2.c. As stated in the hint the volume of the d-dimensional ball is :

The acceptance rate of a sample is proportional to the ratio of volumes of the d-dimensional unit box ($1^d = 1$) and ball $\left(\frac{2\pi^{\frac{d}{2}}}{d \cdot (\frac{d}{2}-1)!} \right)$

$\Rightarrow$ meaning the acceptance probability is:

$$p = \frac{V_O}{V_\square} = \frac{2\pi^{\frac{d}{2}}}{d \cdot (\frac{d}{2}-1)!}$$

- for $d = 10$:

$$p = \frac{2\pi^{2.5}}{10 \cdot (4!)} = \frac{34.98}{240} = 0.145$$

$\Rightarrow$ as seen in the lecture, following the geometric distribution Expectation, the Expected number of samples to obtain 1 accepted one is: $E = \frac{1}{p}$

$\Rightarrow$ meaning to obtain 1000 accepted samples we will need: $1000E = \frac{1000}{p} = \frac{1000}{0.145} = 6859.7$

$= \boxed{6860 \text{ samples}}$

$\Rightarrow$ similarly, for $\underline{d = 20}$

$$\boxed{P = \frac{2\pi^{10}}{20 \cdot 9!} = 0.0258}$$

$E = 38.749$

$1000E = 38{,}749{,}34 \approx \boxed{38{,}750 \quad \text{samples}}$

$\Rightarrow$ and for $\underline{d = 40}$:

$$\boxed{P = \frac{2\pi^{20}}{40 \cdot 19!} = 3.6 \cdot 10^{-9}}$$

$E = 277{,}413{,}226.2$

$1000E = \boxed{2.77 \cdot 10^{11} \quad \text{samples}}$