Writting assignment 6

name: Jamie Ash
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Tautology: I will fly to Vietnam on Thursday, 2022-09-29, or I will not fly to Vietnam next on Thursday, 2022-09-29.

This statement can be decomposed into two simpler statements.
P: I will fly to Vietnam on Thursday, 2022-09-29.
Q: I will not fly to Vietnam on Thursday, 2022-09-29.

When Q is not $\sim P$...

```
P = c(TRUE, FALSE) #true and false values for P
Q = !P #not pee
PoQ = P|Q #pee or q
data.frame(P, Q, PoQ)
```

```
##       P     Q  PoQ
## 1  TRUE FALSE TRUE
## 2 FALSE  TRUE TRUE
```

All possible outcomes of $P \cup Q$ are true, so my tautology is a tautology.

Question 4: If $4 \nmid a^2$ the a is odd.

The contrapositive of question 4 is as follows...

$$\text{If } a \text{ is even, then } 4 \mid a^2.$$

Proof: Assume a is even. So $a = 2k$ for $k \in Z$. It follows that $a^2 = 4(k)(k) = 4l$ for $l \in Z$. Thus the remainder of $4l/4$ is l for $l \in Z$. This means $a^2/4 = l$ for $l \in Z$. Therefore $4 \mid a^2$.

Question 6: (For $x \in R$) If $x^2 + 5x < 0$, then $x < 0$.

The contrapositive of question 6 is as follows...

$$\text{(For } x \in R\text{) If } x > 0, \text{ then } x^2 + 5x > 0.$$

Proof: Assume $x > 0$ and $x \in R$, then $x \in R^+$. Through the multiplicative property of R^+ we find $x^2 + 5x = y$, for $y \in R^+$. Therefore $x^2 + 5x > 0$.