2.3 Permutations when all objects are distinguishable

Ex: How many 3 letter permutations can you make using the letters MATH?

$4 \times 3 \times 2 = 24$

M A I
M A H
M T H
M T A
M H A
M H T

what about 2 letter permutations?

$4 \times 3 = 12$

choosing r objects from n we get $\frac{n!}{(n-r)!}$ permutations when all objects are distinguishable.

The notation for r objects chosen from n to create permutations is ${}_nP_r$ so we could say that

$$ {}_nP_r = \frac{n!}{(n-r)!} $$

Ex: There are 8 people running for different positions on a club team. You can only select 5 of the 8. How many ways can you select those 5?

$$_8P_5 = \frac{8!}{(8-5)!} = \frac{8\times7\times6\times5\times4\times3\times2\times1}{3\times2\times1}$$

$$_8P_5 = 6720$$

Note: $0! = 1$

$_nP_n = n!$ → no repetition

Page 93, #'s 1-15

9. If a Canadian social insurance number begins with the digit 6, it indicates that the number was registered in Manitoba, Saskatchewan, Alberta, Northwest Territories, or Nunavut. If the number begins with a 7, the number was registered in British Columbia or the Yukon. How many different SINs can be registered in each of these groups of provinces and territories?

Start with 6 : $\underline{1}\ \underline{10}\ \underline{10}\ \ \underline{10}\ \underline{10}\ \underline{10}\ \ \underline{10}\ \underline{10}\ \underline{10}$

$= 10^8 = 100\ 000\ 000$

start with 7 = same

Ex: Evaluate $_7P_4 = \frac{7!}{(7-4)!} = 7 \cdot 6 \cdot 5 \cdot 4$

$= 840$

p. 82 # 6(b) $(n+4)(n+3)(n+2)! = (n+4)!$

p. 93 # 9 SIN: ___ ___ ___

MB, SK, NWT, NV Begins with 6: $1 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$

$= 10^8 = 100\,000\,000$

BC, YK: Begins with 7: $1 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10$

$= 10^8 = 100\,000\,000$

#11 (a) $\frac{n!}{(n-1)!}$ $n > 0, n \in N$

$n \geq 1, n \in N$

#15 (b) $_{n+1}P_2 = 72$, solve for n

$\Rightarrow \frac{(n+1)!}{(n+1-2)!} = 72$

$\Rightarrow \frac{(n+1)!}{(n-1)!} = 72$

$\Rightarrow \frac{(n+1)(n)(n-1)!}{(n-1)!} = 72$

$\Rightarrow (n+1)n = 72$

$\Rightarrow n^2 + n = 72$

$n^2 + n - 72 = 0$

$(n+9)(n-8) = 0$

$n+9 = 0$ | $n-8 = 0$

$n = -9$ | $n = 8$

NO GOOD ☹ | GOOD ☺