$3185 = 5 \cdot 7^2 \cdot 13$

$5 = 4k+1 = 4(1)+1$ $\qquad$ $13 = 4l+1 = 4(3)+1$

5 & 13 as a sum of 2 squares

$5 = a^2+b^2 \qquad 13 = c^2+d^2.$

(I)

$3185 = 7^2 \cdot 5 \cdot 13 \quad 7^2 \cdot (a^2+b^2)(c^2+d^2) = 7^2\left((ad-bc)^2 + (\sim)^2\right)$

$= 7^2\left((ad+bc)^2 + (\sim)^2\right).$

$(a^2+b^2)(c^2+d^2) = (ad-bc)^2 + (\sim)^2 \qquad = (7(ad-bc))^2 + (7(\sim))^2$

$(7(ad+bc))^2 + (7(\sim))^2$ 2 diff

$(a^2+b^2)(c^2+d^2) = (ad-bc)^2 + (\sim)^2$

$\boxed{n \equiv 0, 1, 2 \mod 4.}$ $\quad$ ~~contra~~ positive. $n \equiv 3 \mod 4$.

5 $\quad$ 9

$4 \mid n \qquad d$

$\frac{n}{4} \in \mathbb{Z} \qquad \frac{n-1}{4} \in \mathbb{Z} \quad 4 \mid n-1$

$\frac{n-2}{4} \in \mathbb{Z} \quad 4 \mid n-2$

$A, B \subseteq C$ $\qquad$ $|A| = |B|$

$$\underline{A \cup B} = A \cap B \iff \underline{A = B}$$

(I) $A \cup B = A \cap B \Rightarrow A = B$

(II) $A = B \Rightarrow A \cup B = A \cap B$

Proof (I) Assume $A \cup B = A \cap B$

To prove $A = B$.

$x \in A$ show $x \in B$ then $A \subseteq B$

$y \in B$ show $y \in A$ then $B \subseteq A$

$$\boxed{A = B}$$

(II) Assume $\underline{A = B}$

$A \cap B = A \cup B$

$x \in A \cup B$ show $x \in A \cap B$, then $A \subseteq B$

$y \in A \cap B$ show $x \in A \cup B$, then $B \subseteq A$

arbitrary $x \in A$ then $x \in B$

$A, B \subseteq A \cup B$

$x \in A \subseteq A \cup B$

$x \in A \cup B = A \cap B$ — $x \in B$

$3185 = \underbrace{7^2 \cdot 5 \cdot 13}$

$= N^2 \cdot m$

7

$5 \cdot 13$

$a^2 + b^2$ $\quad$ $c^2 + d^2$

$2, 1$ $\quad$ $2, 3$

$(a^2+b^2)(c^2+d^2)$

$N \quad (ad-bc)^2 + (\quad)^2$

$N \quad (ad+bc)^2 + (\quad)^2$

Note $5 = 1^2 + 2^2$

$13 = 2^2 + 3^2$

Thus by expression $5 \cdot 13 = (\quad) + (\quad)$

$= (\quad) + (\quad)$

Then $2 \cdot 2 \; 7^2 \cdot 5 \cdot 13$