PROBABILITY PART B **SOLUTIONS**

1. **ANSWER:** Each selection for each part of the meal is independent of the previous selection. Therefore, we can use the Fundamental Counting Principle. Multiply the number of outcomes of each choice together to get the total possible number of outcomes.

(# appetizers) x (# entrées) x (# desserts) = 3 x 2 x 4

2. **ANSWER:** 5 letters means we have 5 blanks to fill in. The number of outcomes for each outcome decreases as we cannot repeat letters.
   ___ x _____ x_____ x _____ x___ = 26 x 25 x 24 x 23 x 22 = 7 893 600
   7 893 600 five letter passwords are possible.
3. **ANSWER:** Again, 5 digits means we have 5 blanks. Before restricting our options, there are 10 digits from 0 to 9 to choose from.
   ___ x _____ x_____ x _____ x___

- The last digit determines whether the number is odd or not, so we can only choose from 1, 3, 5, 7 or 9. There are 5 options.
  ___ x _____ x_____ x _____ x 5
- The first digit cannot be the same as our last digit. The first digit also cannot be a zero (since that would make this a 3 digit number, e.g. 0315 = 315). That removes 2 of our options.
  8 x _____ x_____ x _____ x 5
- The second digit can be a zero, so we get one of our options back. The second digit cannot be the same as our first digit though, so again we lose an option. Gaining one and losing one means we have the same number of options as the first number.
  8 x 8 x_____ x _____ x 5
- For the next two numbers we lose one option each as repeats aren't allowed.

  8 x 8 x 7 x 6 x 5 = 13 440 five-digit numbers with no repeating digits

4. **ANSWER:**

- Moving only left or down it will always take a total of 7 moves to get from point A to point B
- You will always have to make at least 3 moves to the left and at least 4 moves down.
- In determining the number of different paths, we need to eliminate the identical paths that would be produced by considering each leftward move and unique, or each downward move as unique. For instance, we would only want to consider an order like DOWN-DOWN once, not twice, since if you rearrange the two "DOWN" moves you have still moved along the same path by moving down twice in a row.

$$\frac{\#\ of\ actions!}{\#\ repeated\ lefts! \times \#\ repeated\ downs!} = \frac{7!}{3!\,4!} = 35$$

There are 35 different paths to take from point A to point B.

5. **ANSWER:**

- The order of players picked in each subgroup does not matter. All we care about are the final groupings, so we will use combinations

$$\begin{aligned} &\#\ of\ possible\ line-ups \\ &\quad = \#\ of\ defense\ groups\ \times \#\ of\ forward\ groups \\ &\quad \times \#\ of\ goalie\ groups\ possible \end{aligned}$$

# of line-ups = ${}_9C_2$ x ${}_{14}C_3$ x ${}_2C_1$ = 36 x 364 x 2 = 26 208

The coach could make 26 208 different possible starting line-ups.

6. ANSWER:

- Use the “fill in the blanks” approach to visualize her options.
- Remember there are 26 letters and 10 digits from 0 to 9

__ x __ x __ x __ x __ x __ x __x __

There is only one option for the first two letters and first three numbers.

P I __ __ 3 1 4 __

1 x 1 x 26 x 26 x 1 x 1 x 1 x 10 = 6760

There are 6760 possible license plates.

7. ANSWER:

- With French and Math mandatory, he has three courses left to fill
- There are seven courses listed as options
- The order he selects the courses does not matter

We are choosing three courses from seven, there are:

$_7C_3$ = 35 possible ways to fill his timetable.

8. ANSWER:

$$\frac{(n-1)!}{(n+2)!} = \frac{(n-1)!}{(n+2)(n+1)(n)(n-1)!} = \frac{1}{(n+2)(n+1)(n)}$$

9. ANSWER: $\frac{7!}{2!2!} = 1260\ ways$

10. ANSWER: Use algebra and the "pick" formula

- $\frac{7!}{(7-r)!} = 210$
- $\frac{7!}{210} = (7-r)!$
- $24 = (7-r)!$ → we know 24 is equal to 4!
- $4! = (7-r)!$ → we can now take the factorial off both sides
- $4 = 7 - r$
- **r = 3**