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Example 2:

OAT **-25°C** = 273 + (-25) = 248 K
39√248 = **614 kt**
20√248 = **315 m/s**

So with ΔISA±0, we have:

- at sea level (+15°C) ***a*** **≈ 660 kt**
- at 25000 ft (-35°C) ***a*** **≈ 600 kt**
- at 34500 ft (-54°C) ***a*** **≈ 576 kt**

As we can see, the results found are too difficult to figure out without a calculator, so there is a third option that can be worked out mentally in a matter of seconds:

LSS (in kt) ≈ 643 + (1.2 x T° in Celsius)

Here is how this one works:

Starting with 0°C (that's 273 K) we find that LSS is:

- 38.94√273 = **643 kt** at 0°C
- 38.94√263 = **631 kt** at -10°C
- 38.94√253 = **619 kt** at -20°C
- 38.94√243 = **607 kt** at -30°C
- 38.94√233 = **594 kt** at -40°C
- etc.

We can easily see that for every 10°C difference, there is about 12 kt change in the LSS. That is 1.2 times the temperature difference. This is shown in example 3 below. It is reasonably accurate, giving results only 1 or 2 kt off.

Example 3:

OAT **-25°C** ≈ 643 + (1.2 x [-25]) = 643-30 = **613 kt**
OAT **-40°C** ≈ 643 + (1.2 x [-40]) = 643-48 = **595 kt**

The Mach number (M) is used as a reference mostly for high-altitude and/or high-speed flight, as the airflow around a given airfoil or aircraft (and configuration) will behave in much the same manner for a given Mach number—other variables left aside. M 1.0 represents the speed of sound in given conditions—temperature, pressure, and fluid characteristics. M 0.81 represents 81% of the local speed of sound, as an example.

Since the speed of sound varies with temperature, two aircraft flying on the same route with the same Mach number but at significantly different altitudes—and thus temperatures—will have different true airspeeds. For example, consider aircraft A at 25,000' (-35°C) at M 0.80 and aircraft B at 35,000' (-54°C), also maintaining M 0.80. Yet they would have a TAS difference of about 20 kt.

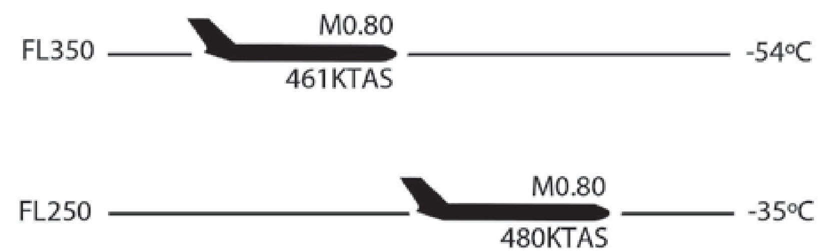

Figure 1.3.2

- 5°C difference ≈ 6 kt difference in ***a***, or 1%
- 10°C difference ≈ 12 kt difference in ***a***, or 2%
- 20°C difference ≈ 24 kt difference in ***a***, or 4%

The opposite is also true: If two aircraft maintain identical TAS or IAS, the one with a higher FL will have a higher Mach number.

Once the HWC and XWC have been found, all that is required is to **add the greatest component to one third of the smallest component**. If both components are the same, pick your favorite one to divide by three… Yes, it is truly that simple. In the figure 4.5.2 above, the XWC is greater than the HWC, so the total wind speed **c = b + (a/3)**. You can compare the results with a calculator, and will find this simple method to be a reasonably close match.

Examples:

HWC	= 22 kt
XWC	= 10 kt
Total wind	= 22 + (10/3) ≈ **25 kt**
	(calculator result: **24.17 kt**)

TWC	= 45 kt
XWC	= 70 kt
Total wind	= 70 + (45/3) = **85 kt**
	(calculator result: **83.22 kt**)

HWC	= 30 kt
XWC	= 30 kt
Total wind	= 30 + (30/3) = **40 kt**
	(calculator result: **42.43 kt**)

Now we can leave Pythagoras back in the schoolbooks and enjoy this simplified method without making the brain overheat or wasting precious time.

4.6 The wind diagram on your HSI or ND:

We have just covered how to find HWC, TWC, and XWC, and how we can combine them to figure out the total wind speed.

Reading the wind component on a graph or plotting it on a whiz wheel is all well, but it is not a realistic solution while airborne—especially when flying manually—unless it is a transoceanic flight with autopilot on and time to spare. Most airliners will display the current wind conditions on a screen somewhere, but this feature is often not available for other types in general aviation or regional aircraft.

This is where the HSI or ND can become a very useful tool. What we have seen with the wind graphs above can be mentally superimposed on the HSI or ND, with the radius from the aircraft symbol in the center to the outer edge of the instrument display representing the total wind speed.

The first step in the graphical solution is to find the total wind speed from HWC or TWC and XWC, as described in 4.5. The second step is to plot these components on the HSI or ND right in front of us to visualize the wind direction with reasonable precision, as shown in figure 4.6 below.

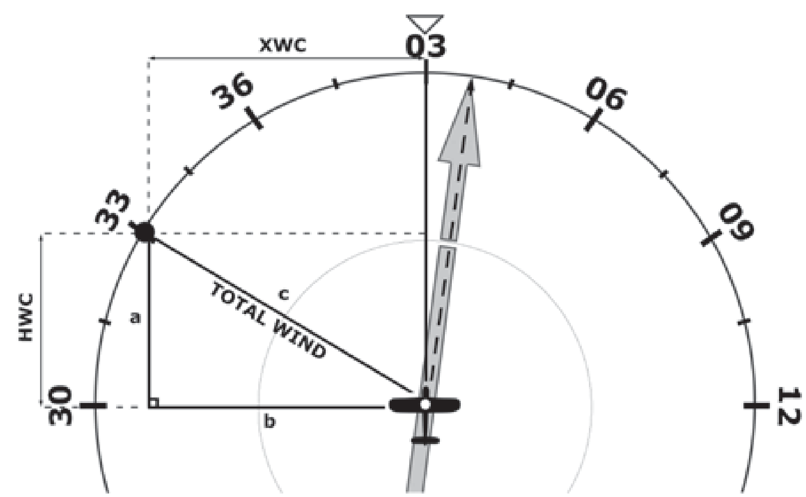

Figure 4.6