Section 1.3 Matrices and Their Algebra

32. The $(i,j)^{th}$ entry of $(AB)^T$ is the $(j,i)^{th}$ entry in AB, which is

$$\begin{aligned} & (j^{th} \text{ row of } A) \cdot (i^{th} \text{ column of } B) \\ = \ & (i^{th} \text{ column of } B) \cdot (j^{th} \text{ row of } A) \\ = \ & (i^{th} \text{ row of } B^T) \cdot (j^{th} \text{ column of } A^T) \end{aligned}$$

which is the $(i,j)^{th}$ entry of B^TA^T. Since $(AB)^T$ and B^TA^T have the same size, they are equal.