Math 2030 Assignment 1

E.T.

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The following assignment has a nominal value of 50 points.

1. (20 pts) Show that

   (a)
   $$1 - \binom{n}{2} + \binom{n}{4} - \binom{n}{6} + \ldots = 2^{n/2} \cos \frac{n\pi}{4}$$

   (b)
   $$\binom{n}{1} - \binom{n}{3} + \binom{n}{5} - \binom{n}{7} + \ldots = 2^{n/2} \sin \frac{n\pi}{4}$$

   Sol.

2. (10 pts) Show that
   $$\binom{n}{1} + \binom{n}{5} + \binom{n}{9} + \ldots = \frac{1}{2}\left(2^{n-1} + 2^{n/2} \sin \frac{n\pi}{4}\right)$$

3. (10 pts) Compute the following sum:
   $$\binom{n}{0} + 2\binom{n}{1} + 3\binom{n}{2} + \ldots + (n+1)\binom{n}{n}$$

4. (10 pts) Compute the following sum:
   $$\binom{n}{0} - \binom{n}{1} + \binom{n}{2} - \ldots + (-1)^m \binom{n}{m}$$