

The Product Rule for Counting *extend*

ANSWERS 

1



How many even 4-digit numbers have no repeated digit?

$$\text{ends in } 0: 9 \times 8 \times 7 = 504$$

ends in 2, 4, 6 or 8:

$$8 \times 8 \times 7 \times 4 = 1792$$

Answer 2296

2



Six friends stand in a line for a photo. Amy and Ben must stand next to each other. How many different orders are there?

Amy and Ben as one block:

$$5 \times 4 \times 3 \times 2 \times 1 = 120$$

the block can be AB or BA: $\times 2$

Answer 240

3



The letters of PLANET are put in a different order. The word must start and end with a vowel. How many arrangements are there?

ends: 2×1 for A and E

middle: $4 \times 3 \times 2 \times 1 = 24$

Answer 48

4



Raj has n shirts and $n + 2$ pairs of trousers. He can make 99 different outfits of a shirt and trousers. Find n .

$$n(n + 2) = 99, n^2 + 2n - 99 = 0$$

$$(n + 11)(n - 9) = 0$$

Answer $n = 9$

5



How many whole numbers between 1000 and 5000 have only odd digits?

first digit 1 or 3

$$2 \times 5 \times 5 \times 5$$

Answer 250

6



How many 3-digit numbers have at least one digit that is a 7?

$$\text{no } 7 \text{ at all: } 8 \times 9 \times 9 = 648$$

$$900 - 648$$

Answer 252

7



A 4-digit PIN uses the digits 0 to 9. Digits can repeat, but no two digits next to each other can be the same. How many PINs are there?

each digit after the first: 9 choices

$$10 \times 9 \times 9 \times 9$$

Answer 7290

8



Four couples sit in a row of 8 seats. Each couple sits side by side. Show that there are 384 ways to seat them.

order of the 4 couples:

$$4 \times 3 \times 2 \times 1 = 24$$

each couple either way round:

$$2 \times 2 \times 2 \times 2 = 16$$

Reason $4 \times 3 \times 2 \times 1 \times 2^4 = 384$