways

Main meal/dessert: 2 boxes 

5	4
---	---

 $5 \times 4 = 20$  ways

Total 2-course meals =  $15 + 20 = 35$  ways

Video: [Product rule for counting](#)

[Solutions to Starter and E.g.s](#)

**Exercise**

9-1 class textbook:	p240 E8.1 Qu 1-15 odd
A*-G class textbook:	No exercise
9-1 homework book:	p82 E8.1 Qu 1-8
A*-G homework book:	No exercise

[Homework book answers \(only available during a lockdown\)](#)

