**Converting between Fahrenheit and Celsius temperature scales Mentally.**

On a recent trip to the USA I found it frustrating mentally converting the temperatures from the **Fahrenheit scale** to the more familiar **Celsius scale**.

There is no problem if you have a calculator on hand but the formula can be awkward when trying to work out a quick answer.

Basically, the freezing point of water in Fahrenheit is 320F and in Celsius it is 00C

The boiling point of water in Fahrenheit is 2120F and in Celsius it is 1000C.

The linear graph is as follows:

 0F

 212

 180

 32

 100

 0 100 0C

 The gradient of this line is 180 or 9 or 1.8

 100 5

 The “y” intercept is 32

If we want to change from degrees C to degrees F, the most convenient formula is:

 F = 1.8C + 32 or F = 9C + 32

 5

If we want to change from degrees F to degrees C it is more convenient to transpose the formula to the form:

C =5× (F – 32)

 9

On my trip, a typical temperature in Arizona was 350C which amounts to

F = 9×35 + 32 = 95 in Fahrenheit.

 5

The temperature range was often between 250Cand 450C

which is 770F to 1130F

If the temperature were 390C the calculation would be **9 × 39 + 32**

 **5**

which is a little awkward to do mentally.

However if we notice the gradient of the graph is close to **2**, the calculation would be much easier to do mentally.

The proper formula is **F = 1.8C + 32**

and if we make the approximation **F = 2C + “something”,** we will need to work out a value for the **“something”** which fits the temperature range.

Since we know that 350C = 950F we can use this as a guide:

95 = 2 × 35 + “something”

95 = 70 + “something”

So the approximate formula to use is F ≈ 2C + **25**

or transposed, we get C = (F – 25)

 2

If I draw the two graphs accurately, we see that they fit very closely in the required temperature range. The **RED** line is the exact line.

 The **BLUE** line is the approximation.

 0F

0C

20

Considering the 390C from above we see that the exact number in 0F = **102.20**

And our approximate formula gives 2×39 + 25 = **1030**

For temperatures close to 350C the approximations are very close.

At the extreme ends of the range, the approximations are within 20F

|  |  |  |
| --- | --- | --- |
| Exact Celsius | Exact Fahrenheit | Approx Fahrenheit |
| 25 | 77 | 75 |
| 35 | 95 | 95 |
| 45 | 113 | 112 |

**This method will work for any restricted temperature range.**

Consider the case of a winter period where the temperature averages 50C and varies between 00C and 100C

|  |  |
| --- | --- |
| **Celsius** | **Fahrenheit** |
| 0 | 32 |
| 5 | 41 |
| 10 | 50 |

Finding an approximate equation, let F = 2C + p

Subs C = 5, F = 41

41 = 10 + p so p = 31

The approximate equation is F = 2C + **31**

As you can see the graphs are very close for this range of temperatures.

The **RED** line is the exact line.

The **BLUE** line is the approximation.

 0F

0C

|  |  |  |
| --- | --- | --- |
| Exact Celsius | Exact Fahrenheit | Approx Fahrenheit |
| 0 | 32 | 31 |
| 5 | 41 | 41 |
| 10 | 50 | 51 |

**Some interesting points:**

There is a temperature which is the **same number** in the Fahrenheit and Celsius scales.

Let T 0C= T 0F

Then T = 9T + 32

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 So 5T = 9T + 160

 – 160 = 4T

 T = – 40

This means **– 400F = – 400C**

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Also we find that **160C ≈ 610F** (just change the numbers round!)

Also **280C ≈ 820F**

There are no other pairs which behave like this.

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