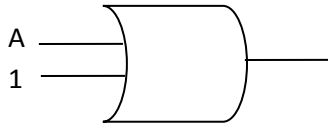
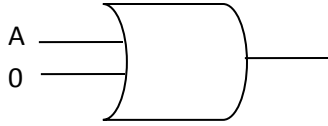


BOOLEAN ALGEBRA INVESTIGATIONS

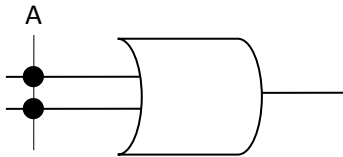
Adapted from <http://educ.queensu.ca/~compsci/resources/BoolLogic/assocdistrib.html>



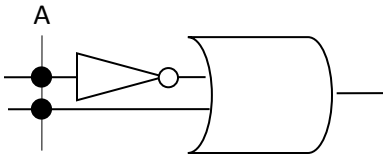
1. If one of the inputs is always 1 (true), what is the output? [Click here to enter text.](#)
Therefore, $A + 1 =$ [Click here to enter text.](#)



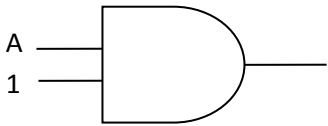
2. If one of the inputs is always 0 (false), what is the output? [Click here to enter text.](#)
What variable is the output dependent upon? [Click here to enter text.](#)
Therefore, $A + 0 =$ [Click here to enter text.](#)



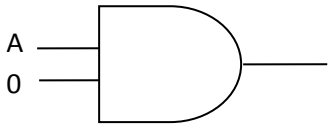
3. If $A = 0$, then the output is [Click here to enter text.](#)
If $A = 1$, then the output is [Click here to enter text.](#)
How does the output compare with the input? [Click here to enter text.](#)
Therefore, $A + A =$ [Click here to enter text.](#)



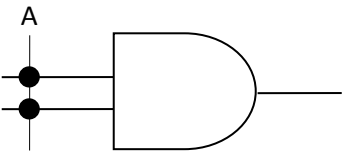
4. If $A = 1$, then the output is [Click here to enter text.](#)
If $A = 0$, then the output is [Click here to enter text.](#)
How does the output compare with the input? [Click here to enter text.](#)
Therefore, $A + \bar{A} =$ [Click here to enter text.](#)



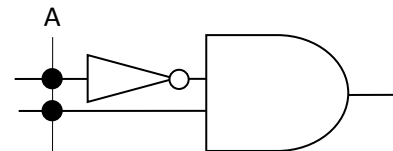
5. If one of the inputs is always 1 (true), what is the output? [Click here to enter text.](#)
What variable is the output dependent upon? [Click here to enter text.](#)
Therefore, $A * 1 =$ [Click here to enter text.](#)



6. If one of the inputs is always 0 (false), what is the output? [Click here to enter text.](#)
Therefore, $A * 0 =$ [Click here to enter text.](#)



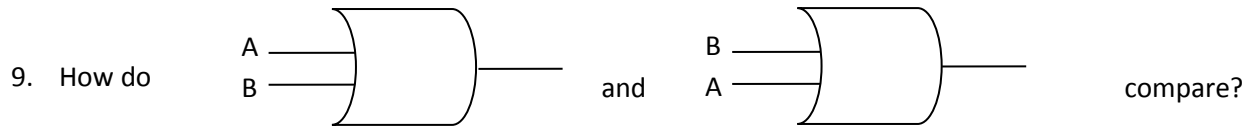
7. If $A = 0$, then the output is [Click here to enter text.](#)
If $A = 1$, then the output is [Click here to enter text.](#)
How does the output compare with the input? [Click here to enter text.](#)
Therefore, $A * A =$ [Click here to enter text.](#)



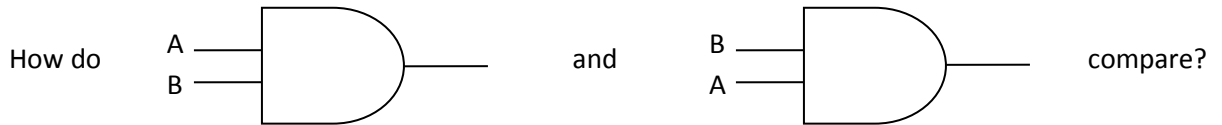
8. If $A = 1$, then the output is _____
If $A = 0$, then the output is _____
Therefore, $A * \bar{A} =$ _____

List the EIGHT basic rules of Boolean Algebra you gained from exercises 1-8:

[Click here to enter text.](#)



Therefore, $A+B =$ _____



What arithmetic law is this? _____

Therefore, $A*B =$ _____

10. Consider the boolean expression $A + B + C$. Does it matter which OR you evaluate first : $(A+B$ or $B+C)$? Verify that $(A + B) + C = A + (B + C)$ by writing out truth tables for each expression. Make an intermediate column for $(A+B)$ and $(B+C)$ in each truth table. Here is a table to get you started:

A	B	C	(A+B)	(A+B)+C	(B+C)	A+(B+C)
0	0	0				
0	0	1				
0	1	0				
0	1	1				
1	0	0				
1	0	1				
1	1	0				
1	1	1				

11. Now consider the boolean expression $A * B * C$. Does it matter which AND you evaluate first : $(A*B$ or $B*C)$? Verify that $(A * B) * C = A * (B * C)$ by writing out truth tables for each expression. Make intermediate columns for $(A*B)$ and $(B*C)$ in each truth table.

12.

A	B	C	(A*B)	(A*B)*C	(B*C)	A*(B*C)
0	0	0				
0	0	1				
0	1	0				
0	1	1				
1	0	0				
1	0	1				
1	1	0				
1	1	1				

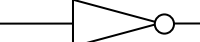
Which arithmetic law is this? _____

What arithmetic law does this demonstrate for boolean algebra? [Click here to enter text.](#)

19. Given the laws you proved in problems 12-18, what can you say about $(A+B)*(C+D)$?
 [HINT: what algebra method can be used?] Draw a truth table to prove your hypothesis.

>> $(A+B)*(C+D) =$ [Click here to enter text.](#)

A	B	C	D	(A+B)	(C+D)	(A+B)* (C+D)					

20. Consider the NOT gate  . Construct a truth table.

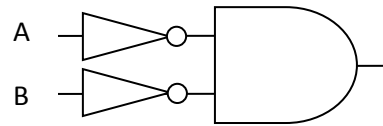
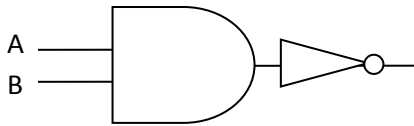
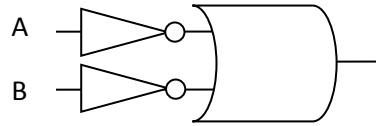
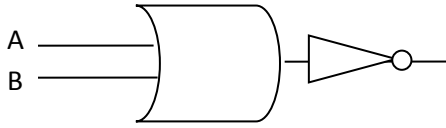
A	\bar{A}

21. Construct a truth table for the following: 

A	

22. What conclusions can you draw from looking at the two truth tables?
 >> [Click here to enter text.](#)

23. Construct truth tables for each of the following:



Add more columns if you need to complete any of the tables.

A	B		

A	B		

A	B		

A	B		

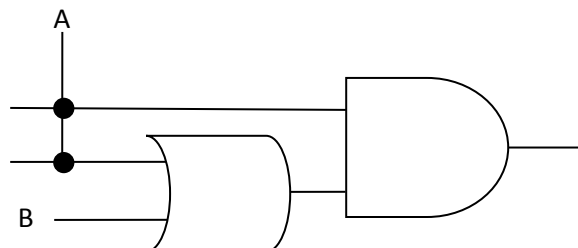
24. Compare the four truth tables. What conclusions can you draw? Use boolean expression to express your findings.

>>Click here to enter text.

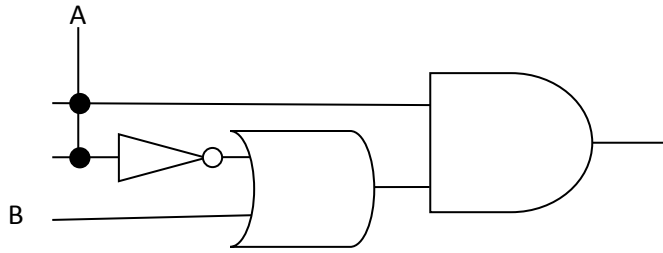
These expressions are known as DeMorgan's Law.

25. Consider the following diagram. If A=0, what is the output? _____.

If A=1, what is the output? _____. Therefore, $A*(A + B) =$ _____.



26.

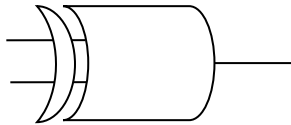


Write a truth table for the above diagram.

A	B		

Does it look familiar? What conclusions can you draw? [Click here to enter text.](#)

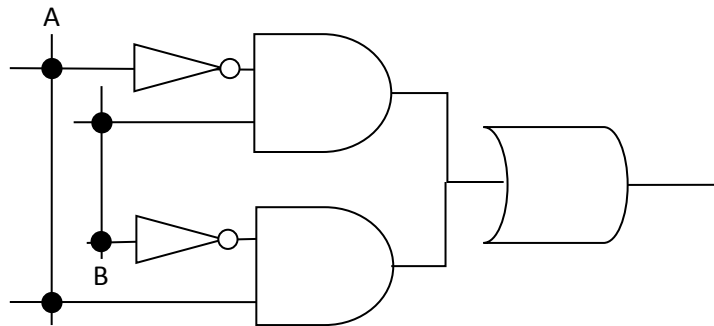
27. Now consider the XOR gate



Create a truth table.

A	B		

28. Now write a boolean expression for the following diagram. [Click here to enter text.](#)

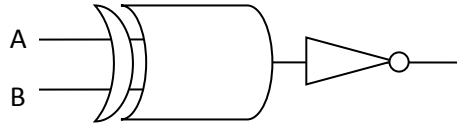
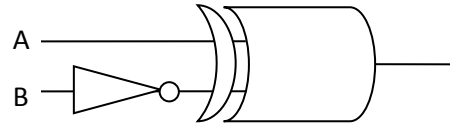
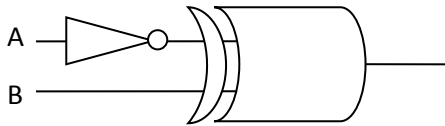


Construct a truth table.
Add more columns if you need them.

A	B		

Compare the truth tables for 27 and 28. What is your conclusion? [Click here to enter text.](#)

29. Compare the following three diagrams, by writing out the boolean expressions and then constructing corresponding truth tables.



A	B		

A	B		

A	B		

What are your conclusions? [Click here to enter text.](#)