3E

3.2.1

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

3.2.2

$$3 \cdot 2 \cdot 1 = 6$$

3.2.3

$$9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$$

On a 362 880 possibilités.

Nombre de secondes: $362\,880 \cdot 5 = 1\,814\,400$ s
$= 504$ h

$\Rightarrow$ Il faudrait 3 semaines

3E

$\boxed{3.2.4}$

a) $2! = 2 \cdot 1 = 2$

b) $3! = 3 \cdot 2 \cdot 1 = 6$

c) $10! = 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 3\,628\,800$

d) $2! \cdot 3! = 2 \cdot 6 = 12$

e) $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 20 \cdot 6 = 120$

f) $50! = 30\,414\,093\,201\,713\,378\,043\,612\,608$
$166\,064\,768\,844\,377\,641\,568\,960$
$512\,000\,000\,000\,000$

g) $6! = 6 \cdot 5! = 6 \cdot 120 = 720$

h) $100! \simeq 9{,}3326215443944152 7 \cdot 10^{157}$

i) $1000! \simeq 4{,}0238726 \cdot 10^{2567}$

$\boxed{3.2.5}$

a) $\dfrac{12!}{9!} = \dfrac{12\cdot 11\cdot 10\cdot \cancel{9!}}{\cancel{9!}} = 12\cdot 11\cdot 10 = 1320$

b) $\dfrac{11!}{3!\,2!\,4!} = \dfrac{11\cdot 10\cdot \cancelto{3}{9}\cdot \cancelto{2}{\cancelto{4}{8}}\cdot 7\cdot 6\cdot 5\cdot \cancel{4!}}{\cancel{3}\cdot\cancel{2}\cdot 1\cdot \cancel{2}\cdot 1\cdot \cancel{4!}} = 11\cdot 10\cdot 3\cdot 2\cdot 7\cdot 6\cdot 5$

$= 138\,600$

c) $\dfrac{12!}{8!\cdot 4!} = \dfrac{\cancelto{3}{12}\cdot 11\cdot \cancelto{5}{10}\cdot \cancelto{3}{9}\cdot \cancel{8!}}{\cancel{8!}\cdot \cancelto{1}{4}\cdot \cancel{3}\cdot \cancelto{1}{2}\cdot 1} = 3\cdot 11\cdot 5\cdot 3$

$= 495$

d) $\dfrac{100!}{98!\,5!} = \dfrac{100\cdot 99\cdot \cancel{98!}}{\cancel{98!}\cdot 5!} = \dfrac{\cancelto{5}{\cancelto{25}{100}}\cdot \cancelto{33}{99}}{\cancel{5}\cdot\cancel{4}\cdot\cancel{3}\cdot 2\cdot 1} = \dfrac{165}{2}$

e) $\dfrac{n!}{(n-2)!} = \dfrac{n\cdot(n-1)\cdot\cancel{(n-2)!}}{\cancel{(n-2)!}} = n(n-1) = n^2 - n$

f) $\dfrac{(n+2)(n+1)(n)\cancel{(n-1)!}}{\cancel{(n-1)!}} = n\cdot(n+1)(n+2)$

$= n^3 + 3n^2 + 2n$