**Exercise 11a**

1. x ^ (~y V x)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x | y | ~y | (~y V x) | x ^ (~y V x) |
| True | True | False | True | True |
| True | False | True | True | True |
| False | True | False | False | False |
| False | False | True | True | False |

1. a V (~b ^ c)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| a | b | c | ~b | (~b ^ c) | a V (~b ^ c ) |
| True | True | True | False | False | True |
| True | True | False | False | False | True |
| True | False | False | True | False | True |
| False | True | True | False | False | False |
| False | True | False | False | False | True |
| False | False | True | True | True | True |
| True | False | True | True | True | True |
| False | False | False | True | False | False |

1. (a V (~b V c)) ^ ~b

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| a | b | c | ~b | (~b V c) | (a V (~b V c)) | (a V (~b V c)) ^ ~b |
| True | True | True | False | True | True | False |
| True | True | False | False | False | True | False |
| True | False | False | True | True | True | True |
| False | True | True | False | True | True | False |
| False | True | False | False | False | False | False |
| False | False | True | True | True | True | True |
| True | False | True | True | True | True | True |
| False | False | False | True | True | True | True |

1. (a ^ b) V ~c
2. ~(p ^ q) V (p ^ r) ^ ~r



