

## A CONVERSATION BETWEEN A RECENTLY RETIRED MATHS TEACHER AND A YEAR 11 STUDENT HE HAS BEEN TUTORING.

Maths Teacher: Hello Sara, what shall we study today?

Y 11 Student: I've come to tell you I don't need maths tutoring any more.

Maths Teacher: Oh, why is that Sara?

Y 11 Student: We just got these Graphics Calculators and I can even do Year 12 and Year 13 problems already!

Maths Teacher: Well, please show me what you can do!

Y 11 Student: Right. I can now solve really hard equations – no sweat!

To solve  $5x + 4 = 3x + 16$

First I put it in "Equation" mode and press EXE

Then I select "Solver" by pressing F3

Then I type out the equation like this....

$$5x + 4 = 3x + 16$$

Then I press EXE again (to store it or something)

Then, here's the cool bit, I just press F6 for "solve" and I get  $x = 6$ !

Maths Teacher: Don't you remember? I taught you to do equations like that by "*doing things to both sides*"? You used to be really good at it too! Surely you remember, we used to set it out like this:

$$5x + 4 = 3x + 16$$

$$2x + 4 = 16$$

$$2x = 12$$

$$x = 6$$

Y 11 Student: Well, I sort of remember that **long way**, but now I don't have to remember do I?

Maths Teacher: Show me what else you can do Sara.

Y 11 Student: I can solve things I saw in Year 12 and Year 13 assessments!

This was an excellence question in Year 12!

I just type out  $250(0.55)^x = 50$

And I get the answer in 2 seconds ...  $x = 2.69$  hours.

Maths Teacher: I am not sure if I am impressed or shocked!  
Do a Year 13 equation for me will you Sara?

Y 11 Student: Here's one Sir,  $5^{3x+1} = 2^x$

Maths Teacher: Can you really solve that Sara?

Y 11 Student: Watch this Sir...  
Just type  $5^{(3x+1)} = 2^x$   
Press EXE and then F6 for "solve" and hey presto  $x = -0.389$ .

Maths Teacher: Sara, do you realise there is a big difference between  
*knowing* a thing and *understanding* it?

Y 11 Student: I don't know what you mean Sir.

Maths Teacher: I mean, do you understand what you are really doing?  
Does your teacher explain what is happening?

Y 11 Student: Yes of course she does but it just goes in one ear and out the other.  
I just wait for the part where she says what to press on the calculator to  
get the answer.

Maths Teacher: That is just what I mean Sara. You **know what to do** to get an answer  
but you really **don't understand what you are doing!**

Y 11 Student: Who cares as long as I get the right answers?

Maths Teacher: **I care Sara.**

Y 11 Student: Here is another thing I learnt Sir. I don't need to factorise any more!

Maths Teacher: Does this calculator factorise for you Sara?

Y 11 Student: Well, not quite Sir, but the ones we are getting next year do!

Maths Teacher: How would you use this to factorise, say,  $x^2 - x - 30$  Sara?

Y 11 Student: Well, I go to “Equation” then press F2 for “polynomial” then press “degree 2” then I put in values for a, b and c.  
a = 1, b = -1 and c = -30  
Now press F1 to “solve” and I get 6 and -5  
So the brackets are  $(x - 6)(x + 5)$  See!

Maths Teacher: **Sara, wouldn't it be easier to just factorise it?**

Y 11 Student: Oh no Sir, this way I don't have to think at all!

Maths Teacher: Sara, what does factorise mean?

Y 11 Student: ..er.. find the brackets or something Sir.

Maths Teacher: Do you know what the factors of 6 are Sara?

Y 11 Student: ...er... We haven't done those yet.  
I remember something else too. I can use it to see if something is expanded properly or not.  
If I type  $(A + B)^2 = A^2 + B^2$  and press EXE, it tells me it is wrong by printing out a number **0**.

Maths Teacher: What does it do if you get it right then?

Y11 Student: If I type  $(A + B)^2 = A^2 + 2AB + B^2$  it prints out a number **1**.

Maths Teacher: Do you use this to simplify fractions too Sara?

Y 11 Student: Of course Sir.

Maths Teacher: OK simplify  $\frac{35}{42}$

Y 11 Student: Right. Go into “Run” mode and just use it like an ordinary calculator.  
Press  $35 \div 42$  and the answer is  $5 \div 6$  which is  $\frac{5}{6}$

Maths Teacher: Sara, we spent ages learning how to simplify fractions.  
We wrote  $\frac{35}{42} = \frac{5 \times 7}{6 \times 7} = \frac{5}{6}$  using the idea that  $\frac{7}{7} = \frac{1}{1}$  or just **1**

Y 11 Student: But Sir, I told you I don't have to do it *the hard way* now!

Maths Teacher: Sara, can you simplify  $\frac{5 \times k}{6 \times k}$  ?

Y 11 Student: No, but when I get the algebraic calculator it will be easy!

Maths Teacher: **It IS easy already Sara if you *understand* the basics.**  
Tell me, do you remember how to draw a line graph like  
 $y = 2x - 4$  ?  
Do you remember what the gradient and y intercept are?

Y 11 Student: No problem now Sir! Just go to graph mode, type in  $2x - 4$  press EXE  
Then press F6 to "draw".

Maths Teacher: OK you have the graph but what is the gradient?

Y 11 Student: Easy! Just press F1 "trace" and it says  $dy/dx = 2$ . The teacher says  
this means the gradient ...AND... if you press this little left and right  
thingy a little cross moves along the line and it tells you the  
coordinates of any point on the graph you want.  
So if I move it to the x axis I can see it crosses at 2.  
I can't see where it crosses the y axis because it is off the screen but if  
I press F2 for "zoom", I can then press F4 for "zoom out" so that I can  
now see where it crosses the y axis.  
Then if I move the little cross to the y axis I can see it crosses at - 4.

Maths Teacher: Sara, do you realise that this calculator is taking away the necessity  
to think? In fact, I suspect it is taking away your willingness and your  
ability to think! The trouble is, you can get the "answers" without the  
need for understanding of the proper basics!  
Think of it like this: **It is just like giving you some questions with  
the answer book and all you have to do is find the answers in  
the answer book! Is that really what "doing mathematics"  
means nowadays?**

Y 11 Student: Well it **is** recommended by the NCEA so it **must** be OK. Right?

Maths Teacher: Right Sara. Right!