

$$\textcircled{6} \text{ a) } 6!$$

$$= 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

$$= 720$$

$$\text{b) } \frac{15!}{12!}$$

$$= 15 \times 14 \times 13$$

$$= 2730$$

$$\textcircled{7} \text{ a) } 7 \times 6 \times 5 = \frac{7!}{4!}$$

$$\frac{7 \times 6 \times 5 \times \cancel{4 \times 3 \times 2 \times 1}}{\cancel{4 \times 3 \times 2 \times 1}}$$

$$\text{e) } 30 \times 29 \times 28 \times 3 \times 2 \times 1$$

$$= \frac{30!}{27!} \times 3!$$

$$= \frac{30! 3!}{27!}$$

$$\text{i) } 101 \times 100 \times 99 \times 60 \times 59 \times 58$$

$$\frac{101!}{98!} \times \frac{60!}{57!}$$

$$\frac{101! 60!}{98! 57!}$$

SOLUTIONS => FUNDAMENTAL COUNTING PRINCIPLE

1. Main Course Dessert Beverage
5 x 3 x 4

= 60 ways a customer may order a meal if they choose 1 item from each category.

2. Letter Letter Letter Number Number Number.
26 x 26 x 26 x 10 x 10 x 10

= 17 576 000 license plates can be made using 3 letters followed by 3 digits if repetitions are allowed.

$$3. \text{ President} \quad \text{Vice-President} \quad \text{Secretary}$$
$$15 \quad \times \quad 14 \quad \times \quad 13$$

= 2730 ways that a 15-member club can select a president, vice-president, and secretary.

4. a) Grade 12 President Grade 11 Vice-President Grade 11 Secretary.

$$10 \quad \times \quad 8 \quad \times \quad 7$$

= 560 ways to elect a Gr.12 President, a Gr.11 Vice-President and a Gr.11 Secretary.

b) Grade 12 President Grade 12 Vice-President Grade 11 Secretary

$$10 \quad \times \quad 9 \quad \times \quad 8$$

= 720 ways to elect a Gr.12 President, a Gr.12 Vice-President and a Gr.11 Secretary.

5. (Clockwise) 1st number (Counterclockwise) 2nd number (Clockwise) 3rd number

$$60 \times 60 \times 60$$

= 216 000 different combinations are possible.

SOLUTIONS => FACTORIAL NOTATION

6a) $6!$

$$(6 \times 5 \times 4 \times 3 \times 2 \times 1) \\ = 720$$

b) $\frac{15!}{12!}$

$$\left(\frac{15 \times 14 \times 13 \times \cancel{12} \times \cancel{11} \times \cancel{10} \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{12 \times 11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1} \right)$$

$$= 15 \times 14 \times 13 \\ = 2730$$

$$c) \frac{9!}{2!}$$

$$\left(\frac{9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times \cancel{2} \times \cancel{1}}{2 \times 1} \right)$$
$$= 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3$$
$$= 181\,440$$

$$d) \frac{9!}{7!}$$

$$\left(\frac{9 \times 8 \times \cancel{7} \times \cancel{6} \times \cancel{5} \times \cancel{4} \times \cancel{3} \times \cancel{2} \times \cancel{1}}{\cancel{7} \times \cancel{6} \times \cancel{5} \times \cancel{4} \times \cancel{3} \times \cancel{2} \times \cancel{1}} \right)$$

$$= 9 \times 8$$

$$= 72$$

$$e) 4! - 3!$$

$$= (4 \times 3 \times 2 \times 1) - (3 \times 2 \times 1)$$

$$= \frac{24}{\quad} - \frac{6}{\quad}$$

$$= 18$$

$$\begin{aligned}
 & f) 11! \\
 & = (11 \times 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1) \\
 & = 39\ 916\ 800 \quad \leftarrow \text{LARGEST!}
 \end{aligned}$$

$$\begin{aligned}
 & g) \frac{3!}{4} \\
 & = \left(\frac{3 \times 2 \times 1}{4} \right) \\
 & = \frac{6}{4} \\
 & = \frac{3}{2} \text{ or } 1.5 \quad \leftarrow \text{SMALLEST!}
 \end{aligned}$$

$$\begin{aligned}
 & h) \frac{10!}{2!} \\
 & = \left(\frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{2 \times 1} \right) \\
 & = 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \\
 & = 1\ 814\ 400
 \end{aligned}$$

$$\begin{aligned} \text{i) } & \frac{7!}{6!} \\ &= \left(\frac{7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{6 \times 5 \times 4 \times 3 \times 2 \times 1} \right) \\ &= 7. \end{aligned}$$

7.

$$a) 7 \times 6 \times 5 \quad b) 10 \times 9 \times 8 \times 7 \times 6 \quad c) 10 \times 9 \times 8$$

$$= \frac{7!}{4!}$$

$$= \frac{10!}{5!}$$

$$= \frac{10!}{7!}$$

$$d) 12 \times 11 \times 10 \times 9 \quad e) 30 \times 29 \times 28 \times 3 \times 2 \times 1$$

$$= \frac{12!}{8!}$$

$$= \frac{30! \cdot 3!}{27!}$$

$$f) 25 \times 24 \times 23 \times 22 \times 4 \times 3 \times 2 \times 1$$

$$= \frac{25! \cdot 4!}{21!}$$

$$g) 40 \times 39 \times 38 \times 9 \times 8 \times 7$$

$$= \frac{40! 9!}{37! 6!}$$

$$h) 66 \times 65 \times 64 \times 63 \times 27 \times 26$$

$$= \frac{66! 27!}{62! 25!}$$

$$i) 101 \times 100 \times 99 \times 60 \times 59 \times 58$$

$$= \frac{101! 60!}{98! 57!}$$

$$\begin{aligned} j) & 85 \times 84 \times 83 \times 11 \times 9 \times 8 \times 4 \times 3 \times 2 \times 1 \\ &= \frac{85! 11! 9! 4!}{82! 10! 7!} \end{aligned}$$

$$\begin{aligned} k) & 50 \times 49 \times 48 \times 16 \times 15 \times 14 \times 2 \times 1 \\ &= \frac{50! 16! 2!}{47! 13!} \end{aligned}$$

$$\begin{aligned} l) & 41 \times 40 \times 39 \times 27 \times 26 \times 25 \times 8 \times 7 \times 6 \\ &= \frac{41! 27! 8!}{38! 24! 5!} \end{aligned}$$