

Given a positive integer  $n$ ,  $n$  factorial (written  $n!$ ) is a shorthand for the product of all positive integers less than or equal to the given integer  $n$ .

$$n! = n \cdot (n - 1) \cdot (n - 2) \cdot \dots \cdot 3 \cdot 2 \cdot 1$$

For example,  $4! = 4 \cdot 3 \cdot 2 \cdot 1 = 24$ . (By convention, we say that  $0! = 1$ .)

1. Evaluate the following.

(a)  $5!$

(b)  $6!$

(c)  $\frac{6!}{5!}$

(d)  $\frac{5!}{6!}$

(e)  $\frac{102!}{100!}$

2. Simplify each of the following. Assume  $n$  is a positive integer.

(a)  $\frac{(n+2)!}{n!}$

(b)  $\frac{(n-3)!}{n!}$

(c)  $\frac{(2n+2)!}{(2n)!}$

(d)  $\frac{(2n+2)!}{2n!}$

(e)  $\frac{(n!)^2}{((n+1)!)^2}$