

## STEP II, 2018, Q6

- 6 (i) Find all pairs of positive integers  $(n, p)$ , where  $p$  is a prime number, that satisfy

$$n! + 5 = p.$$

- (ii) In this part of the question you may use the following two theorems:

1. For  $n \geq 7$ ,  $1! \times 3! \times \cdots \times (2n - 1)! > (4n)!$ .
2. For every positive integer  $n$ , there is a prime number between  $2n$  and  $4n$ .

Find all pairs of positive integers  $(n, m)$  that satisfy

$$1! \times 3! \times \cdots \times (2n - 1)! = m!.$$



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