True or False Problems

1. If $a_n, b_n > 0$ and $\sum_{n=1}^{\infty} a_n$ converges and $\sum_{n=1}^{\infty} b_n$ diverges then $\sum_{n=1}^{\infty} a_n b_n$ diverges.
2. If $a_n, b_n > 0$ and $\sum_{n=1}^{\infty} a_n$ converges and $\sum_{n=1}^{\infty} b_n$ diverges then $\sum_{n=1}^{\infty} a_n + b_n$ diverges.
3. If $\sum_{n=1}^{\infty} a_n$ converges and $\sum_{n=1}^{\infty} b_n$ converges then $\sum_{n=1}^{\infty} a_n + b_n$ converges.
4. If $\sum_{n=1}^{\infty} a_n$ converges then $\sum_{n=1}^{\infty} a_n^2$ converges.
5. If $a_n > 0$ and $\sum_{n=1}^{\infty} a_n$ converges then $\sum_{n=1}^{\infty} a_n^2$ converges.
6. If $a_n, b_n > 0$ and $\sum_{n=1}^{\infty} a_n$ converges and $\sum_{n=1}^{\infty} b_n$ converges then $\sum_{n=1}^{\infty} a_n/b_n$ converges.
7. If $\sum_{n=1}^{\infty} a_n$ converges then $\sum_{n=1}^{\infty} n a_n$ converges.
8. If $\{a_n\}$is increasing and bounded above then it is convergent.
9. If $\{a_n\}$is decreasing and positive then it is convergent.
10. If $\{a_n\}$is increasing and positive then it is convergent.
11. If $\{a_n\}$is monotonic and bounded below then it is convergent.
12. If $\{a_n\}$is convergent and bounded then it is monotonic.
13. If $a_n > 0$ and $\lim_{n\to\infty} a_n = 0$ then $\{a_n\}$ is monotonically decreasing.
14. If $\sum_{n=1}^{\infty} a_n$ converges then it converges absolutely.
15. If $\sum_{n=1}^{\infty} |a_n|$ converges then $\sum_{n=1}^{\infty} a_n$ converges.
16. If $\sum_{n=1}^{\infty} a_n$ converges absolutely then $\sum_{n=1}^{\infty} \sin(a_n) a_n$ converges.
17. If $\sum_{n=1}^{\infty} a_n$ converges conditionally then $\sum_{n=1}^{\infty} a_n/\sqrt{n}$ converges absolutely.
18. If $\sum_{n=1}^{\infty} a_n$ converges conditionally and $\{b_n\}$ is bounded then $\sum_{n=1}^{\infty} a_n b_n$ converges.
19. If $\sum_{n=1}^{\infty} a_n$ converges absolutely and $\{b_n\}$ is bounded then $\sum_{n=1}^{\infty} a_n b_n$ converges.
20. If the radius of convergence of $\sum_{n=1}^{\infty} a_n x^n$ is 3 then $\sum_{n=1}^{\infty} a_n$ is divergent.
21. If $\sum_{n=1}^{\infty} a_n$ is divergent then the radius of convergence of $\sum_{n=1}^{\infty} a_n x^n$ is 1/3.
22. If $c \in \mathbb{R}$ is some constant then the radius of convergence of $\sum_{n=1}^{\infty} c a_n x^n$ is the same as the radius of convergence of $\sum_{n=1}^{\infty} a_n x^n$.
23. If $P(x)$ is some polynomial then $\sum_{n=1}^{\infty} P(n) x^n$ has radius of convergence 1.