

### Problems for Mathematical Induction

1. Show that for all  $n$ , the number  $n^5/5 + n^3/3 + 17n/15$  is a natural number.

2. Show that  $3^{2n+2} + 8n - 9$  is divisible by 16.

3. Show that for all  $n$ ,  $2^n \mid (n+1)(n+2)\dots(2n)$ .

4. Show that  $2^{3^n} + 1$  is divisible by  $3^{n+1}$ .

5. Show that for any fixed integer  $m > 0$ ,

$$\frac{m!}{0!} + \frac{(m+1)!}{1!} + \dots + \frac{(m+n)!}{n!} = \frac{(m+n+1)!}{n!(m+1)!}$$