First refinement:

for each prime,

mark $\boxed{p^2}$, $(p+1)p$, ...

because for $\underset{\text{num}}{=} \underline{x} \cdot p < p \cdot p$

assume every $p' < p$ has mark all its multiples

$\Rightarrow$ num $= \underset{\sim}{x} \cdot p$

does not contain p as factor

$\because x < p$

x must be a composite number formed by smaller primes

Second refinement:

$2\ 3\ 4\ 5\ 6\ \cdots \sqrt{n}\ \cdots$

$\uparrow$

Note that:

for each p, $p^2, (p+1)p^2 \cdots$

are what we mark

but when $p > \sqrt{n}$, $p \cdot p > n$

$\Rightarrow$ no need to mark anymore!

bound $= \lfloor \sqrt{n} \rfloor \rightarrow$ why not $\lceil \sqrt{n} \rceil$

for i in $[2, \text{bound}]$

mark $i^2, (i+1)i \cdots$

because say $\sqrt{n} = 2.\cdots$

when $p=2$ still have check

$p=3$ we don't need to check