

The Maths students need for tertiary courses - advice for Careers Teachers and Secondary Maths teachers.

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- Teaching in Cert IV Health Science Foundations Course and working on a STEM project to develop strategies for Colleges across the University to improve pass rates, retention and to give students the confidence to tackle the Maths in their courses

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- Supporting students and assisting lecturers develop strategies to help students with maths in the College of Business at VU

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- Senior Mathematics teacher at Mount St Joseph's Girls' College
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- This session will look at the 'hidden' Maths required for many tertiary courses and detail the actual Maths needed, which is often basic Maths or particular aspects the senior curriculum
- Most students will require Maths at some stage in their tertiary studies, but few students and teachers are aware of this when students make their subject choices in Years 9, 10 & 11, as Maths is neither recommended or a prerequisite for most courses.
- Up to 50 % of students are failing or withdrawing from some tertiary courses/units because they cannot cope with the Maths requirements of their courses.

'The Perfect Storm'

- Universities, Tafes and RTOs are competing for students and often the maths required in the courses is not clear, nor is maths listed as a pre-requisite. Many students then believe, or are told, they don't need maths to do Business, Science etc
- ...But when students get into the course they find there is actually significant maths involved in the course and many students are actually failing....and realising that they should have continued with maths in year 11 & 12
- Some students pass if they repeat the unit, but that comes at a great cost because usually they have to pay for repeating the subject and it may delay their studies by one year.
- Many students drop out of the course, simply because they can't cope with the maths components and don't have the confidence to seek the assistance provided.

Courses we will discuss today:

- Nursing, Paramedics, Midwifery
- Sports and Exercise Science
- Education and Early Childhood Education,
- Physical Sciences and Engineering
- Biological Sciences, Biomedical Science, Psychology
- Business
- Building, Carpentry , Electrical Engineering,

Health Sciences

Nursing, Paramedics & Midwifery

-require basic Maths without & with calculators

- Multiply and divide decimals by 10, 100 & 1000 to convert units: kg, g, mg, mcg, L, mL
- Add, subtract, multiply and divide decimals
- Using formulae
- Multiply and divide fractions
- Convert fractions to decimals
- Rates, ml/ hour, mg/min, beats per min
- Rounding off and estimating
- Times tables

*Paramedics need to do and demonstrate all division by long division (to comply with international conventions)

Academic support

Sports and Exercise Science

- Pythagoras
- Trigonometry
- Simple vectors
- Rates
- Force
- Transposing formulae (simple)
- Statistics
- Fractions
- Decimals
- Ratio and proportion
- Using Xcel

Education and Early Childhood Education

- Whole numbers
- Decimals
- Fractions
- Ratio, proportion & percentages
- Measurement, Area and volume
- Space & shape
- Statistics and Probability
- Pattern, order and algebra
- Geometry
- Time
- Times tables

(without calculators)

Physical Sciences, Engineering and Building (degree)

- Maths methods (Year 12)
- Physics (Year 12)

Engineering Mathematics 1 & 2 topics include:

- Linear, polynomial, exponential and logarithmic equations
- Differentiation, integration, definite integral, fundamental theorem of integral calculus and Integration methods, partial derivatives, first order linear differential equations (DE's), separable DE's, integrating factor, first and second order linear DE's in engineering applications.
- Statistics including distributions, measures of variability and confidence limits, probability, mutually exclusive and independent events, permutations and combinations, binomial and Poisson probability
- Matrix methods, first order differential equations, complex numbers and infinite series and their application to engineering problems

Physical Sciences, Engineering and Building (cont)

Engineering Physics 1 and 2

The following Mathematical skills with application to Physics based problems and equations are essential for Physics students:

- Understanding numbers, scientific notation, significant figures and operations with significant figures and measurements and uncertainties in measurements.
- Vector algebra (adding/subtracting vectors in 1D & 2D space), vector laws, dot and cross products, unit vectors with applications to relative velocity.
- Interpreting graphs, plotting data, linear and trigonometric sinusoidal functions with application to waves/sound and electrical physics.
- Transposing (physics) equations, solving simultaneous equations with application to Newton's 2nd law problems and Kirchhoff's law in Electrical Physics.
- Calculus: integration and differentiation with applications to mechanics and electrical Physics.

Mathematics

- Maths Methods (year12)
- Specialist Maths (year12)

Biological Sciences

- Maths Methods for some courses
- Statistics
- Order of magnitude
- Transposing formulae
- Measurement: Units, conversions, area, volume and capacity
- Rates

Double degree Law and Business

- Statistics
- Business maths (see later slides)

Psychology

- Statistics and probability

Trades: Carpentry, Plumbing, Building

- Decimals
- Fractions
- Ratio and percentage
- Rates
- Measurement: units, area and volume
- Estimation
- Ability to mentally calculate (most maths is done whilst driving or doing repetitive tasks on the job) and by hand calculations on the job
- Times tables

Trades: Electrical

- All of the above plus
- Trigonometry and Pythagoras
- Lots of transposition involving Greek letters, subscripts and superscripts

$$1. \quad y = \frac{\lambda(x-d)}{d}$$

$$2. \quad y = \frac{Ml^2l}{8EI}$$

$$3. \quad R = R_o(1 + \alpha t)$$

$$4. \quad I = \frac{E-e}{R-r}$$

$$5. \quad y = 4 a b^2 c^2$$

$$6. \quad t = 2\pi \sqrt{\frac{l}{g}}$$

$$7. \quad N = \sqrt{\left(\frac{a+x}{y}\right)}$$

$$8. \quad Z = \sqrt{R^2 + (2\pi fL)^2}$$

$$9. \quad \frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{2}$$

$$10. \quad \frac{a^2}{x^2} + \frac{b}{y^2} = 1$$

$$11. \quad A = \frac{\pi R^2 \theta}{360}$$

$$12. \quad A = \frac{3(F-f)}{L}$$

Maths Required by Apprentices and Trainees

- <http://www.aatinfo.com.au/Career-Resources/Industry-Career-Information---Quizzes>

Business

Currently supporting Business Statistics in First Year (Diploma and Higher Education)

Further Maths (Year 12) is a good preparation

- Statistics
- Probability
- Proportional reasoning & percentages
- Transposing formula
- Algebra, functions and graphs

Topics

Business Mathematics (Diploma of Business Enterprise only)

- Business applications of percentages
- Depreciation (straight line, reducing balance and units of production);
- Break Even Analysis

Business Statistics

- Types of data and sampling methods;
- Tabular and graphical presentation of data
- Frequency distribution and histogram, cumulative and/or relative frequency tables and graphs
- Measures of central tendency and dispersion
- Simple probability (contingency tables), binomial and normal distributions
- Correlation and linear regression
- Time series forecasting and data smoothing
- Sampling distributions
- Estimation (confidence intervals)
- Hypothesis testing
- Index numbers

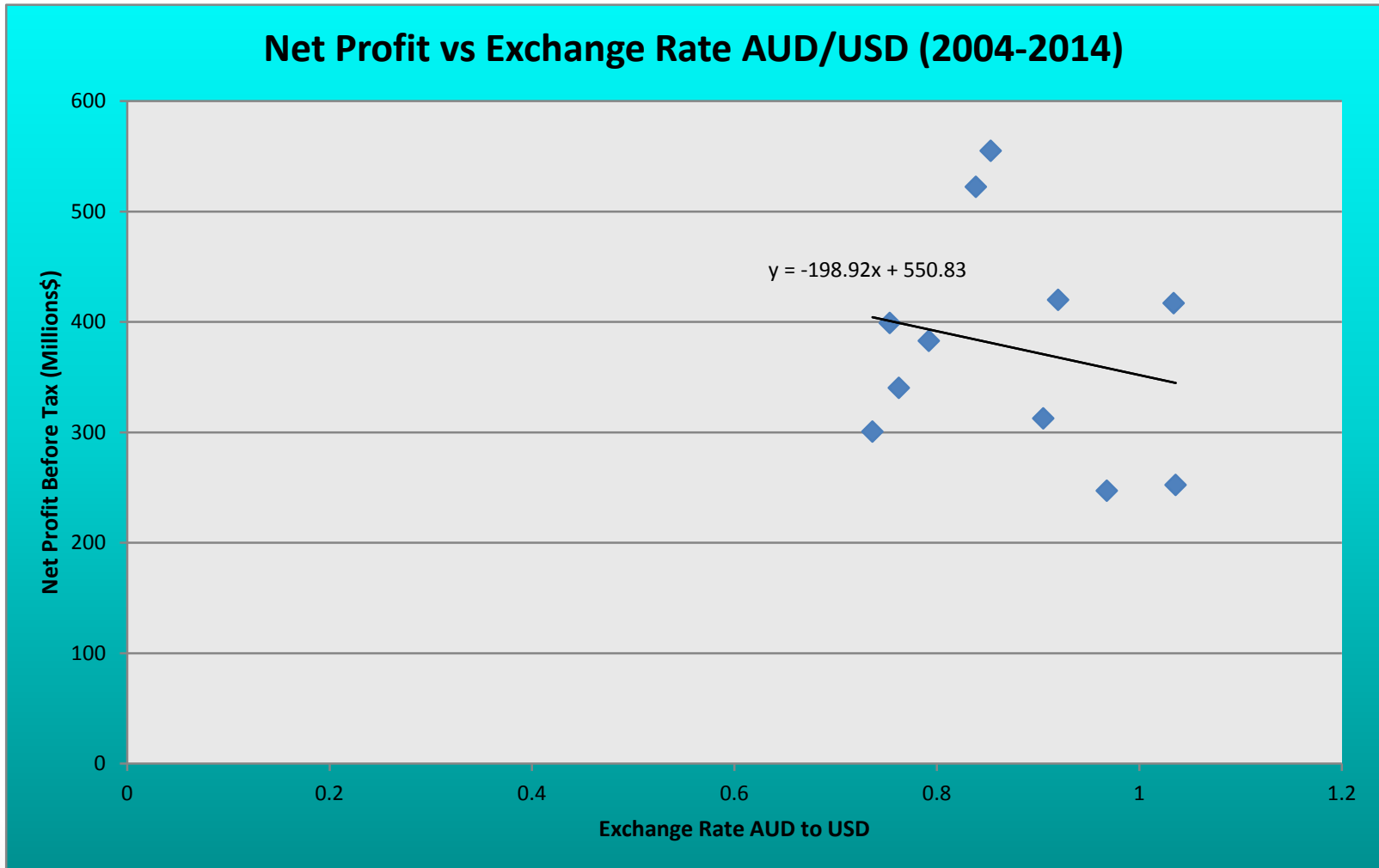
Use of Technology

- MS Excel Statistics Toolpack for descriptive statistics; correlation and regression

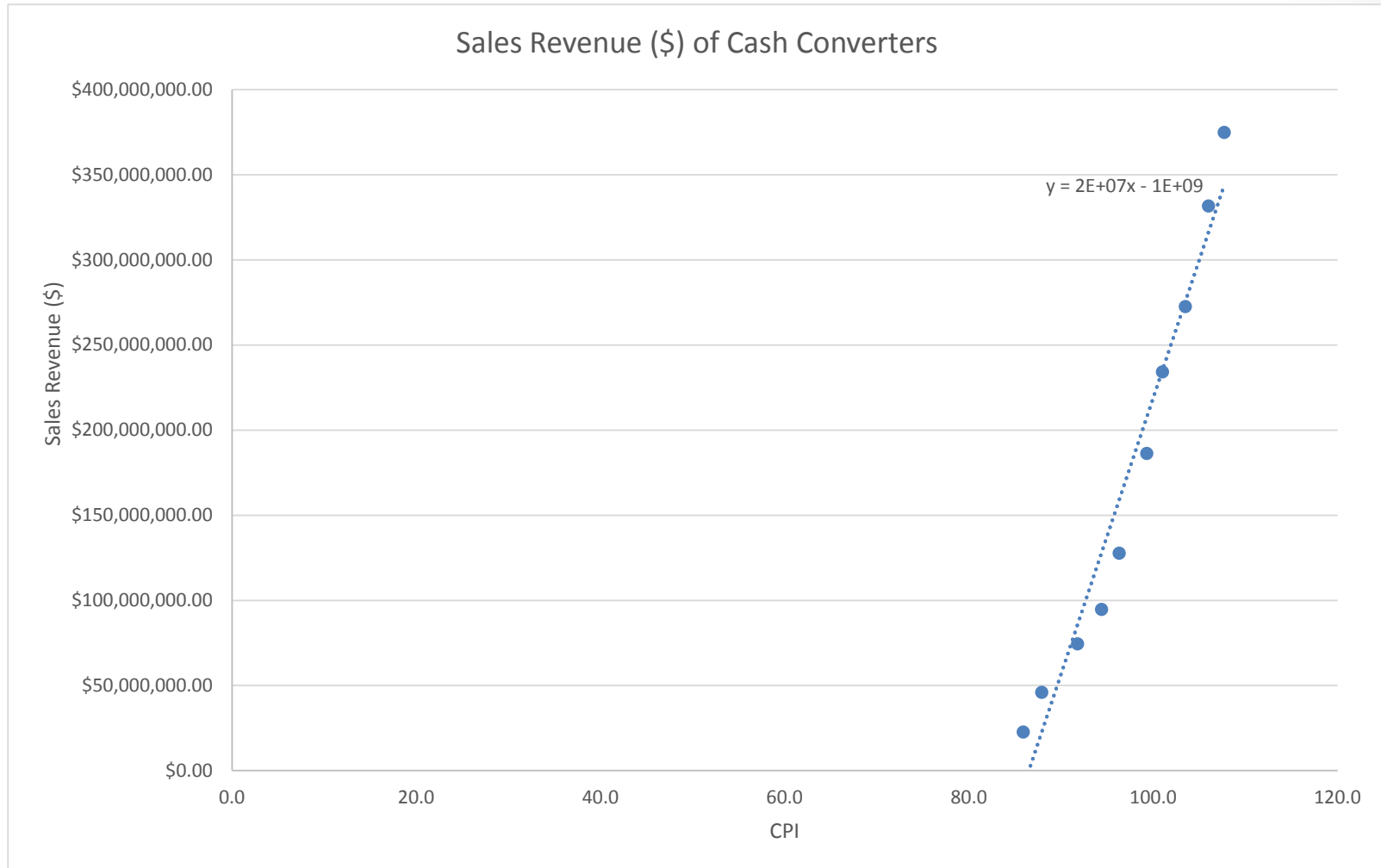
Frequent causes for consultations – Business Maths

- Algebra/using formulae eg $C = S \times R$, $N = L(1-R)$
- Converting between percentages/fractions/decimals
- Using different representations of a straight line
eg $y = mx + c$ vs $C = Vx + F$
- Solving simultaneous equations algebraically and/or graphically
- Probability – binomial and normal distributions
- Correlation and regression
- Hypothesis testing
- BODMAS within formulae eg $t_{calc} = \frac{18.4 - 20}{4.8 / \sqrt{35}}$
- Interpreting results within the context of a set task or given situation.

Example of Student Response to Assignment Question



...but more frequently...



Problem solving and analytical skills are also required in other subjects

- Economics - The use of mathematical notation and formulae, interpreting graphs and analysing the effects of changes to graphs.

eg “If $\% \Delta Q_d < \% \Delta P \Rightarrow$ **inelastic demand**
 $\Rightarrow \epsilon_p < 1.$ ”

- Accounting: Interpreting results; comparing within context

eg 2016: Net profit ratio = 12%

2015: Net profit ratio = 14%

Industry average in 2016 = 17%

Is this a good result for 2016?

Modes of support

- Primarily drop-in sessions and one-to-one appointments, but also
- Orientation workshops
- Support tutorials
- Exam revision workshops
- Materials on Learning Management System (VU Collaborate)
- MathsOnline for foundation skills
- Planning a trial of support by teleconference (WebEx) for 2017

Questions??