8. [12 points] Suppose a_n and b_n are sequences of positive numbers with the following properties.

- $\displaystyle\sum_{n=1}^{\infty} a_n$ converges.

- $\displaystyle\sum_{n=1}^{\infty} b_n$ diverges.

- $0 < b_n \leq M$ for some positive number M.

For each of the following questions, circle the correct answer. No justification is necessary.

a. [2 points] Does the series $\displaystyle\sum_{n=1}^{\infty} a_n b_n$ converge?

| Converge | Diverge   Cannot determine

b. [2 points] Does the series $\displaystyle\sum_{n=1}^{\infty} (-1)^n b_n$ converge?

Converge   Diverge | Cannot determine |

c. [2 points] Does the series $\displaystyle\sum_{n=1}^{\infty} \sqrt{b_n}$ converge?

Converge | Diverge | Cannot determine

d. [2 points] Does the series $\displaystyle\sum_{n=1}^{\infty} \sin(a_n)$ converge?

| Converge | Diverge   Cannot determine

e. [2 points] Does the series $\displaystyle\sum_{n=1}^{\infty} (a_n + b_n)^2$ converge?

Converge   Diverge | Cannot determine |

f. [2 points] Does the series $\displaystyle\sum_{n=1}^{\infty} e^{-b_n}$ converge?

Converge | Diverge | Cannot determine