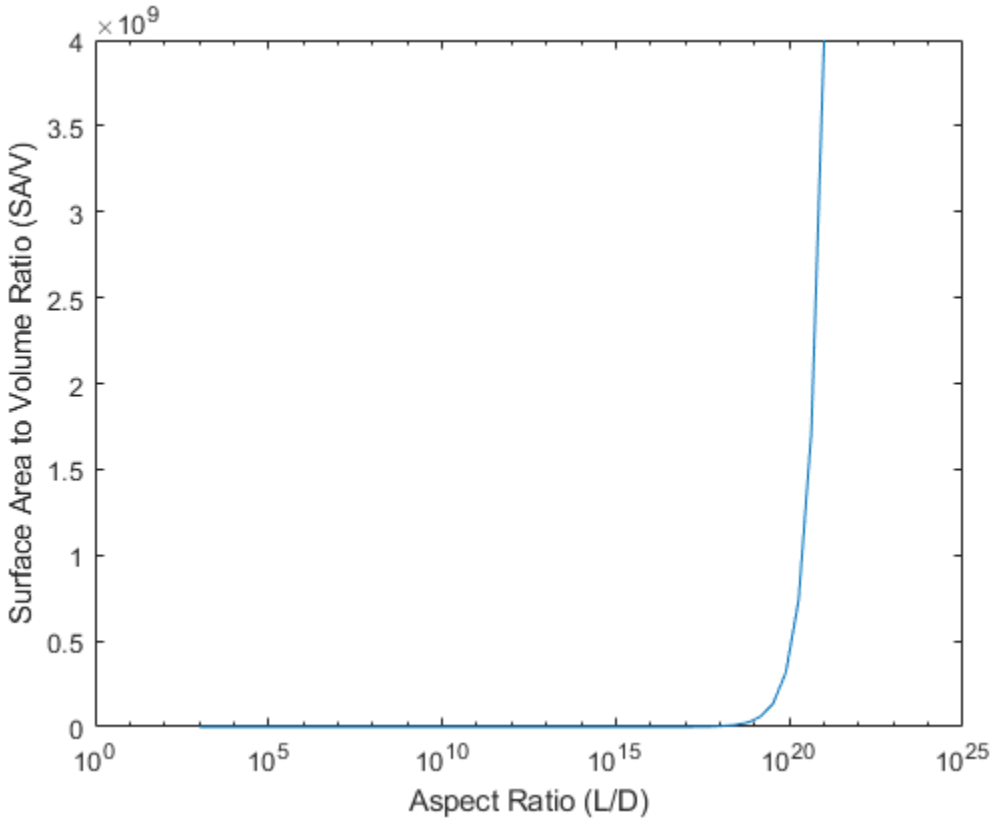
Problem 1:

a) A/V for 1 cm diameter and 1 cm length: 600 m^{-1}

b)



Problem 2:

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$V = \pi \cdot 0.005^2 \cdot 0.01 = 7.854 \times 10^{-7} m^3$

$\frac{5000}{7.854 \times 10^{-7}} = 6.3662 \times 10^9$ Defects/m^3

a) 50 cm fiber:

$V = \pi (2.5 \times 10^{-6})^2 \cdot 0.5 = 9.8175 \times 10^{-12} m^3$

$9.8175 \times 10^{-12} \cdot 6.3662 \times 10^9 =$ **0.0625 defects**

b) 3000 fibers:

$0.0625 \cdot 3000 =$ **187.5 defects**

c) 1 layer:

33.33 yarn sections

$187.5 \cdot 33.33 =$ **6250 Defects**

d) 10 layers:

62500 Defects

Problem 3:

Sidewalk: concrete
Pavement: asphalt
RC Plane: carbon fiber
Houses: plywood

Code for problem 1:

```
clc;clear;
length1=0.01;
dia1=0.01;
volume=(pi*(dia1/2)^2)*length1;
SA1=(pi*dia1*length1)+(2*pi*(dia1/2)^2);
SAVratio=SA1/volume;
diameters=logspace(-9,0);
ARs=[];
SAVratios=[];
for i=1:length(diameters)
    len=volume/(pi*(diameters(i)/2)^2);
    ARs(i)=len/diameters(1);
    SA=(pi*diameters(1)*len)+(2*pi*(diameters(1)/2)^2);
    SAVratios(i)=SA/volume;
end
semilogx(ARs,SAVratios)
xlabel('Aspect Ratio (L/D)')
ylabel('Surface Area to Volume Ratio (SA/V)')
```