

PHY 117 HS2026

Week 3, Lecture 1

Sept. 29th, 2026

Prof. Ben Kilminster

Prof. Florencia Canelli

Today:

Energy

Energy conservation

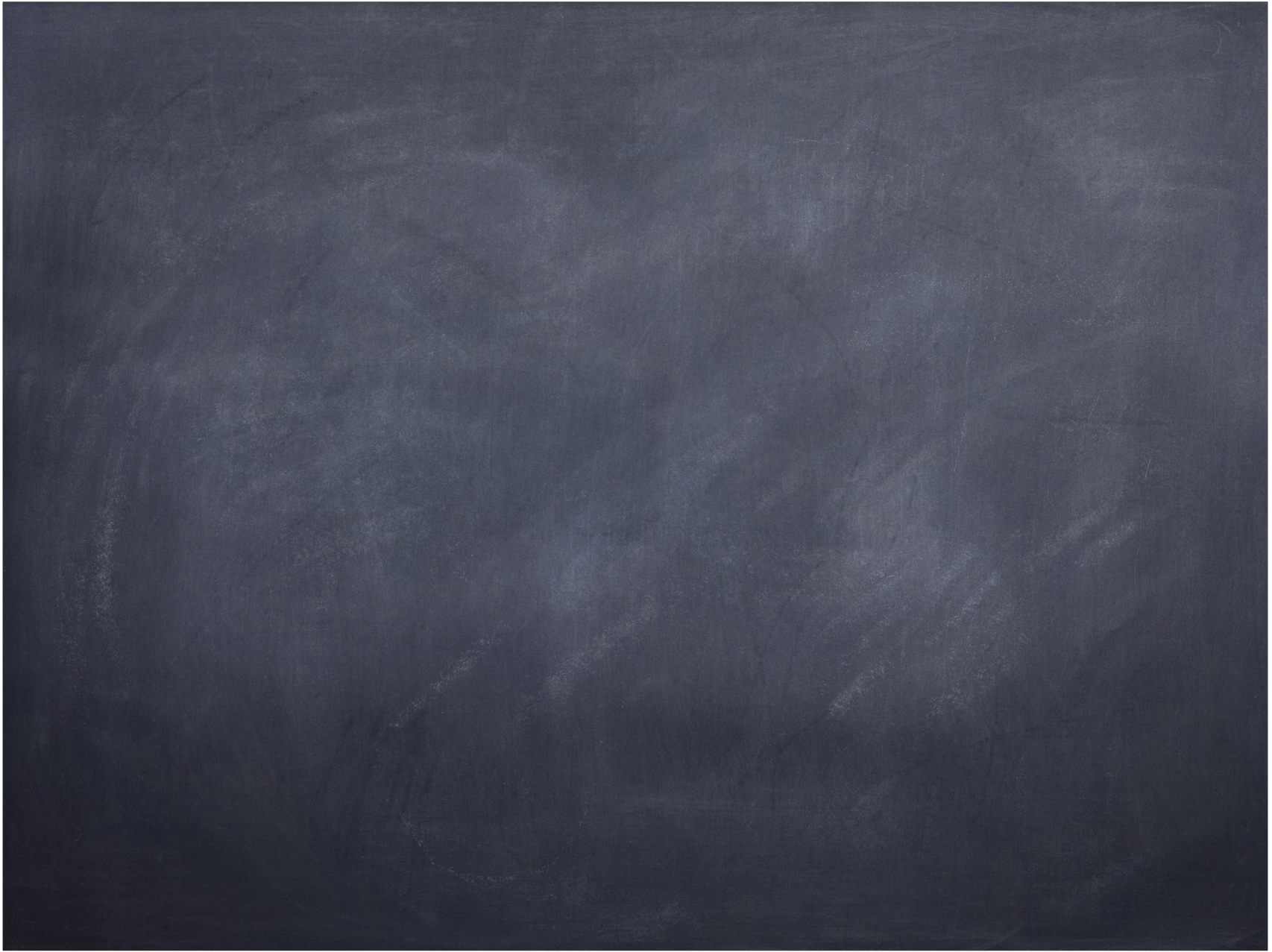
Kinetic energy

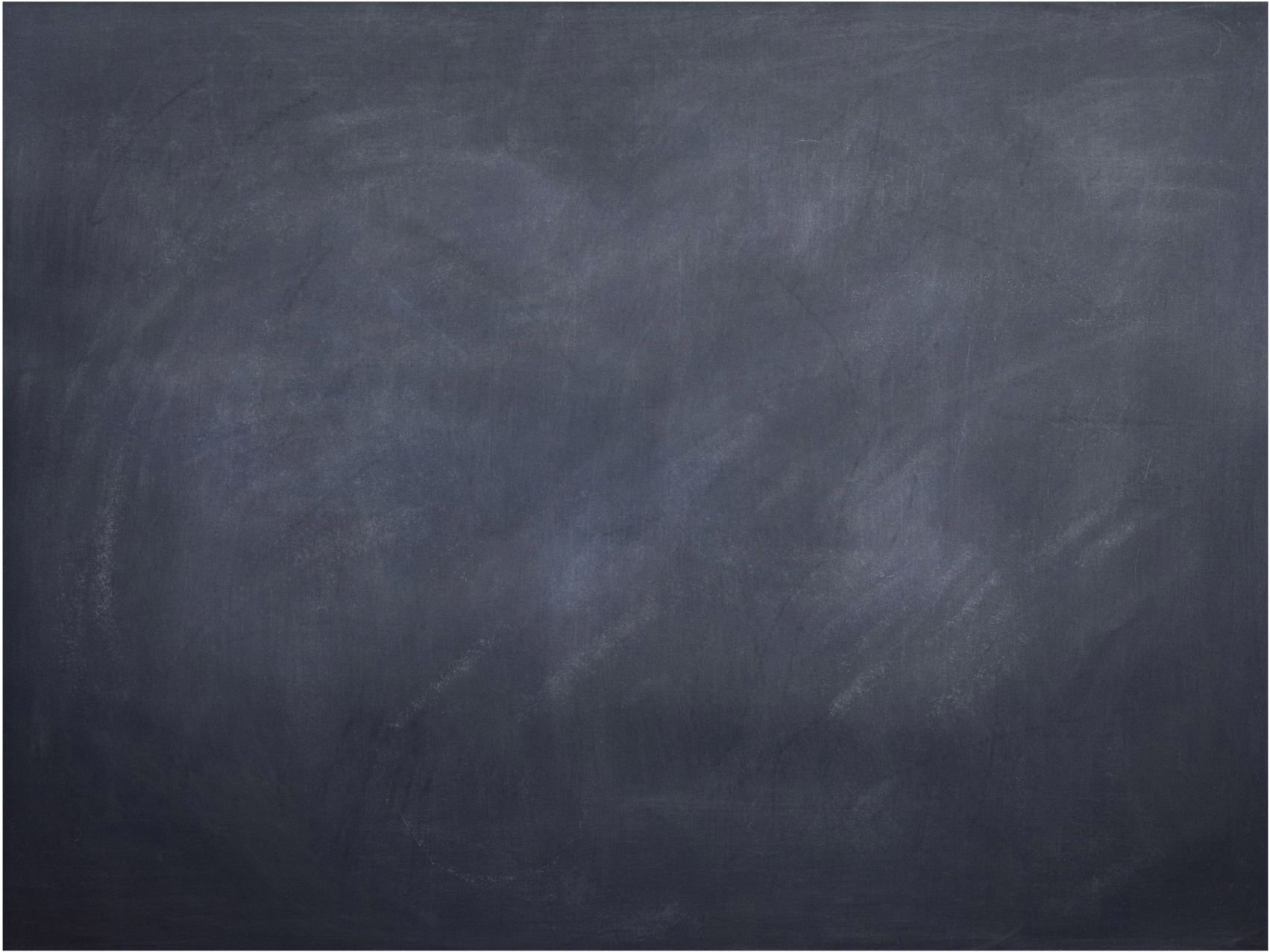
Potential energy

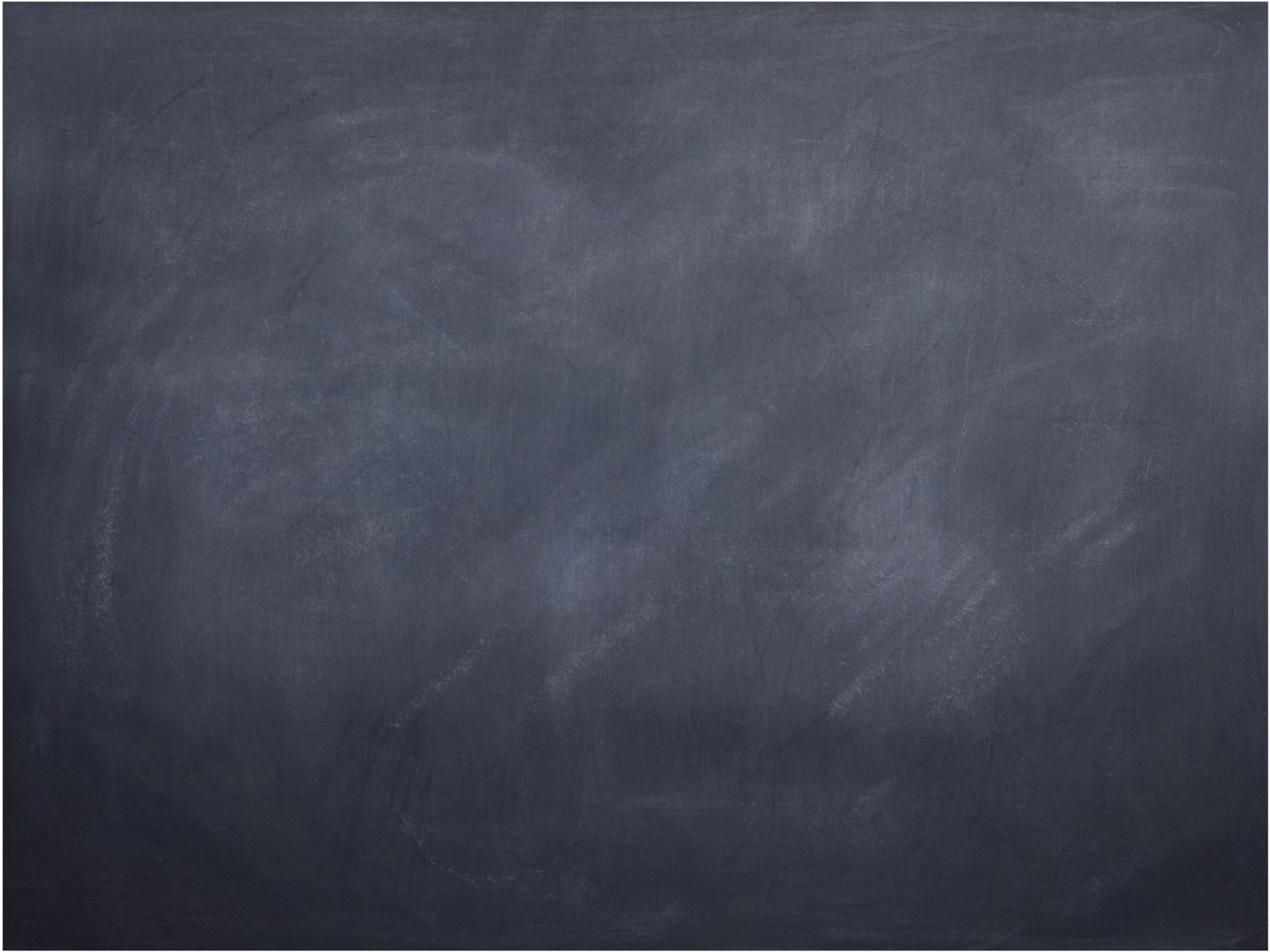
Work

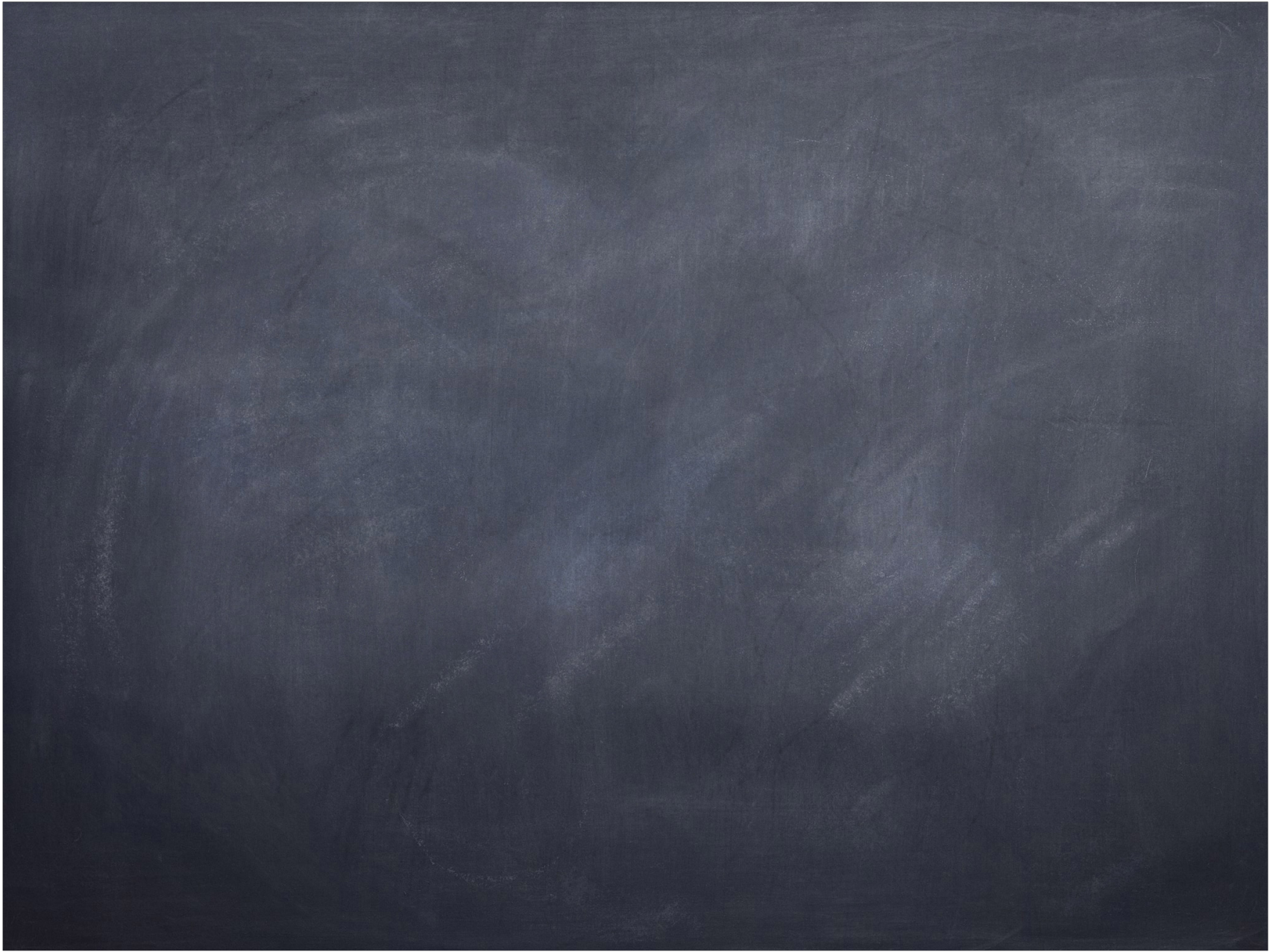
New script 1, v3 : Thanks
to Dean Mark for
finding typos!

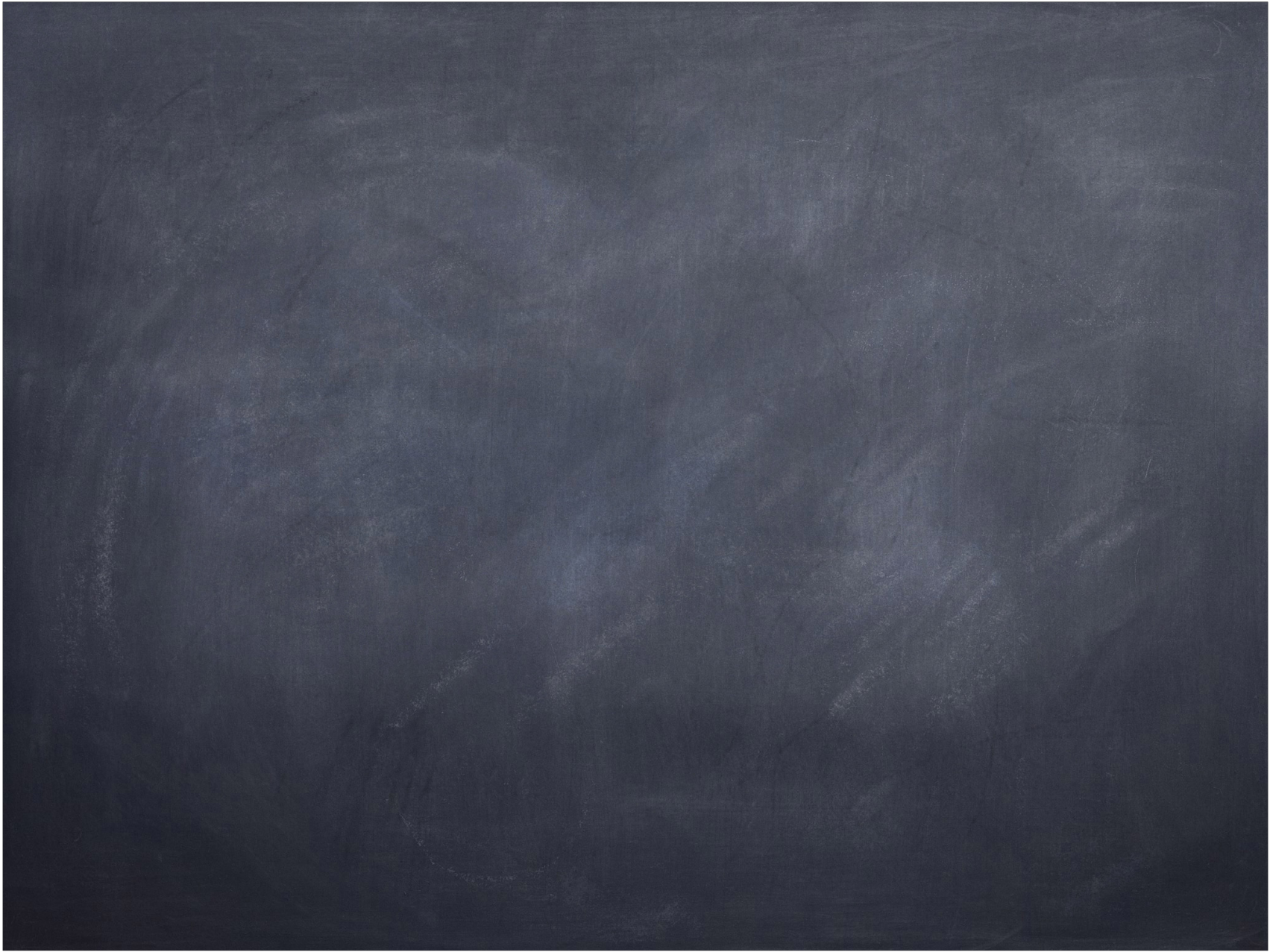
Please do Quiz #2
on OLAT if you
haven't yet.
Quiz #3 you can do after
tomorrow's lecture.

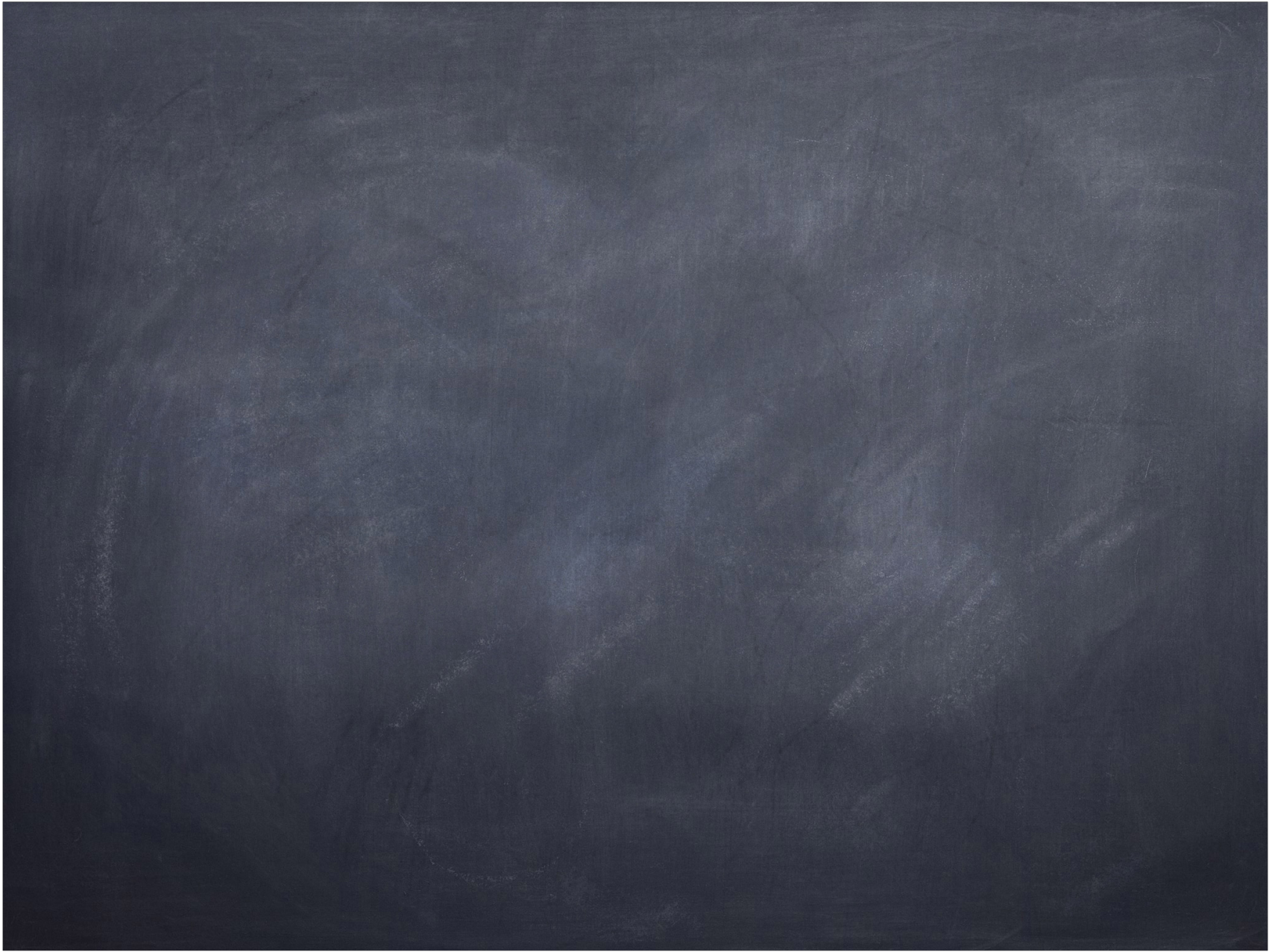


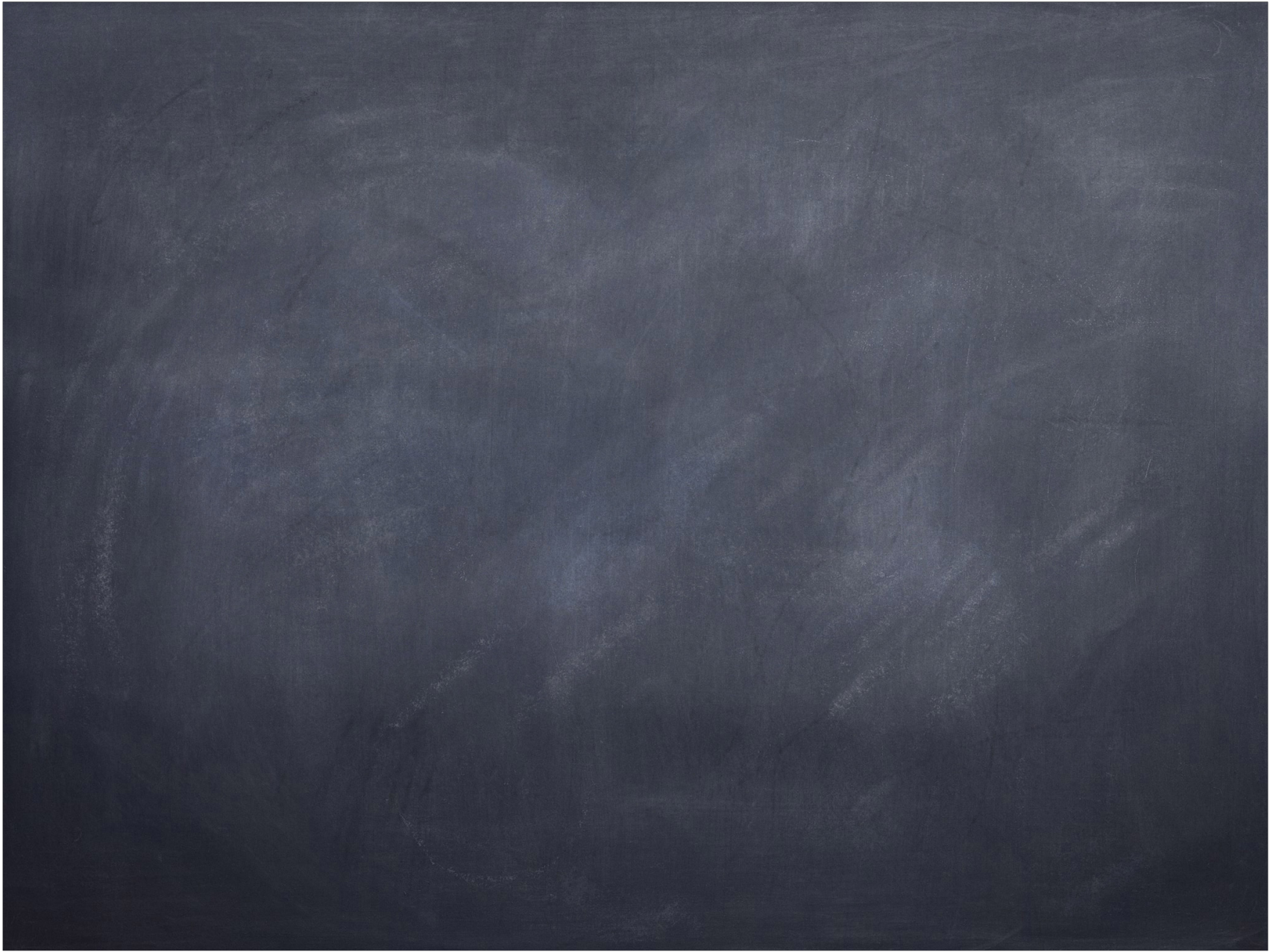


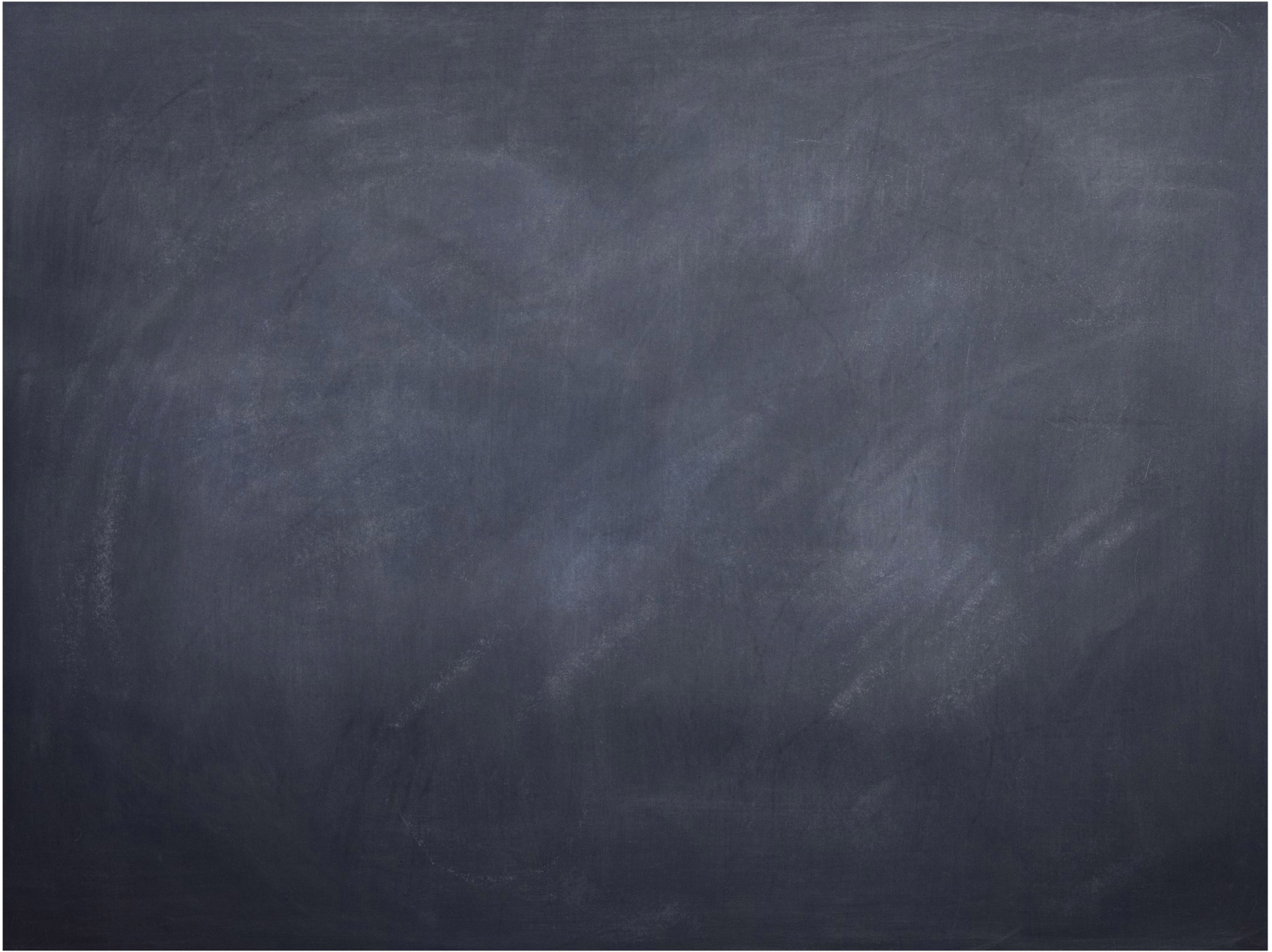


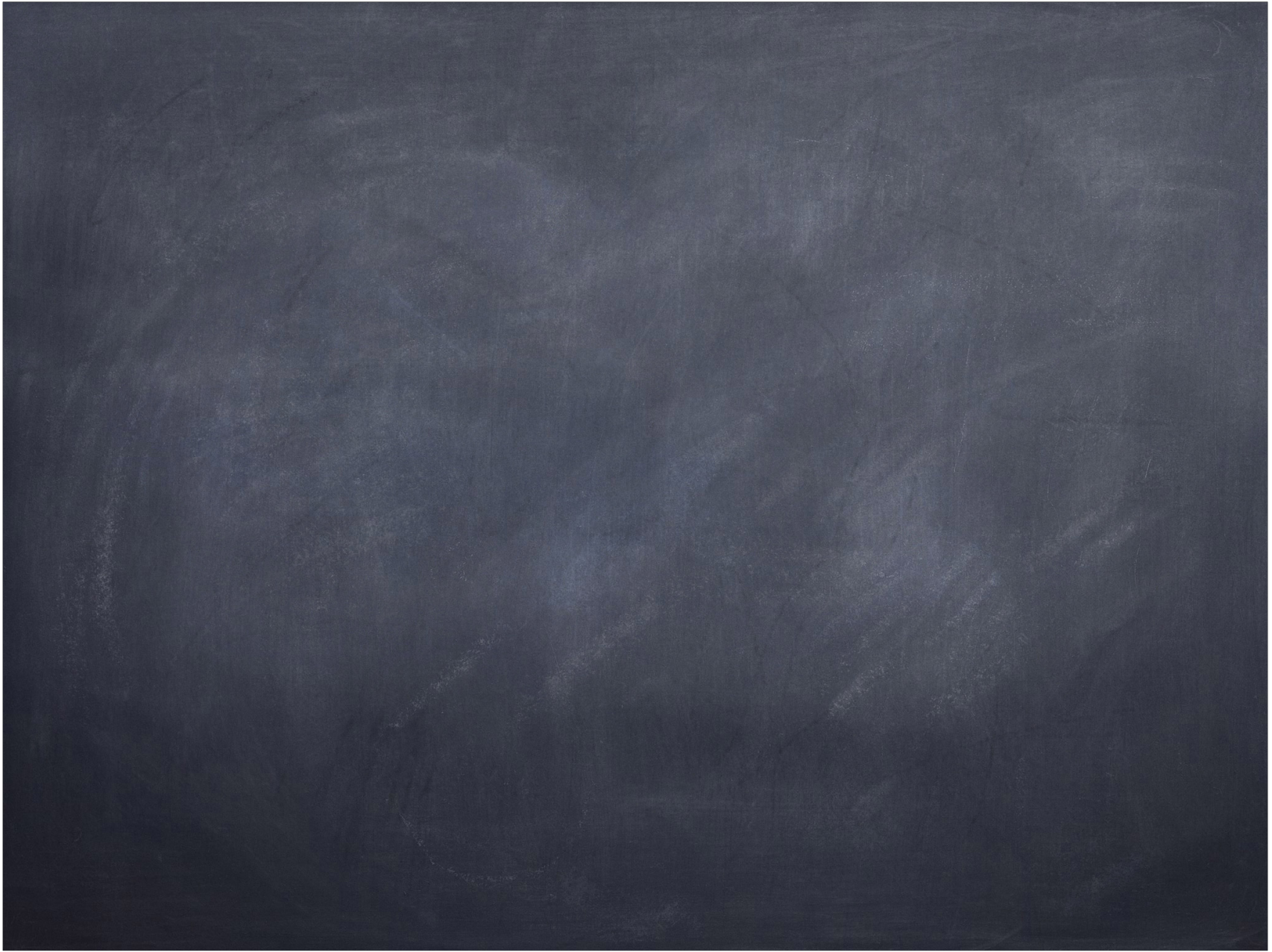


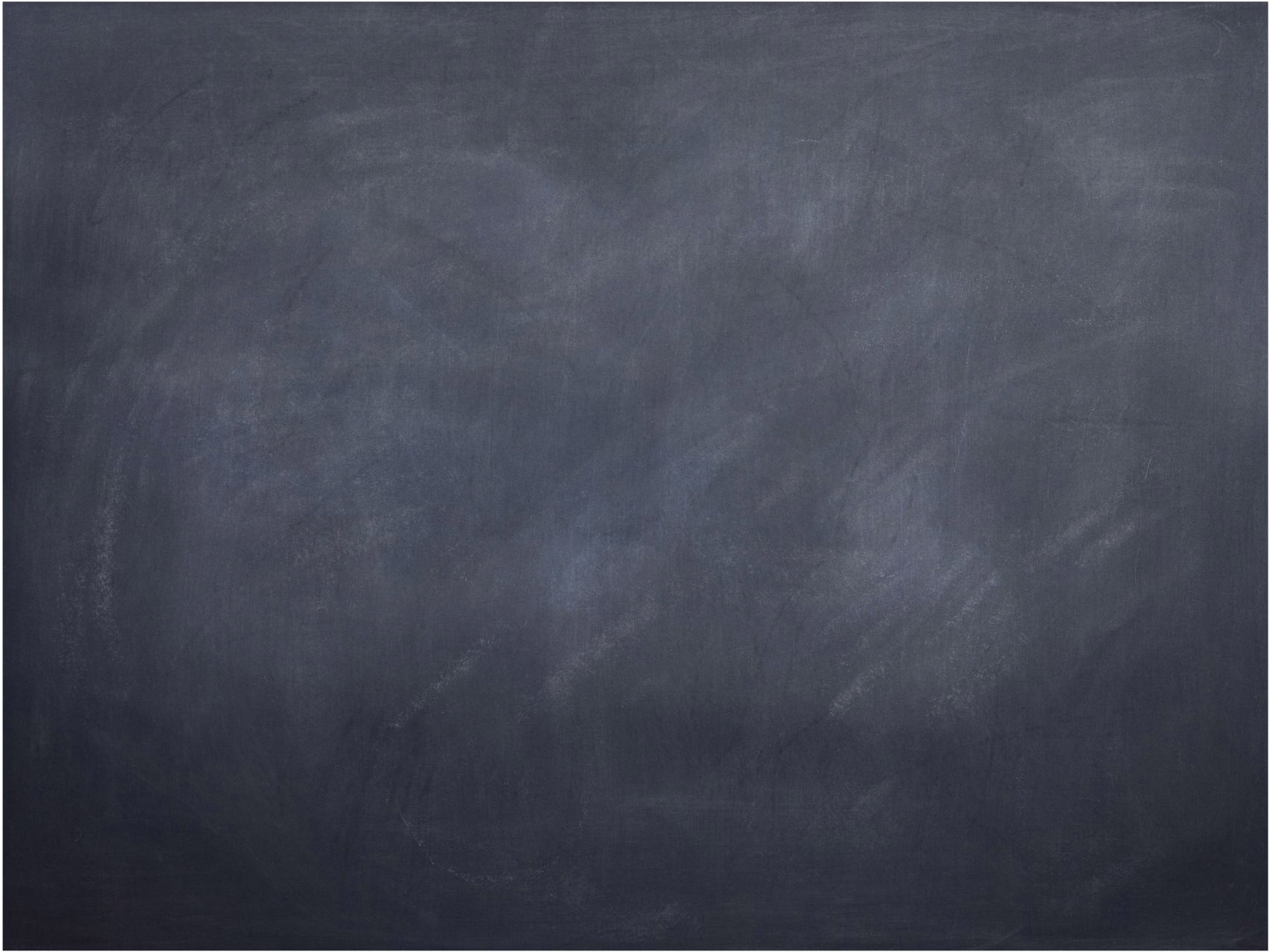


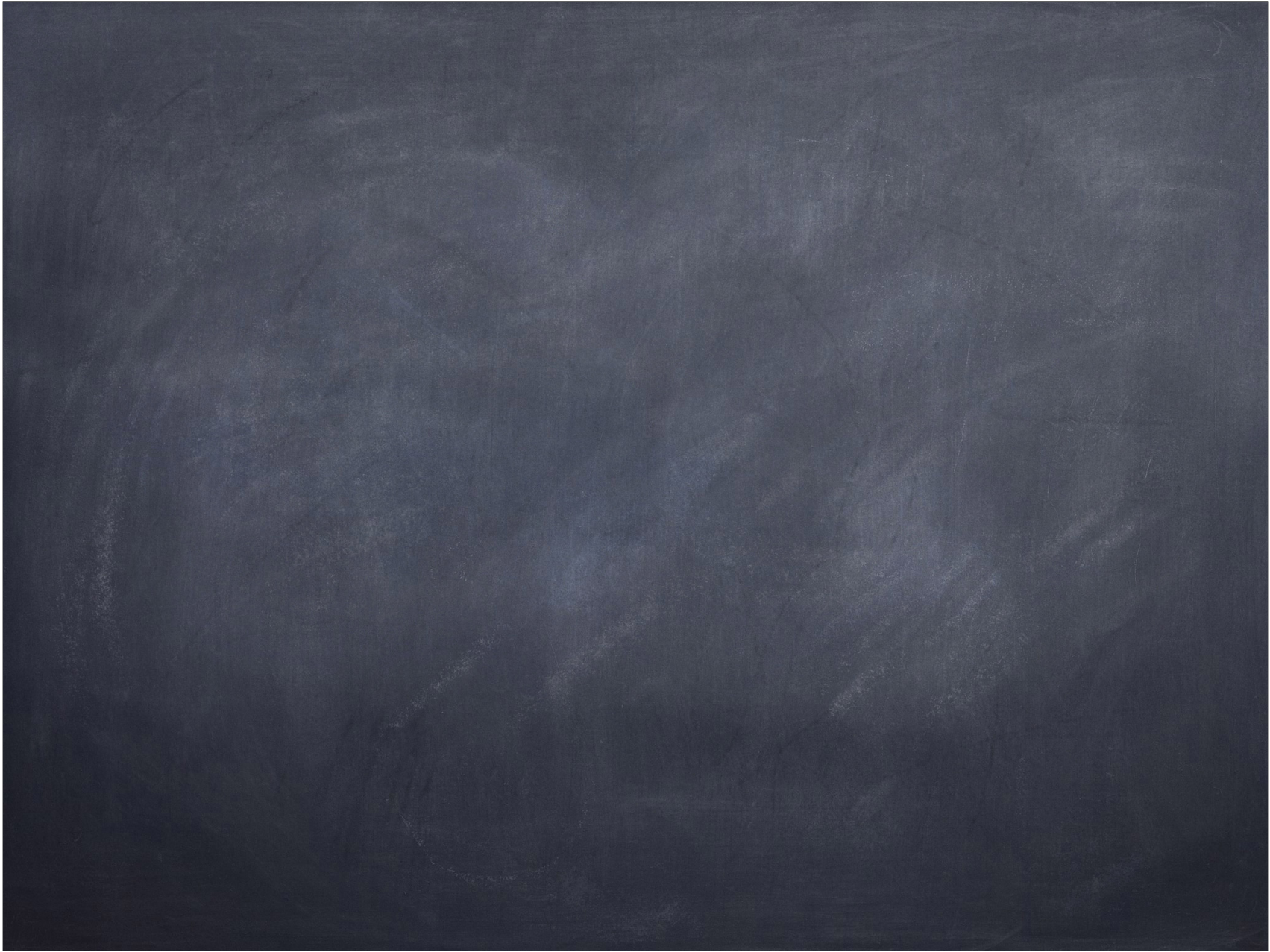


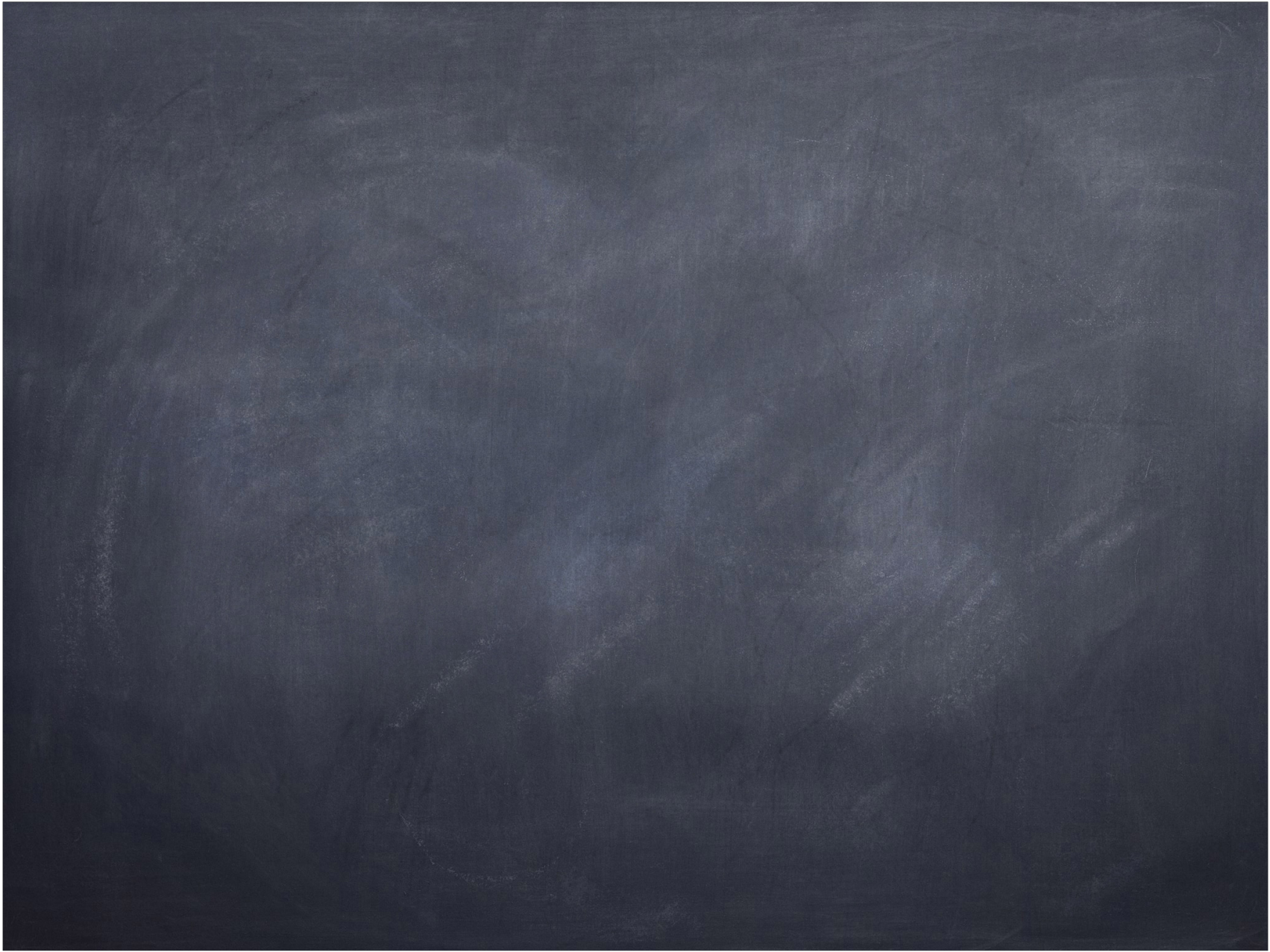


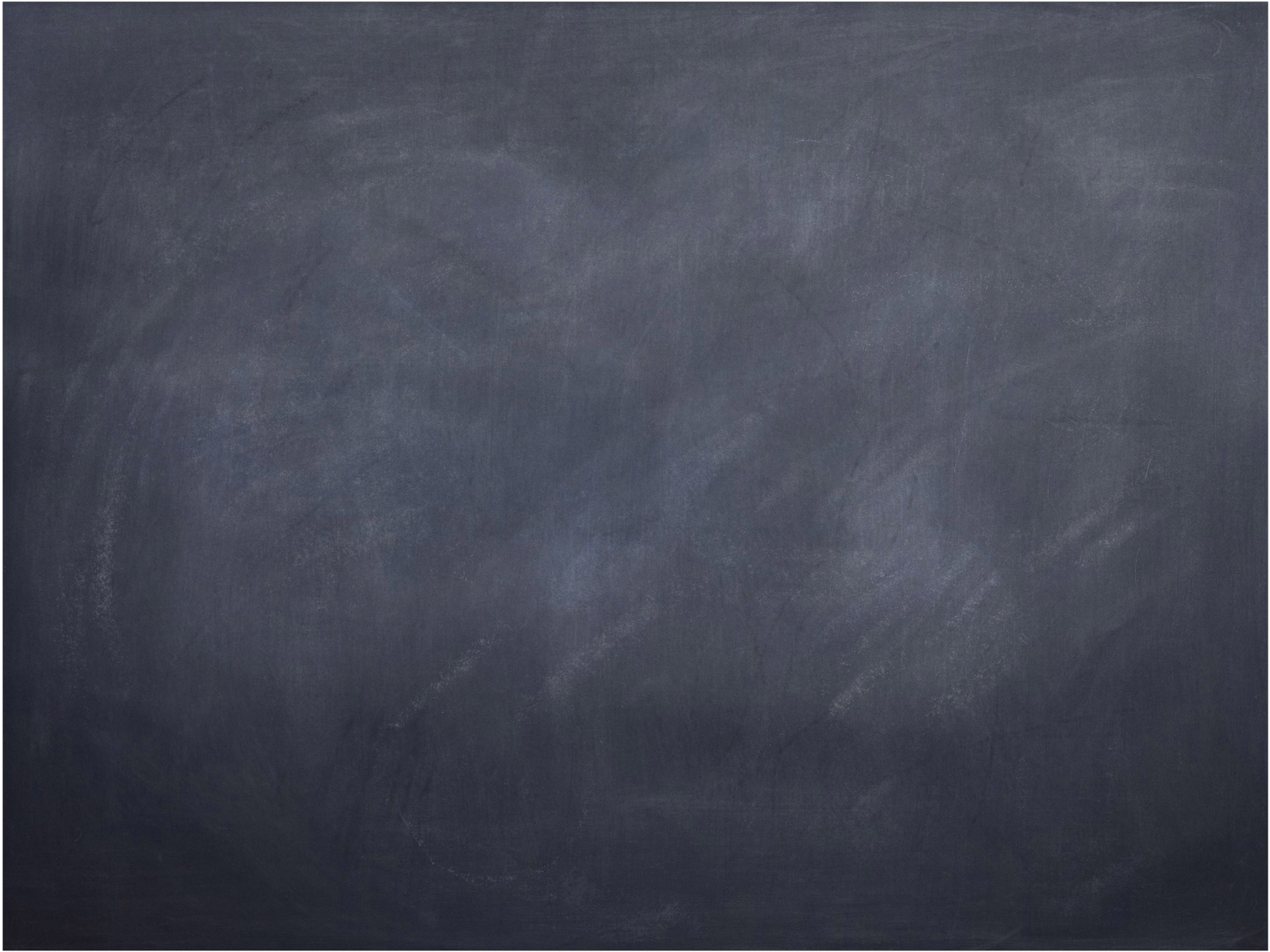












summary so far,

Energy is conserved

$$E_{\text{before}} = E_{\text{after}}$$

$$\text{Potential energy from gravity} = mgh = U$$

$$\text{Kinetic energy} = \frac{1}{2}mv^2 = K$$

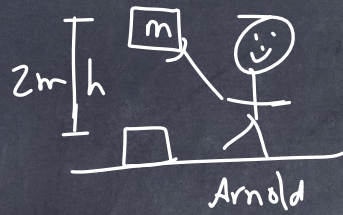
work-energy
theorem

$$W_{\text{TOT}} = \Delta K = \frac{1}{2}mv_f^2 - \frac{1}{2}m_i v_i^2$$

potential energy
+
work relation

$$W = -\Delta U$$

$$W = \int_{s_i}^{s_f} \vec{F} \cdot d\vec{s}$$

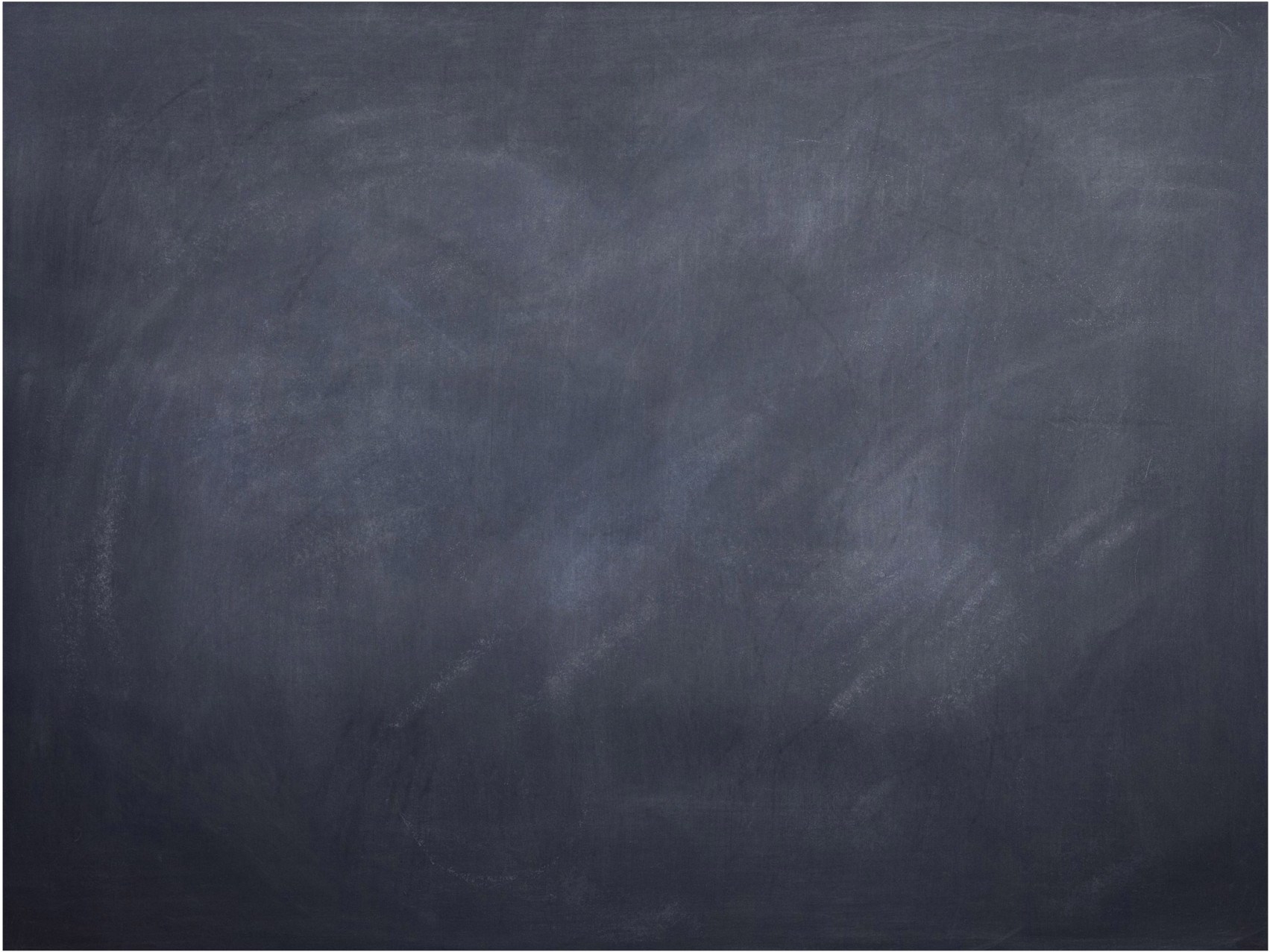


$$m = 5 \text{ kg}$$

Consider Arnold again. If he lifts the block with 50 N of force, to a height of $2m$, and then let go. How fast will it travel when it hits the ground?

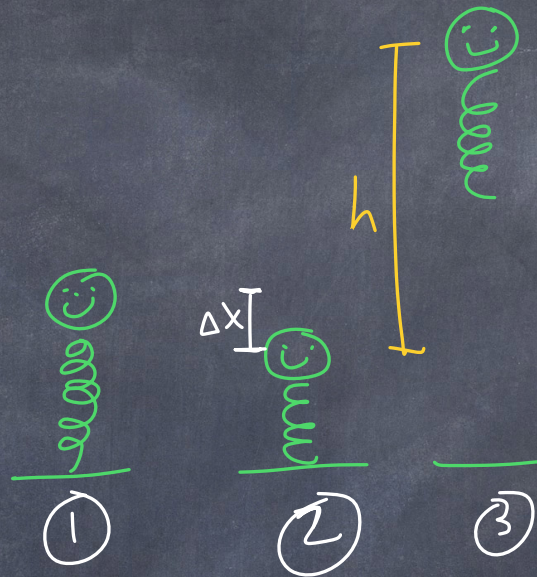
Arnold has done $+100\text{ J}$ of work, while gravity has done -100 J of work. Where did Arnold's 100 J go?

Now Arnold drops the weight, how fast is it
when (just before) it hits the ground?





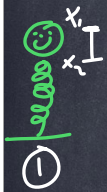
How high does the grasshopper jump?



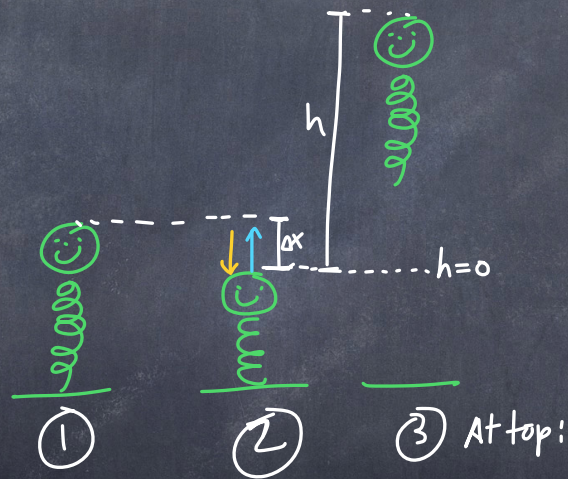
- ① grasshopper just sitting there at equilibrium.
- ② additional compression, Δx from equilibrium.
- ③ grasshopper releases spring, jumps a height, h .

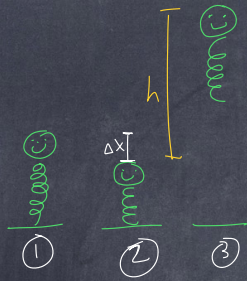


Focus on spring energy, U_s .
 we know the force on a spring:



so far: work done by spring:
is $W_s = -\frac{1}{2}k(\Delta x)^2$





Apply energy conservation:

$$\text{Total energy } ② = \text{Total energy } ③$$