# The Fundamental Counting Principle

If one event can occur in $m$ ways and a second event can occur in $n$ ways, then together they can occur in $m \times n$ ways.

The fundamental counting principle can be used for multiple trials (events).

Examples:

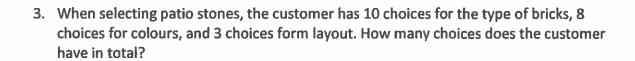1. Determine the number of possible outcomes when a coin is tossed
   a) Twice

   $2^2 = 4$

   b) Three times

   $2^3 = 8$

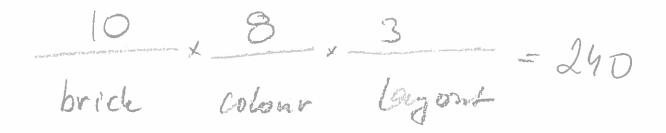   c) Four times

   $2^4 = 16$

   d) n times

   $2^n$

2. A committee has 15 people.
   a) In how many ways could a president and a vice president be chosen?

   $\underline{15} \times \underline{14} = 210$

   b) In how many ways could a president, vice president, and a secretary be chosen?

   $\underline{15} \times \underline{14} \times \underline{13} = 2730$

3. When selecting patio stones, the customer has 10 choices for the type of bricks, 8 choices for colours, and 3 choices form layout. How many choices does the customer have in total?

$$\underset{\text{brick}}{10} \times \underset{\text{colour}}{8} \times \underset{\text{layout}}{3} = 240$$

4. On a TV game show, a contestant spins a spinner to randomly select a letter of the alphabet. At the same time, the contestant rolls a standard die. What is the total number of possible outcomes?

$n(\text{Alphabet}) = 26$

$n(\text{die}) = 6$

$26 \times 6 = 156$

5. How many two-digit numbers can be formed from digits 1, 2, 3, 4, 5 if repetition is
a) Permitted?

$n = 5$

$5 \times 5 = 25$

b) Not permitted?

$5 \times 4 = 20$

6. An eight-character password has been randomly assigned, containing digits, capital letters and lower-case letters, with <u>repetition permitted.</u>

$\overset{26}{|}$

$h=10$
$0-9$    $26$

a) How many passwords are available in total?

$h(options) = 10+26+26$
$= 62$

$\underline{62} \times \underline{62} \times \underline{62} \times \underline{62} \times \underline{62} \times \underline{62} \times \underline{62} \times \underline{62}$

$= 62^8$

$= 2.18 \times 10^{14}$

• different order = different (unique) password

b) In how many ways could the password begin four different capital letters followed by four different digits?

$\underline{26 \times 25 \times 24 \times 23} \times \underline{10 \times 9 \times 8 \times 7}$

$= 1\ 808\ 352\ 000$

c) In how many ways could the password contain one digit and seven letters?

1-10 options    and    8 possible placements $= 10 \times 8$

$\underline{D} \quad \underline{52} \quad \underline{52} \quad \underline{52} \quad \underline{52} \quad \underline{52} \quad \underline{52} \quad \underline{52}$

$52^7$

$h = 80 \times 52^7$

$= 8.22 \times 10^{13}$