Q 1: givens $P_{MSL} = 101362$ Pa @ MSL

& Want P @ $12{,}564_m$ MSL (let's call this P_2)

$P_{MSL} = 101362$ Pa

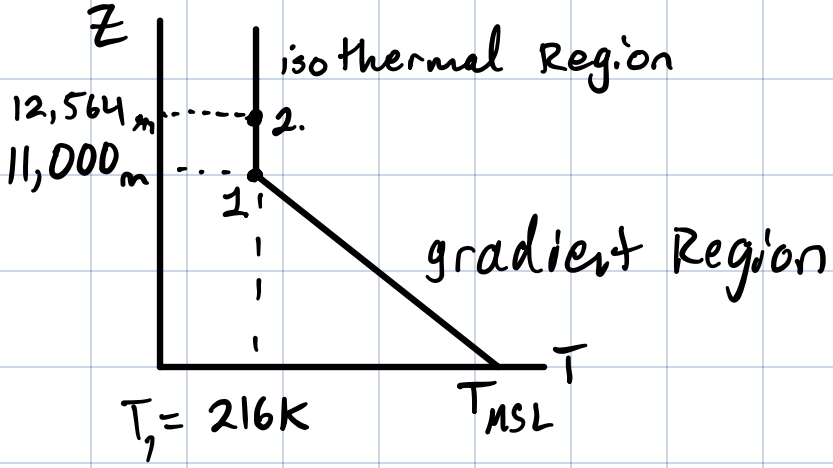
a (lapse Rate) = -0.0065 K/m

isothermal Region starts @ $11{,}000_m$, $T = 216$ K

& $T/T_{MSL} = 0.75$ @ this point

P @ 12564_m ?

Recal atmospheric temperature:



Since this a Non-standard atmosphere, we must use equations to get pressure @ altitude, using correct equations for each portion of the atmosphere

gradient Region: $P_1 = P_{MSL} \cdot \left(\frac{T_1}{T_{MSL}}\right)^{-g/aR}$

$= 101362\ Pa\ (0.75)^{\frac{-9.8\ m/s^2}{(-0.0065\ K/m)(287\ J/kgK)}}$

$= 22{,}328$ Pa

isothermal Region: $P_2 = P_1 \cdot e^{(-g/T_1 R)(h - h_1)}$

$= 22328\ Pa \cdot e^{\left(\frac{-9.8\ m/s^2}{216K \cdot 287\ J/kgK}\right)(12{,}437_m - 11{,}000_m)}$

$= 17433$ Pa

Q2: givens: $V_{ind} = 218$ knots, $C_L = 0.751$
& $S = 3608\ ft^2$ & want W/S

$h = 35{,}000$ ft (STD) → Table A.2

$V_{ind} = 218$ knots
$= 367.9\ ft/s$

$C_L = 0.751$

$S = 3{,}608\ ft^2$

$W/S = ?$

Shevell @ $h = 35{,}000$ ft
$\rho = 7.382 \times 10^{-4}\ \frac{slug}{ft^3}$
$T = 394.08\ ^\circ R$

$L = W$ in SLF

$$V_{true} = V_{reading}\sqrt{\frac{\rho_{SL}}{\rho_{true}}} = (367.9\ \tfrac{ft}{s})\sqrt{\frac{0.002377\ \frac{slug}{ft^3}}{7.382 \times 10^{-4}\ \frac{slug}{ft^3}}}$$

$$\simeq 660.24\ ft/s$$

so $W/S = L/S = \frac{1}{2}(7.382 \times 10^{-4}\ \frac{slug}{ft^3})(0.751)(660\ \frac{ft}{s})^2$

$= 120.8\ lb/ft^2$

Note, could also use $(V_{reading})^2 \cdot \rho_{SL}$ in lift equation

Q3:

Givens: $Re = 190,053$

laminar if $< 5 \times 10^5$

$C_{f_{laminar}} = 1.328/(Re^{0.5})$

$= 0.003$

then $C_{D,f} = \frac{C_f \cdot S_{wet}}{S_{REF}}$

fully exposed

$= \frac{C_f \cdot 2 \cdot 1.02 \cdot S_{REF}}{S_{REF}}$

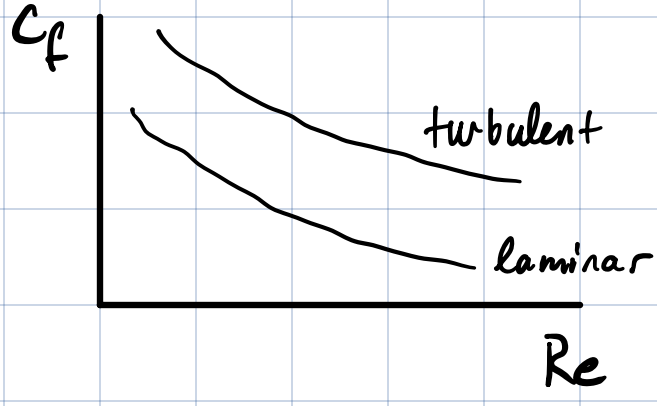
$= C_f \cdot 2 \cdot 1.02$

$= 0.003 \times 2 \times 1.02$

$= 0.0062$

Q4. Select all that is true from below for flat plate boundary layers @ the same Re

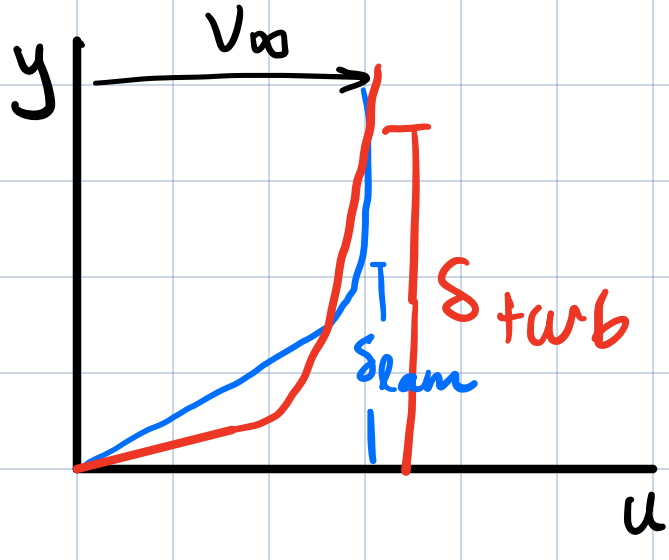
Recal:



therefore, the correct answers are

- laminar boundary layer skin friction is < turbulent boundary layer skin friction

also:



$\delta_{turb} > \delta_{lam}$

&

$$\delta_{lam} = \frac{5.2l}{\sqrt{Re_l}} \quad \& \quad \delta_{turb} = \frac{0.37l}{(Re_l)^{0.2}}$$

both decrease with $Re \uparrow$