**Multiplying Matrices 1**

1. $\left(\begin{matrix}1&1\\1&1\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)$
2. $\left(\begin{matrix}4&1\\2&3\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)$
3. $\left(\begin{matrix}1&0\\0&1\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)$
4. $\left(\begin{matrix}2&0\\0&2\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)$
5. $\left(\begin{matrix}0&-1\\-1&0\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)$
6. $\left(\begin{matrix}0&0\\0&0\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)$
7. $\left(\begin{matrix}a&b\\c&d\end{matrix}\right)\left(\begin{matrix}p&q\\r&s\end{matrix}\right)$
8. $\left(\begin{matrix}1&5\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\end{matrix}\right)$
9. $\left(\begin{matrix}1&2&3\end{matrix}\right)\left(\begin{matrix}4\\5\\6\end{matrix}\right)$
10. $\left(\begin{matrix}1&0&-3\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\\5&6\end{matrix}\right)$
11. $\left(\begin{matrix}1&2&3\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\end{matrix}\right)$

**Multiplying Matrices 2**

1. $\left(\begin{matrix}4&1\\2&3\end{matrix}\right)\left(\begin{matrix}-1&2\\3&-4\end{matrix}\right)$
2. $\left(\begin{matrix}1&0\\0&1\end{matrix}\right)\left(\begin{matrix}-1&2\\3&-4\end{matrix}\right)$
3. $\left(\begin{matrix}1&-1\\-2&0\end{matrix}\right)\left(\begin{matrix}-1&2\\3&-4\end{matrix}\right)$
4. $\left(\begin{matrix}1&0&-3\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\\5&6\end{matrix}\right)$
5. $\left(\begin{matrix}1&-5\end{matrix}\right)\left(\begin{matrix}1&-2&3\\-4&5&-6\end{matrix}\right)$
6. $\left(\begin{matrix}5&0\\0&5\end{matrix}\right)\left(\begin{matrix}a&b\\c&d\end{matrix}\right)$
7. $\left(\begin{matrix}a&b\\c&d\end{matrix}\right)\left(\begin{matrix}p&q\\r&s\end{matrix}\right)$
8. $\left(\begin{matrix}p&q\\r&s\end{matrix}\right)\left(\begin{matrix}a&b\\c&d\end{matrix}\right)$
9. $\left(\begin{matrix}1&0&2\\-1&3&0\\0&-2&-3\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\\7&8&9\end{matrix}\right)$
10. $\left(\begin{matrix}1&2\\3&4\end{matrix}\right)^{2}$
11. $\left(\begin{matrix}-1&2\\3&-4\end{matrix}\right)\left(\begin{matrix}1&1\\1&1\end{matrix}\right)$
12. Compare your answer to question 11 with that of question 1 and make conclusions

**Multiplying Matrices 3**

|  |  |  |
| --- | --- | --- |
| $$A=\left(\begin{matrix}1&2\\3&4\end{matrix}\right)$$ | $$B=\left(\begin{matrix}4&1\\2&3\end{matrix}\right)$$ | $$C=\left(\begin{matrix}2&0\\0&2\end{matrix}\right)$$ |

1. $AB$
2. $BA$
3. $C\left(AB\right)$
4. (CA)B
5. $A^{2}$
6. $A(A^{2})$
7. $\left(A^{2}\right)A$
8. $(A+B)^{2}$
9. $A^{2}+2AB+B^{2}$
10. $\left(\begin{matrix}1&0&-3\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\\5&6\end{matrix}\right)$
11. $\left(\begin{matrix}1&-1\\-1&0\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\end{matrix}\right)$
12. $\left(\begin{matrix}1&0&1\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\\7&8&9\end{matrix}\right)$
13. $\left(\begin{matrix}1&2&3\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\end{matrix}\right)$
14. State two matrices $A$ and $B$ for which $AB$ is possible but $BA$ is not.

**Multiplying Matrices 1**

1. $\left(\begin{matrix}1&1\\1&1\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)= \left(\begin{matrix}4&6\\4&6\end{matrix}\right)$
2. $\left(\begin{matrix}4&1\\2&3\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)= \left(\begin{matrix}7&12\\11&16\end{matrix}\right)$
3. $\left(\begin{matrix}1&0\\0&1\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)= \left(\begin{matrix}1&2\\3&4\end{matrix}\right)$
4. $\left(\begin{matrix}2&0\\0&2\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)= \left(\begin{matrix}2&4\\6&8\end{matrix}\right)$
5. $\left(\begin{matrix}0&-1\\-1&0\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)= \left(\begin{matrix}-3&-4\\-1&-2\end{matrix}\right)$
6. $\left(\begin{matrix}0&0\\0&0\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)= \left(\begin{matrix}0&0\\0&0\end{matrix}\right)$
7. $\left(\begin{matrix}a&b\\c&d\end{matrix}\right)\left(\begin{matrix}p&q\\r&s\end{matrix}\right)= \left(\begin{matrix}ap+br&aq+bs\\cp+dr&cq+ds\end{matrix}\right)$
8. $\left(\begin{matrix}1&5\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\end{matrix}\right)= \left(\begin{matrix}21&27&33\end{matrix}\right)$
9. $\left(\begin{matrix}1&2&3\end{matrix}\right)\left(\begin{matrix}4\\5\\6\end{matrix}\right)= \left(32\right)$
10. $\left(\begin{matrix}1&0&-3\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\\5&6\end{matrix}\right)=\left(\begin{matrix}-14&-16\end{matrix}\right)$
11. $\left(\begin{matrix}1&2&3\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\end{matrix}\right)$ Not possible.

**Multiplying Matrices 2**

1. $\left(\begin{matrix}4&1\\2&3\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\end{matrix}\right)= \left(\begin{matrix}7&12\\11&16\end{matrix}\right)$
2. $\left(\begin{matrix}1&0\\0&1\end{matrix}\right)\left(\begin{matrix}-1&2\\3&-4\end{matrix}\right)= \left(\begin{matrix}-1&2\\3&-4\end{matrix}\right)$
3. $\left(\begin{matrix}1&-1\\-2&0\end{matrix}\right)\left(\begin{matrix}-1&2\\3&-4\end{matrix}\right)= \left(\begin{matrix}-4&6\\2&-4\end{matrix}\right)$
4. $\left(\begin{matrix}1&0&-3\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\\5&6\end{matrix}\right)=\left(\begin{matrix}-14&-16\end{matrix}\right)$
5. $\left(\begin{matrix}1&-5\end{matrix}\right)\left(\begin{matrix}1&-2&3\\-4&5&-6\end{matrix}\right)= \left(\begin{matrix}21&-27&33\end{matrix}\right)$
6. $\left(\begin{matrix}5&0\\0&5\end{matrix}\right)\left(\begin{matrix}a&b\\c&d\end{matrix}\right)= \left(\begin{matrix}5a&5b\\5c&5d\end{matrix}\right)$
7. $\left(\begin{matrix}a&b\\c&d\end{matrix}\right)\left(\begin{matrix}p&q\\r&s\end{matrix}\right)= \left(\begin{matrix}ap+br&aq+bs\\cp+dr&cq+ds\end{matrix}\right)$
8. $\left(\begin{matrix}p&q\\r&s\end{matrix}\right)\left(\begin{matrix}a&b\\c&d\end{matrix}\right)= \left(\begin{matrix}ap+cq&bp+dq\\ar+cs&br+ds\end{matrix}\right)$
9. $\left(\begin{matrix}1&0&2\\-1&3&0\\0&-2&-3\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\\7&8&9\end{matrix}\right)= \left(\begin{matrix}-3&18&21\\11&13&15\\-29&-34&-39\end{matrix}\right)$
10. $\left(\begin{matrix}1&2\\3&4\end{matrix}\right)^{2}= \left(\begin{matrix}7&10\\15&22\end{matrix}\right)$
11. $\left(\begin{matrix}-1&2\\3&-4\end{matrix}\right)\left(\begin{matrix}1&1\\1&1\end{matrix}\right)= \left(\begin{matrix}1&1\\-1&-1\end{matrix}\right)$
12. Compare your answer to question 11 with that of question 1 and make conclusions

**Multiplying Matrices 3**

|  |  |  |
| --- | --- | --- |
| $$A=\left(\begin{matrix}1&2\\3&4\end{matrix}\right)$$ | $$B=\left(\begin{matrix}4&1\\2&3\end{matrix}\right)$$ | $$C=\left(\begin{matrix}2&0\\0&2\end{matrix}\right)$$ |

1. $AB= \left(\begin{matrix}8&7\\20&15\end{matrix}\right)$
2. $BA= \left(\begin{matrix}7&12\\11&16\end{matrix}\right)$
3. $C(AB)= \left(\begin{matrix}16&14\\40&30\end{matrix}\right)$
4. $(CA)B= \left(\begin{matrix}16&14\\40&30\end{matrix}\right)$
5. $A^{2}= \left(\begin{matrix}7&10\\15&22\end{matrix}\right)$
6. $A(A^{2})= \left(\begin{matrix}37&54\\81&118\end{matrix}\right)$
7. $(A^{2})A= \left(\begin{matrix}37&54\\81&118\end{matrix}\right)$
8. $(A+B)^{2}= \left(\begin{matrix}40&36\\60&64\end{matrix}\right)$
9. $A^{2}+2AB+B^{2}= \left(\begin{matrix}41&31\\69&63\end{matrix}\right)$
10. $\left(\begin{matrix}1&0&-3\end{matrix}\right)\left(\begin{matrix}1&2\\3&4\\5&6\end{matrix}\right)=\left(\begin{matrix}-14&-16\end{matrix}\right)$
11. $\left(\begin{matrix}1&-1\\-1&0\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\end{matrix}\right)= \left(\begin{matrix}-3&-3&-3\\-1&-2&-3\end{matrix}\right)$
12. $\left(\begin{matrix}1&0&1\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\\7&8&9\end{matrix}\right)= \left(\begin{matrix}8&10&12\end{matrix}\right)$
13. $\left(\begin{matrix}1&2&3\end{matrix}\right)\left(\begin{matrix}1&2&3\\4&5&6\end{matrix}\right)$ Not possible.
14. State two matrices $A$ and $B$ for which $AB$ is possible but $BA$ is not. Any for which the numbers of columns in A does not match the number of rows in B **and** for which the number of rows in A does match the number of columns in B.