1. Which formula is not equivalent to the other two?

   a. \[ \sum_{n=3}^{6} \frac{(-1)^{n-1}}{n - 1} \]

   b. \[ \sum_{n=1}^{4} \frac{(-1)^{n}}{n + 1} \]

   c. \[ \sum_{n=0}^{3} \frac{(-1)^{n}}{n + 2} \]

   Explain your answer.

   b) is not equivalent to a) and c) since

   a) \[ = \frac{1}{2} - \frac{1}{3} + \frac{1}{4} - \frac{1}{5}, \]

   b) \[ = -\frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5}, \quad \text{and} \]

   c) \[ = \frac{1}{2} - \frac{1}{3} + \frac{1}{4} - \frac{1}{5} \]
2. Suppose that \( f \) and \( g \) are integrable and that

\[ \int_{4}^{9} f(x) \, dx = 5 \]

and

\[ \int_{4}^{9} g(x) \, dx = -3. \]

Find

\[ \int_{2}^{3} x(f(x^2) - 2g(x^2)) \, dx. \]

\[ \triangle \]

\[ \int_{2}^{3} x (f(x^2) - 2g(x^2)) \, dx \]

\[ = \int_{2}^{3} (f(x^2) - 2g(x^2)) \frac{1}{2} \, d(x^2) \]

\[ = \int_{2^2}^{3^2} (f(u) - 2g(u)) \frac{1}{2} \, du \]

\[ = \frac{1}{2} \int_{4}^{9} f(u) \, du - \int_{4}^{9} g(u) \, du \]

\[ = \frac{5}{2} + 3 = \frac{11}{2} \]
3. Could it be that
\[ \int_0^{\pi/2} 3 \sin(x^3) \, dx = 2\pi \, ? \]

Explain your answer.

△

\[ 3 \sin(x^3) \leq 3 \quad \text{since} \quad \sin(y) \leq 1 \]

Thus,
\[ \int_0^{\pi/2} 3 \sin(x^3) \, dx \leq \int_0^{\pi/2} 3 \, dx = \frac{3\pi}{2} < 2\pi. \]

Therefore, the integral cannot equal \( 2\pi \).
4. Find \( f(2012) \) if

\[
\int_1^x f(t) \, dt = (x - 1) \cos(\pi x).
\]

Let \( F(x) = \int_1^x f(t) \, dt \).

Then by the Fundamental Theorem of Calculus,

\[
F'(x) = f(x).
\]

Thus \( f(x) = \frac{d}{dx} \left[ (x - 1) \cos(\pi x) \right] \)

\[
= \cos(\pi x) + (x - 1) \left( -\pi \sin(\pi x) \right)
\]

Now, \( f(2012) = \cos(\pi \times 2012) \)

\[
- 2011 \pi \sin(2012 \pi)
\]

\[
= 1 - 2011 \pi \times 0 = 1.
\]