HW 3 – Evens

Sec. 2.3

(2) If a function is differentiable, then it is continuous.

P: a function is differentiable
Q: it is continuous

(8) If $|r|<1$, then any geometric series $\left(\sum_{n=0}^{\infty} x^n\right)$ converges on $\{x \in \mathbb{R} \mid |x| \leq r\}$.

P: $|r|<1$
Q: any geometric series converges on $\{x \in \mathbb{R} \mid |x| \leq r\}$

Sec. 2.4

(2) A function has a constant derivative iff (if & only if) it is linear.

Sec. 2.5

(4)

P	Q	P∨Q	~(P∨Q)	~Q	~(P∨Q) ∨ ~Q
T	T	T	F	F	F
T	F	T	F	T	T
F	T	T	F	F	F
F	F	F	T	T	T

Sec. 2.5

(8)

P	Q	R	~R	Q ∧ ~R	P ∨ (Q ∧ ~R)
T	T	T	F	~~T~~ F	T
T	T	F	T	T	T
T	F	T	F	F	T
T	F	F	T	~~T~~ F	T
F	T	T	F	~~T~~ F	~~T~~ F
F	T	F	T	T	T
F	F	T	F	F	F
F	F	F	T	~~T~~ F	~~T~~ F

(10) $((P \wedge Q) \vee R) \Rightarrow (R \vee S)$ F

T F

can only happen this way, fr. the truth table of $P \to Q$.

$\Rightarrow R \vee S = F \Rightarrow R = F \;\&\; S = F$

and

$(P \wedge Q) \vee R = T$ ($R = F$) $\Rightarrow P \wedge Q = T$

$\Rightarrow P = T,\ Q = T$

Sec. 2.6

(A2)

P	Q	$\sim P$	$\sim Q$	$P \wedge Q$	$\sim P \vee \sim Q$	$\sim(\sim P \vee \sim Q)$
T	T	F	F	T	F	T
T	F	F	T	F	T	F
F	T	T	F	F	T	F
F	F	T	T	F	T	F

(B12)

P	Q	$\sim Q$	$P \wedge \sim Q$	$P \Rightarrow Q$	$\sim(P \Rightarrow Q)$
T	T	F	F	T	F
T	F	T	T	F	T
F	T	F	F	T	F
F	F	T	F	T	F

yes! $P \wedge \sim Q \iff \sim(P \Rightarrow Q)$

Sec. 2.7

(4) Every subset of natural numbers is a subset of real numbers. T

(8) Every integer is the cardinality of some subset of natural numbers. F (negative cardinality?)

Sec. 2.9

(4) Let $P \subseteq \mathbb{Z}$ be the set of all primes. Then,

$$\forall p \in P,\ \exists q \in P,\ q > p$$

(6) $$\forall \varepsilon > 0,\ \exists M > 0,\ \big((x > M) \Rightarrow (|f(x) - b| < \varepsilon)\big)$$

(12) Let X = all people on earth, and let
$F_t(x)$ = "fool x" at time t for $x \in X$. Then,

$$\big(\forall x \in X,\ \exists t \in \mathbb{R},\ F_t(x)\big) \wedge \big(\forall t \in \mathbb{R},\ \exists x \in X,\ F_t(x)\big)$$
$$\wedge\ \sim\big(\forall x \in X,\ \forall t \in \mathbb{R},\ F_t(x)\big)$$

Sec. 2.10

(2) Let P = all primes.

$$\exists x \in P,\ \sqrt{x} \in \mathbb{Q}$$

(4) $$\exists \varepsilon > 0,\ \forall \delta > 0,\ \big((|x-a| < \delta) \wedge (|f(x) - f(a)| \geq \varepsilon)\big)$$

(12) Sometimes, when I choose bet. 2 evils, I choose one I've already tried