

Flying backwards

Atmospheric pressure changes with altitude, as does temperature. If you're at Brian Head Resort in Utah, and you know the average temperature, can someone else tell you the altitude? If you know the average pressure, can someone else tell you the altitude? We'll answer those questions here!

Atmospheric pressure in kilopascals (kPa) at a given altitude in meters is given by the following table:

altitude (m)	pressure (kPa)
0	101.33
500	99.49
1000	97.63
1500	95.91
2000	94.19
2500	92.46
3000	90.81
3500	89.15
4000	87.49
4500	85.91
5000	84.33
6000	81.22
7000	78.19
8000	75.22
9000	72.4
10000	69.64
15000	57.16

1. Let $P(h)$ mean the atmospheric pressure at height h . Is P a one-to-one function? How can you tell?
2. What would be the input for the function P^{-1} ? What would the output be? Give units and describe the meaning of this inverse function.

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3. What are the domain and range for P ?
4. What are the domain and range for P^{-1} ?
5. If I call you up and tell you the atmospheric pressure is 65 kilopascals, what would you guess my altitude to be?
6. At the altitude of Brian Head, around 3353 meters, what is the atmospheric pressure?
7. (Challenge: points) At the altitude of 3353 meters, I'm getting only a fraction or percentage of the oxygen that a person at sea level is getting. If amount of oxygen is proportional to pressure, what fraction of my usual level of oxygen am I getting?

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Average atmospheric temperature in degrees Celsius (C) at a given altitude in meters is given by the following table:

altitude (m)	temperature (C)
0	15
1000	8.5
2000	2
3000	-4.49
4000	-10.98
5000	-17.47
6000	-23.96
7000	-30.45
8000	-36.94
9000	-43.42
10000	-49.9
15000	-56.5
20000	-56.5
25000	-51.6
30000	-46.64
40000	-22.8
50000	-25
60000	-26.13
70000	-53.57
80000	-74.51

8. Let $T(h)$ mean the atmospheric pressure at height h . Is T a one-to-one function? How can you tell?
9. What would the be the input for the function T^{-1} , if it existed? What would the output be? Give units and describe the meaning of this inverse function.

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10. What are the domain and range for T ?

11. If I call you up and tell you the temperature outside of my airplane or spaceship is -25 Celsius, what would you guess my altitude to be?

12. At the altitude of Brian Head, around 3353 meters, what is the temperature?

13. (Challenge: points) Is this table talking about average temperature? temperature in the winter? summer? What are factors that we are not considering?