

I choose you: Chris Lee Period: 3

1. Use mathematical induction to prove that the given formula works for all positive integers n. [6 points]

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \frac{n^2(n+1)^2}{4}$$

1) prove n=1 is true

$$1^3 = \frac{1^2(1+1)^2}{4}$$
.

2) assume n=k is true

3) prove n= k+1 is true

$$\frac{1^{3}+2^{3}+...+k^{3}+(k+1)^{3}}{4}=\frac{(k+1)^{2}(k+2)^{2}}{4}=\frac{k^{2}(k+1)^{2}+4(k+1)^{3}}{4}=\frac{(k+1)^{2}(k+2)^{2}}{4}$$

$$\frac{k^{2}(k^{2}+2k^{4})+4(k^{3}+2k^{2}+k+k^{2}+2k+1)}{(k^{2}+2k+1)(k^{2}+4k+4)} = \frac{(k^{2}+2k+1)(k^{2}+4k+4)}{(k^{2}+4k+4)}$$

$$\left(k^{4} + 2k^{3} + k^{2} + 4k^{3} + 8k^{2} + 4k + 4k^{2} + 8k + 4 \right) / 4 = \left(k^{4} + 4k^{3} + 9k^{2} + 2k^{3} + 8k^{2} + 8k + k^{2} + 4k + 4 \right) / 4$$

$$\left(k^{4} + 5k^{3} + 12k^{2} +$$

- - 1) base case: prove n=2 is true

2) assume n=k is true

3) prove &= k+1 is true

$$k^{3} + 2k^{2} + k + k^{2} + 2k + 1 - k - 1 = (k^{3} - k) + 3k^{2} + 3k$$

(12-1) OR - Sk div by

both terms are divisible by 3

since they're mult by 3

adding 2 terms that are div by by means they can be div by by by not true: 6+9=15

adding two terms both div final sum also div by 6

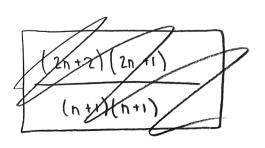
3. Simplify: [4 points]

$$\frac{(2n+2)!(n!)^2}{[(n+1)!]^2(2n)!}$$

$$\frac{(2n+2)!(n!)^2}{[(n+1)!]^2(2n)!}$$

$$\frac{(2n+2)!(2n+1)!}{[(n+1)!]^2}$$

$$\frac{(2n+2)!(2n+1)!}{(n+1)!}$$



4. Evaluate: [2 points each]

a)
$$\binom{-2}{10} = 11$$

$$\frac{-2 \cdot -3 \cdot -4 \cdot ...}{(1 \cdot 1 \cdot 1)}$$

a)
$$\binom{-2}{10} = 11$$

b)
$$\binom{-4}{3} = -20$$

$$\frac{-4 \cdot -5 \cdot -6 \cdot -7 \dots}{3! (-1)!}$$

