1-1 Sets

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M12/5/MATHL/HP1/ENG/TZ1/XX

1. *[Maximum mark: 4]*

Find the value of k if $\sum_{r=1}^{\infty} k\left(\frac{1}{3}\right)^r = 7$.

$S = \frac{a_1}{1-r}$

$\frac{1}{3}k + \frac{1}{9}k + \frac{1}{27}k + \ldots = 7$

Geometric Series

$7 = \frac{\frac{1}{3}k}{1-\frac{1}{3}}$

$7 = \frac{\frac{1}{3}k}{2/3}$

$7 = \frac{1}{\cancel{3}}k \cdot \frac{\cancel{3}}{2}$

$\left[7 = \frac{1}{2}k\right] \cdot 2$ $\boxed{k = 14}$

Number Sets

- $\mathbb{N}$ **Natural Numbers** - the counting numbers.
  Ex: 1, 2, 3, 4, 5, ...
- $\mathbb{W}$ **Whole Numbers** – the natural numbers and zero
- $\mathbb{Z}$ **Integers** – the set of both positive and negative counting numbers and zero.
  > $\mathbb{Z}^+$ Positive Integers
  > $\mathbb{Z}^-$ Negative Integer

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- $\mathbb{Q}$ **Rational Numbers** – the set of all numbers which can be expressed as a fraction of the form p/q where p and q are integers and $q \neq 0$.
    > $\mathbb{Q}^+$ Positive Rational Numbers

    > $\mathbb{Q}^-$ Negative Rational Numbers

- $\mathbb{J}$ **Irrational Numbers** – the set of all numbers which cannot be expressed as a fraction of the form p/q where p and q are integers and $q \neq 0$. $\sqrt{2}, \pi, e, \sqrt[3]{7}, \ldots$

- $\mathbb{R}$ **Real Numbers** - the set of all numbers which can be located on the number line. This encompasses integers, rational, and irrational numbers.
    > $\mathbb{R}^+$ Positive Rational Numbers

    > $\mathbb{R}^-$ Negative Rational Numbers

- $\mathbb{I}$ **<u>Pure Imaginary Numbers</u>** – A number with a imaginary component only. Ex. 3i, -2i, ... where $i = \sqrt{-1}$
- $\mathbb{C}$ **<u>Complex Numbers</u>** – The set of all numbers of the form a + bi where a and b are real numbers. This number has both an imaginary and real component. Ex. 3 + 2i

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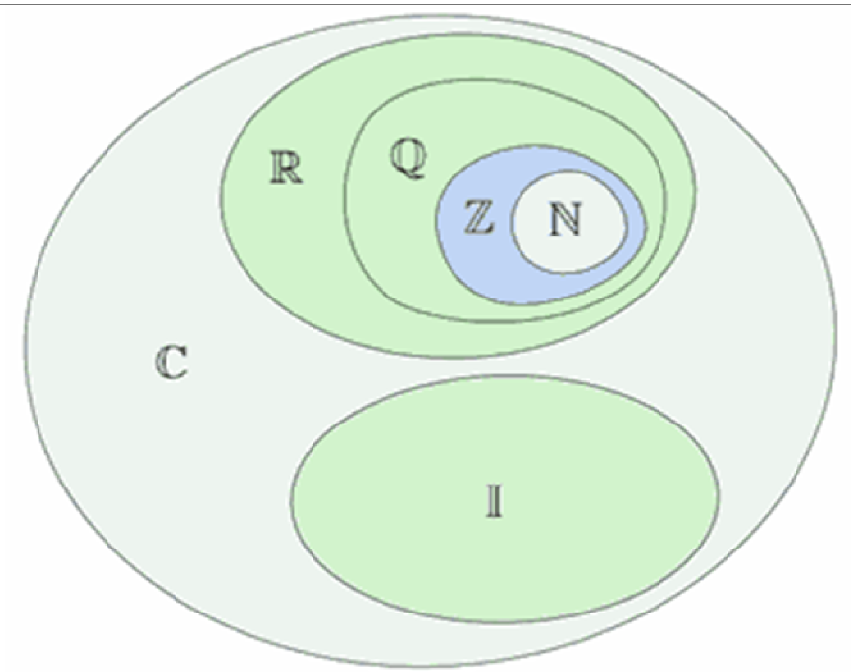

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Countably versus Uncountably Infinite

- The set of positive integers is countably infinite because even though there are infinite amount of positive integers, you can order them and count them. For any given integer, there is a "next one" to count next.
- The set of real numbers is so vast that you could not count them. Between any 2 real numbers, there is an infinite amount of additional numbers. Given any real number, there is no such thing as the next real number.

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Set Notation

- $\in$ - is an element (or member) of
- $\notin$ - is not an element (or member) of
- $\subseteq$ - is a subset of
- $\subset$ - is a proper subset of (meaning A is a subset of B but A$\neq$B
- $\not\subset$ - is not a subset of
- $\varnothing$ - the empty set (set has no members)
- $\{\ \}$ - Set A = $\{1,3,5,7,9,\ldots\}$ or $\{(2n-1)/n\in\mathbb{Z}^{+}\}$

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- $\bigcap$ - the **intersection** of sets A and B, denoted $A \cap B$ is the set of all elements that are in both set A and B.
- $\bigcup$ - the **union** of sets A and B denoted $A \cup B$ is the set of all elements that are in set A, or in set B, or in both.
- U - the **Universal Set** is the set of all elements under consideration for a particular situation.
- ' – the **Compliment** of a given set A is the set of all elements in the universal set that are not elements of set A.

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