# Complex Numbers Q13– Practice/Y1/E (22/5/21)

Are these statements true or false? (Give an explanation, or a counter example, as appropriate.)

(i) All imaginary numbers are complex numbers.

(ii) All complex numbers are imaginary numbers.

(iii) All real numbers are complex numbers.

(iv) Zero is an imaginary number.

(v) The imaginary part of a complex number is an imaginary number.

(vi) All complex numbers are either real numbers or imaginary numbers.

(vii) Two imaginary numbers added together can sometimes give a real number.

(viii) If two complex numbers multiply to give a real number, then they must be conjugates of each other.

(ix) The square root of a non-real complex number is never real.

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## Solution

(i) True: An imaginary number is a number of the form $bi$, where $b$ is real; a complex number is a number of the form $a + bi$, where $a$ & $b$ are real, and $a$ can equal zero. Note: "imaginary" numbers are often referred to as "pure imaginary" numbers, to avoid confusion.

(ii) False: The complex number $a + bi$, where $a \neq 0$ is not imaginary, by the definition in (i).

(iii) True: $a + 0i$ is complex.

(iv) True: $0 = 0i$ is imaginary

(v) False: The imaginary part of $a + bi$ is $b$ (not $bi$ : there is an error to this effect in the AQA FP2 website booklet - unless it's been corrected)

(vi) False: $2 + 3i$ is neither real nor imaginary.

(vii) True: For example, $i$ & $-i$

(viii) False: For example, $i$ & $i$

(ix) True: Suppose that $\sqrt{a + bi} = c$, where $a, b \neq 0$ & $c$ are real;

then $a + bi = c^2$, and equating imaginary parts $\Rightarrow b = 0$, which is a contradiction