**Exercise 1.** Prove that the summation identity

$$1 + 4 + 9 + \cdots + n^2 = \frac{n(n+1)(2n+1)}{6} \tag{1}$$

holds for all $n \in \mathbb{Z}^+$.

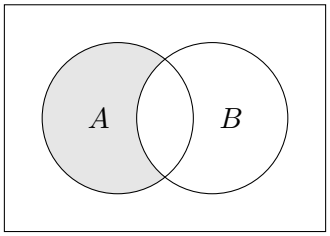
*Proof.* In the case of $n = 1$, we have the left hand side of equation (1) is 1, while the right hand side is $\frac{1(2)(3)}{6} = 1$. So equation (1) holds for $n = 1$.

Suppose equation (1) holds for some $k \in \mathbb{Z}^+$. We will now show that under this assumption, the identity holds for $k + 1$. We see that

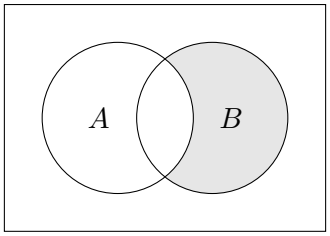
$$\begin{aligned}
1 + 4 + 9 + \cdots + (k+1)^2 &= 1 + 4 + 9 + \cdots + k^2 + (k+1)^2 \\
&= \frac{k(k+1)(2k+1)}{6} + (k+1)^2, \text{ by assumption} \\
&= (k+1)\left[\frac{k(2k+1)}{6} + (k+1)\right] \\
&= (k+1)\left[\frac{k(2k+1) + 6(k+1)}{6}\right] \\
&= (k+1) \cdot \frac{2k^2 + 7k + 6}{6} \\
&= (k+1) \cdot \frac{(k+2)(2k+3)}{6} \\
&= \frac{(k+1)(k+2)(2(k+1)+1)}{6}.
\end{aligned}$$

Therefore, by the Principle of Mathematical Induction, equation (1) holds for all $n \in \mathbb{Z}^+$. □

**Exercise 2.** Draw a Venn diagrams for $A \setminus B$ and $B \setminus A$.




$A \setminus B$




$B \setminus A$

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TikZ Resources:

- Jacques Crémer, A very minimal introduction to TikZ:
  `https://cremeronline.com/LaTeX/minimaltikz.pdf`
- PGF and TikZ examples gallery:
  `http://www.texample.net/tikz/examples/`
- TeX - LaTeX Stack Exchange (covers all TeX related questions, not focused solely on TikZ):
  `https://tex.stackexchange.com`