Problem 1 (11, Section 1.5)

(a) The circle is described by 
\((x-\frac{1}{2})^2 + (y-\frac{1}{2})^2 = \frac{1}{4}\)

Area of the circle = \(\pi \frac{1}{4}\)

Desired probability = \(1 - \frac{\pi/4}{\pi} = 1 - \frac{1}{4} = \frac{3}{4}\)

(b) Area of interest = 1 - \(2 \cdot \left(\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}\right)\)

= 1 - \(\frac{1}{4}\) = \(\frac{3}{4}\)

Probability of interest = \(\frac{3/4}{1}\)
c) This curve is $y = 1 - x^2$

Area of interest $= \int_0^1 (1-x^2) \, dx = x - \frac{x^3}{3}\bigg|_0^1 = 1 - \frac{1}{3} = \frac{2}{3}$

Probability of interest $= \frac{\frac{2}{3}}{1}$

d) $x = y$

Area of the line $= 0$

Probability of interest $= 0$
Problem 2 (6, Section 1.6)

The sample space is $S=\{\text{HHH, HHT, \ldots, TTT}\}$ → 8 outcomes

$P(\text{all three faces are the same}) = P(\text{HHH, TTT}) = \frac{1}{8} + \frac{1}{8} = \frac{1}{4}$

Problem 3 (7, Section 1.7)

Total # of outcomes = $20^{12}$

# of outcomes where no box receives more than 1 ball = \binom{20}{12}

$P_r = \frac{\binom{20}{12}}{20^{12}}$