

# Solid State Physics: Homework #1

Due on March 11, 2025 at 3:10pm

*Professor Tianxing Ma*

郑晓暘

## Problem 1

Give an appropriate positive constant  $c$  such that  $f(n) \leq c \cdot g(n)$  for all  $n > 1$ .

1.  $f(n) = n^2 + n + 1, g(n) = 2n^3$
2.  $f(n) = n\sqrt{n} + n^2, g(n) = n^2$
3.  $f(n) = n^2 - n + 1, g(n) = n^2/2$

### Solution

We solve each solution algebraically to determine a possible constant  $c$ .

#### Part One

$$\begin{aligned} n^2 + n + 1 &= \\ &\leq n^2 + n^2 + n^2 \\ &= 3n^2 \\ &\leq c \cdot 2n^3 \end{aligned}$$

Thus a valid  $c$  could be when  $c = 2$ .

#### Part Two

$$\begin{aligned} n^2 + n\sqrt{n} &= \\ &= n^2 + n^{3/2} \\ &\leq n^2 + n^{4/2} \\ &= n^2 + n^2 \\ &= 2n^2 \\ &\leq c \cdot n^2 \end{aligned}$$

Thus a valid  $c$  is  $c = 2$ .

#### Part Three

$$\begin{aligned} n^2 - n + 1 &= \\ &\leq n^2 \\ &\leq c \cdot n^2/2 \end{aligned}$$

Thus a valid  $c$  is  $c = 2$ .

## Problem 2

计算体心立方堆积、面心立方堆积和密堆积的钢球体积/总体积比值。

**Solution** ti'xing