Pre-Calculus 12 Factorial Notation

Factorials are products, indicated by an exclamation mark.

5! is read as "5 factorial" and means:

$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$
$= 120$

By definition, $n! = n(n-1)(n-2) \ldots 1$ where $n \geq 1$ and $0! = 1$

Ex. 1) Without using a calculator, simplify $\frac{11!}{9!}$

$\frac{11 \cdot 10 \cdot \cancel{9!}}{\cancel{9!}}$

110

* keep subtracting until you can divide/cancel out the denominator

Ex. 2) Simplify $\frac{n!}{(n-2)!}$

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

$n-1-1$
$n-2$

$n(n-1)$ or $n^2 - n$

Ex. 3) Simplify $\frac{(n-6)!}{(n-3)!}$

$\frac{\cancel{(n-6)!}}{(n-3)(n-4)(n-5)\cancel{(n-6)!}}$

$\frac{1}{(n-3)(n-4)(n-5)}$

* always expand the larger one

ie $\frac{n-6}{n-3}$ ← larger

if $n = 10$

$\frac{10-6}{10-3} = \frac{4}{7}$ ← larger

Ex. 4) Solve for n.

$(n+1)! = 12(n-1)!$

divide to get factorials together

$\frac{(n+1)!}{(n-1)!} = 12$

expand factorials

$\frac{(n+1)(n)(n-1)!}{(n-1)!} = 12$

$n+1-1$, n

$(n+1)(n) = 12$

$n^2 + n = 12$

$n^2 + n - 12 = 0$

$(n+4)(n-3) = 0$

solve

$n+4=0$ $\quad n-3=0$

$\therefore n = -4$ $\quad n = 3$

rej

$n \geq 1$

Ex. 5) Solve.

$\frac{(n+3)!}{n!} = 24$

$\frac{(n+3)(n+2)(n+1)n!}{n!} = 24$

$(n+3)(n+2)(n+1) = 24$

3 consecutive numbers

$2 \cdot 3 \cdot 4 = 24$

$\therefore n = 1$

Ex. 6) Evaluate

$\frac{12!}{9!4!}$

$\frac{12 \cdot 11 \cdot 10 \cdot 9!}{9! \cdot 4!}$

$\frac{12 \cdot 11 \cdot 10^5}{4 \cdot 3 \cdot 2 \cdot 1}$

* can use calculator

$11 \cdot 5$

55

Assignment: Worksheet: Factorial Notation