Problem 1

Given $M_* = 3M_\odot$

By mass-luminosity relation, $L = kM^4$ (k is a const.)

$$\frac{L_*}{L_\odot} = \frac{\cancel{k}M_*^4}{\cancel{k}M_\odot^4} = \frac{L_*}{L_\odot} = \left(\frac{M_*}{M_\odot}\right)^4$$

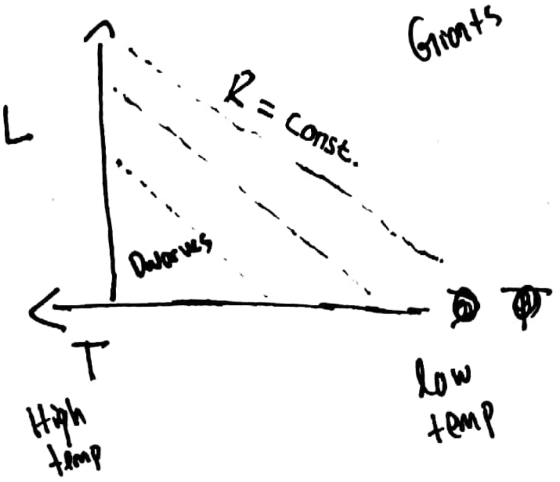
Plug in $M_* = 3M_\odot$

$$\frac{L_*}{L_\odot} = \left(\frac{3M_\odot}{M_\odot}\right)^4$$

$$\boxed{= 3^4}$$

Problem 2

a.)



Diagonal lines across the diagram are lines of constant Radius

X-axis traditionally reversed - sorry!

Consider a star in the top right corner. It has low T & high L.
By $L = 4\pi R^2 \sigma T^4$, if T is low, we must boost R to compensate, if we still want a large L.

b.) Plot color. What value can we use to represent colour?

↓
Hot things are blue
Cold things are red

$\boxed{\text{How about } \lambda_{peak}?}$ $\lambda_{peak} = \frac{\text{const.}}{T}$ So λ_{peak} & temp are basically interchangeable!

Or, Plot spectral type
OBAFGKM

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

if we <u>double</u> T, L increases by $2^4 \rightarrow L_A = 2^4 \cdot L_B$

But L only represents <u>intrinsic</u> brightness – basically, What you would see if you were right next to the star. As you move farther away, apparent brightness decreases

Apparent brightness $\propto \frac{1}{(\text{distance})^2}$

So, Star A is twice as far away, so it will appear $2^2 = 4$ times $\underline{\text{as dim.}}$ (or $\frac{1}{4}$ as bright)
$\hookrightarrow$ compared to Star B.

Therefore, its $\left(\frac{2^4}{4}\right)$ ~~times as~~ [illegible] that of Star B.

apparent brightness is

$\hookrightarrow = 4$

$= \frac{16}{4}$

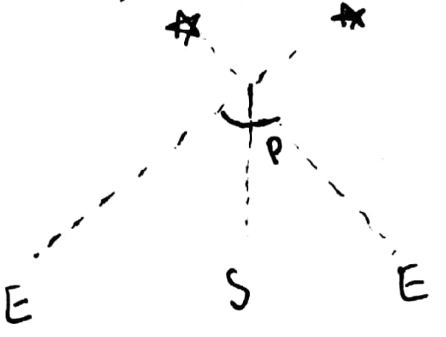
4. O B A F G K M

$\xrightarrow{\hspace{3cm}}$

decreasing temp

F stars are hotter → <u>Shorter</u> peak λ

5.



$\theta = 2p$ [by definition] (1)

$\theta = \frac{\lambda}{D}$ [resolution] (2)

$p = \frac{1}{d}$ (3)

When measuring parallax we are just measuring angular shift on sky → so, we are limited by angular resolution of our telescope.

Plug (3) into (1)

$\theta = 2\left(\frac{1}{d}\right) = \frac{\lambda}{D}$

$\hookrightarrow \boxed{d = \frac{2D}{\lambda}}$