$$\mathbb{M} - M = 5\log_{10} D - 5$$

$$M = -2.5\log_{10} L + C$$

$$\Rightarrow \mathbb{M} = 5\log_{10} D - 5 - 2.5\log_{10} L + C$$

$$= 5\log_{10} D - 2.5\log_{10} L + C$$

D is between 39 & 41, but Kuiper belt is spread out quite more than 1 AU, and it is in the $\log_{10}$ anyway, so we can say:

$$\mathbb{M} \simeq -2.5\log_{10} L + C$$

Recall:

$$L = 4\pi R^2 \sigma T^4$$

$$\Rightarrow \mathbb{M} \simeq -2.5\log_{10}\left(4\pi R^2 \sigma T^4\right) + C$$

$$\simeq \boxed{-5\log_{10} R + C}$$

$$\simeq \cancel{-10\log_{10} T + C}$$

Where we have assumed constant T, which is quite reasonable unless orbit is highly ~~so~~ eccentric.

$$F(m) = \propto \int_0^{N(m)} dN \propto \int_c^{R(m)} R^{-q} dR \propto \left[R^{-q+1} \right]_0^{R(m)}$$

USING INFO
IN QUESTION

$$M = -5 \log_{10} R + c \Rightarrow R = 10^{-\frac{1}{5}(m-c)}$$

SO WE END UP WITH:

$$F(m) \propto \left[R^{-q+1} \right]_0^{10^{-\frac{1}{5}(m-c)}} \propto 10^{-\frac{1}{5}(m-c)(-q+1)}$$

$$\propto 10^{\frac{(c-m)(1-q)/5}}$$

IF $C = M_{MIN}$, WE HAVE WHAT WE WANT.
(Right now I don't see why that'd be the case
though)

"observations show"...

$$\log_{10} F(m) = 0.3m + c$$

$$\Rightarrow 0.3m + c_1 = (c_2 - m)(1-q)/5$$

$$= c_2(1-q)/5 + (q-1)/5 \cdot m$$

$$\Rightarrow 0.3 = \frac{q-1}{5} \Rightarrow q = 2.5$$

NOTE THAT

$$\frac{dN}{dR} = \propto R^{-q} \implies N_{\geq} \propto R^{-q+1} \implies N \propto R^{-1.5}$$

~~MASS $\propto R^3$ (ASSUMING UNIFORM DENSITY)~~

TOTAL MASS OF OBJECTS BETWEEN R & R+dR = NUMBER OF OBJECTS BTWN R & R+dR × MASS OF THESE OBJECTS (MASS OF ONE)

$$\Big\downarrow \qquad R^{-1.5}\, dR \qquad R^3$$

$$MASS(R) = R^{1.5}$$

$$\Downarrow$$

MASS IS DOMINATED BY LARGE OBJECTS

We should go for shallow & wide. #

"IF $\lesssim$ KBOs"...

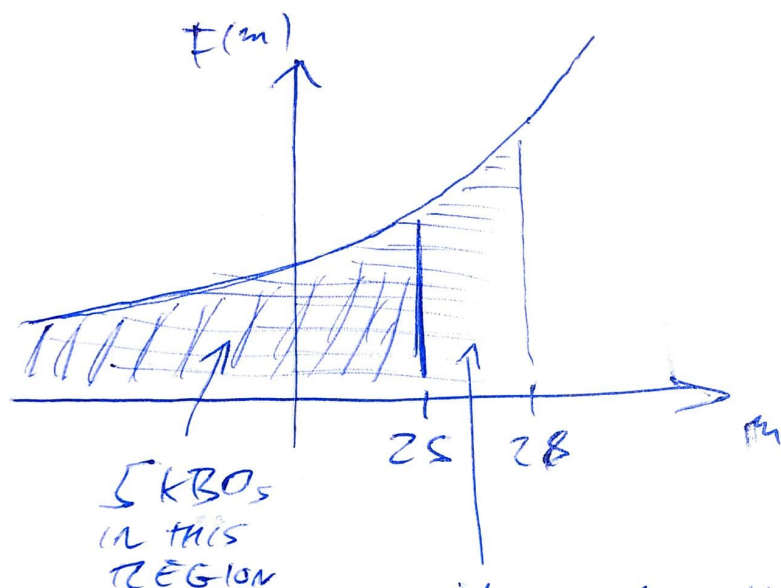$$F(m) \propto 10^{-m(1-2.5)/5} \propto 10^{+0.3m}$$

$$\frac{\int_{-\infty}^{28} 10^{+0.3m}\, dm}{\int_{-\infty}^{25} 10^{+0.3m}\, dm} = \frac{\int_{-\infty}^{25} 10^{+0.3m}\, dm + \int_{25}^{28} 10^{+0.3m}\, dm}{\int_{-\infty}^{25} 10^{+0.3m}\, dm}$$

$$= 1 + \frac{\int_{25}^{28} 10^{0.3m}\, dm}{\int_{-\infty}^{25} 10^{0.3m}\, dm}$$

JUST PUT THIS TO A CALCULATOR:

$$\overset{\sim}{=} 1 + 6.94 \approx 7.94$$

WHAT I'M DOING HERE:

∑ KBOs
IN THIS
REGION
(SHADED ///)

HOW MANY IN THE
≡ HORIZONTALLY
SHADED REGION

$$\frac{X}{5} = \frac{\text{AREA OF HORIZONTALLY SHADED REGION}}{\text{AREA OF VERTICALLY(ISH) SHADED REGION}}$$

$$\approx 7.94$$

$$\Rightarrow X \approx 40 \quad \text{THIS MANY EXPECTED}$$
$$\text{WITH } m < 28.$$