Variable

word for a subtle concept that trips up a lot of programming students. People say it is simple easy when they get it, but people who don't get it are 'clueless' about programming.
Variable

1) int \( X \);
2) \( X = 37 \);

\[ = ( \text{in Java, not math} ) \]

means please copy a command like a Sargent shouts to his/her troops: Advance and fire!
Variable

1) int X;
2) X = 37;

→ (in Java, not math)
means please copy

The ; means "here is the end of this Java statement.
The 37 means number 37, literally;
s and literals are easy to understand.

The effects of these 2 lines of Java, processed sequentially is

\[ X \]

\[ 37 \]

a box, bordering a rectangle of paper, like a farmer's fence borders an empty field.
Variable

1) int X;
2) X = 37;

⇒ (in Java, not math) means please copy

Kenneth holds $1.

does not mean
Kenneth is a dollar!

X contains 37

⇒ the box named X

does not mean
X is 37.

⇒ X is 37.

"Kenneth" is short for "The human named Kenneth"

"Box named X" ⇒ ok to shorten to X.

X is the name of the box.

X is not 37. X is 37. a box, bordering a rectangle of paper, like a farmer's fence borders an empty field
**Variable**

1) `int X;`
2) `X = 37;`

`= (in Java, not math, means please copy)

Kenneth holds $1.

does not mean

Kenneth is a dollar!

X contains 37
`

the box named X
does not mean

X is 37. ← wrong!

"Kenneth" is short for "The human named Kenneth"

"Box named X" → ok to shorten to X.

After 2) the value in the box named X becomes 37.

OK → After 2) the value in box X becomes 37.
Variable

1) int X;
2) \( X = 37 \);
\[ \text{=(in Java, not math, means please copy)} \]
3) \( X = X * 2 \);

"Kenneth" is short for "The human named Kenneth"
Box named \( X \) is ok to shorten to \( X \).

After 2) the value in the box named \( X \) becomes 37.
OK \( \rightarrow \) After 2) the value in box \( X \) becomes 37.
After 3) the value in box \( X \) becomes 74.
So, $X$ is not a name for 37, nor is it a name for 74. $X$ never is 37, 74 or any other number.

What is $X$?

$X$ is a box into which a computer might write or change numbers.

More pedantically, $X$ is the name of a box, but people say $X$ is the box, the value in $X$ was first 37 but stop 3) changed the value in $X$ to 74.