

1. Find the exact value of $1 - \frac{1}{3!} + \frac{1}{5!} - \dots$.
2. At RMT 2009 is a man named Bill who has an infinite amount of time. This year, he is walking continuously at a speed of $\frac{1}{1+t^2}$, starting at time $t = 0$. If he continues to walk for an infinite amount of time, how far will he walk?

3. Evaluate $\lim_{x \rightarrow 0} \frac{10x^2}{\sin^2(3x)}$.

4. Compute $\int_0^1 \tan^{-1}(x) dx$

5. Let $a(t) = \cos^2(2t)$ be the acceleration at time t of a point particle traveling on a straight line. Suppose at time $t = 0$, the particle is at position $x = 1$ with velocity $v = -2$. Find its position at time $t = 2$.

6. Find

$$\sum_{n=2}^{\infty} \frac{d^n}{dx^n}(e^{-ax})$$

for $|a| < 1$.

7. Compute

$$\lim_{n \rightarrow \infty} \sum_{k=1}^n \frac{n-k}{n^2} \cos\left(\frac{4k}{n}\right).$$

8. Evaluate $\int_0^{\infty} 4[x+7]e^{-2x} dx$. Remember to express your answer as a single fraction.

9. Compute $\sum_{n=0}^{\infty} n \left(\frac{1}{5}\right)^n$.

10. Evaluate $\sum_{n=1}^{\infty} \frac{1}{50 + n^2/80000}$, as a decimal to the nearest tenth.