1. Find the following limit
$$\lim_{n\to\infty} \frac{\tan^{-1} n}{2n}$$

2. Determine whether the following series converge or diverge.Make sure to verify the hypothesis of any test you are using.
(a)
$$\sum_{n=2}^{\infty} \frac{1}{n\sqrt{\ln n}}$$
(b)
$$\sum_{n=2}^{\infty} \frac{\cos^2(n)}{n^2+1}$$
(c)
$$\sum_{n=1}^{\infty} \ln(n+1) - \ln(n)$$

3. Show that the following series satisfies the hypothesis of the alternating series test, and thus is convergent.
$$\sum_{n=0}^{\infty} \frac{(-1)^n}{n!}$$
How many terms should one add in order to approximate the sum of the series with error$<$ 0.0002?

4. Give an example of an infinite series which is convergent but not absolutely convergent.

5. A ball bounces back to a height of $\frac{h}{3}$ when dropped from a height of h. Suppose that such a ball is dropped from the initial height of 4 meters and subsequently bounces infinitely many times. What is the total up-and-down distance traveled by the ball?

ANSWERS:

1. 0 (use squeeze theorem)

2. a) divergent (integral test) , b) convergent (comparison test) , c) divergent (telescopic series)

3. 7

4.
$$\sum_{n=1}^{\infty} \frac{(-1)^n}{n}$$

5. 8 meters.