Maths vs Numeracy

Diagnostic Testing 1st Year Engineers

Introduction & Background

- University of Wolverhampton Faculty of Sciences and Engineering have undertaken diagnostic testing for Mechanical and Electronic Engineering first year UG students for several years (as well as Mathematics and Computing students)
- Asked by the engineers to test fundamental mathematical skills on entry
- Wolverhampton is a Post ‘92 University, most students have Btech entry qualifications for engineering courses
- NUI Galway were interested in assessing numeracy skills of a broader range of students, included science students
- NUI Galway is a traditional university (A level equivalent AAB / ABB entry requirements)

Wolverhampton 2014/15

- Conducted diagnostic test at the beginning of Welcome Week
- Multiple Choice paper based test (only 2 possible answers)
- Marked by the students at the end of Welcome Week
- Used really to flag to students areas of mathematics they needed help with
- Students Signposted to the Maths Support Centre very early, ‘pass’ mark 7/10 for each section
- GCSE level mathematics covering Algebra, Trigonometry, Functions and Graphing

Sample Test Questions

1. $\frac{3}{4}$ is bigger than $\frac{5}{7}$. TRUE or FALSE

2. $\sqrt{120} = 2\sqrt{30}$. TRUE or FALSE

3. $\frac{x^2y^{-1} + 2x^7y^3}{2x^7y^3}$ simplifies to $x^2y^{-1} + 1$, if $xy \neq 0$. TRUE or FALSE

3. The line with equation $3x + 15y = 35$ is perpendicular to the line with equation $5x = y + 2$. TRUE or FALSE

4. $y = 3x^2 + x + 1$ intercepts the x–axis twice. TRUE or FALSE

3. $\tan\frac{7\pi}{3} = \sqrt{3}$. TRUE or FALSE

4. For all θ, $\tan^2\theta - \sec^2\theta = -1$. TRUE or FALSE

Summary for Wolverhampton

- Very few students scored 7 / 10 or more for each section (given that they could get on average 5 / 10 by guessing!)
- Mathematics skills weak
- However….
- More engineering students used the maths support centre in Semester 1 than ever before
- 75% pass rate in first year engineering maths module, a modest improvement on previous years (~67%)
- Tutorials better attended than previous years as well

NUI, Galway 2014/15

- Implemented an online Numeracy Test rather than a paper based Maths Test. All the usual aims, identify problems, connect students with support available etc.
- 20 (easy) questions covering arithmetic reasoning, percentages, fractions. Irish Junior Certificate/GCSE level material. Pass mark 18/20.
- Students take the test every two weeks until they pass (they didn't know that at the outset ☺).
- Approx. 1,200 took the test during week 2.

Sample Test Questions

Sample Questions

1. David spent 25% of his pocket money in one shop and then he spent one third of the remainder in another shop. If he had €5.50 left, how much had he at first?

2. During a season a certain football team won half its matches, drew one fifth of its matches and lost the rest. If the team drew 10 matches, find how many matches the team lost?

4. As part of a physics experiment students were asked to stretch a spring to extend its length by 40%. If the original length of the spring is 55 cm, what should be the length of the extended spring?

5. Find 10% of 236. Enter your answer correct to one decimal place.

6. Find 25% of 337. Enter your answer correct to two decimal places.

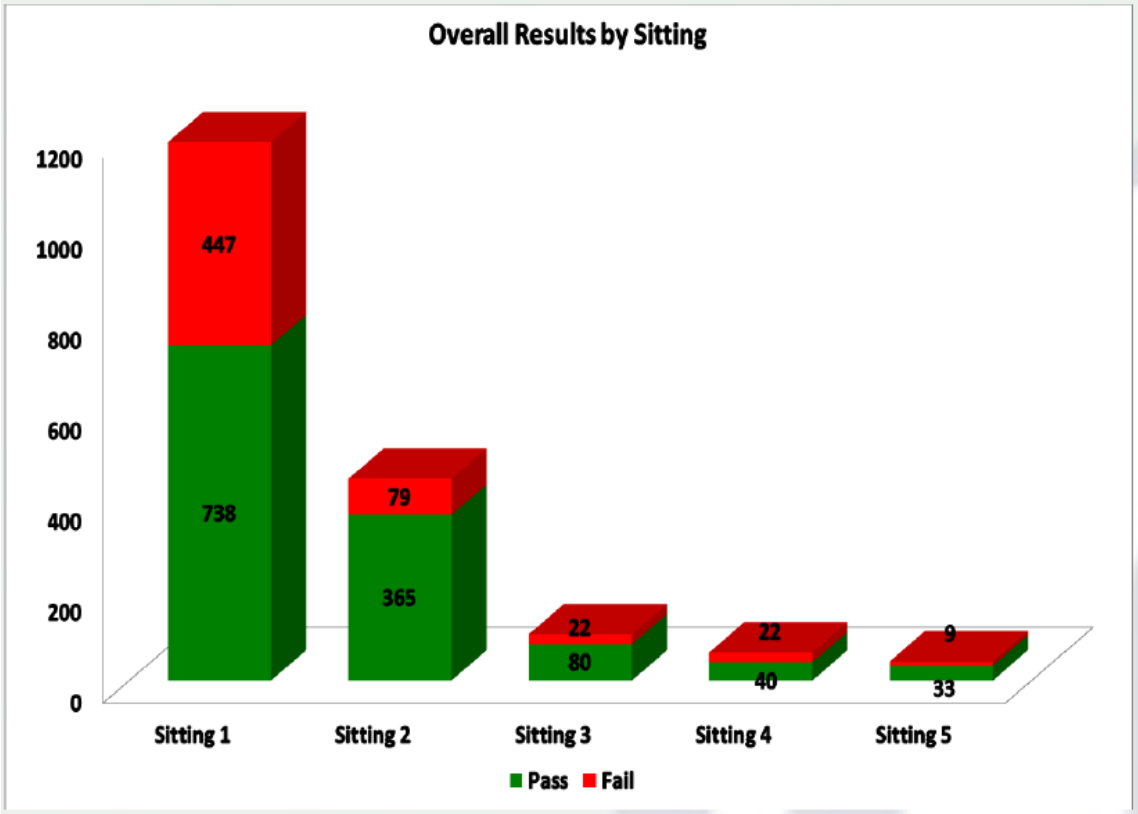
15. Evaluate $(4.5 \times 10^{-1})(2.8 \times 10^{-2})$. Input your answer as a decimal correct to three decimal places.

16. The sum of Jim and Simon's ages is 68. If Simon is 12 years older than Jim, how old is Jim?

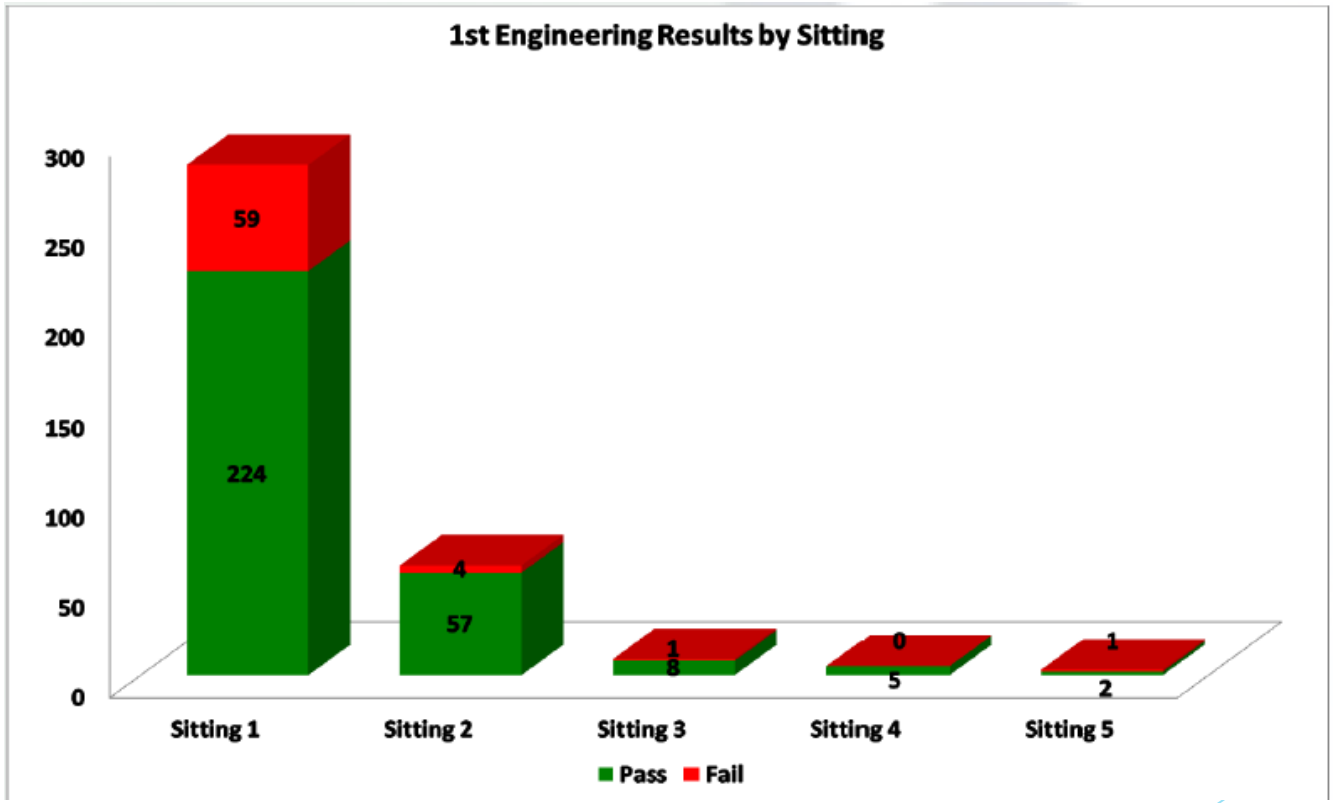
17. Two apples and one orange together cost 60 cent. One apple and two oranges together costs 60 cent. How much does one orange cost?

18. A student's grade in Biology is made up of an exam at Christmas contributing 30%, an exam in Summer contributing 30% and a continuous assessment component contributing 40%. Each of the three components are marked out of 100. A randomly selected student obtained 67 marks out of 100 in the Christmas exam, 55 marks out of 100 in the Summer exam and 33 marks out of 100 in the continuous assessment. What is the students overall mark (out of 100)? Enter your answer correct to one decimal place.

The Results ☹


Overall Results by Sitting
1200
1000
800
600
400
200
0
447
738
79
365
22
80
22
40
9
33
Sitting 1
Sitting 2
Sitting 3
Sitting 4
Sitting 5
Pass
Fail

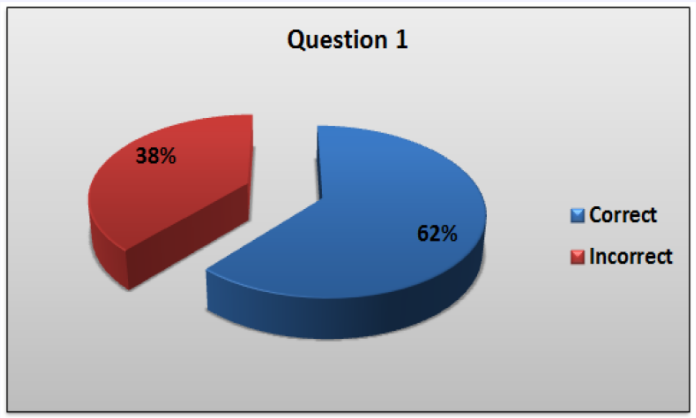
1st Year Engineers



What they were bad at!

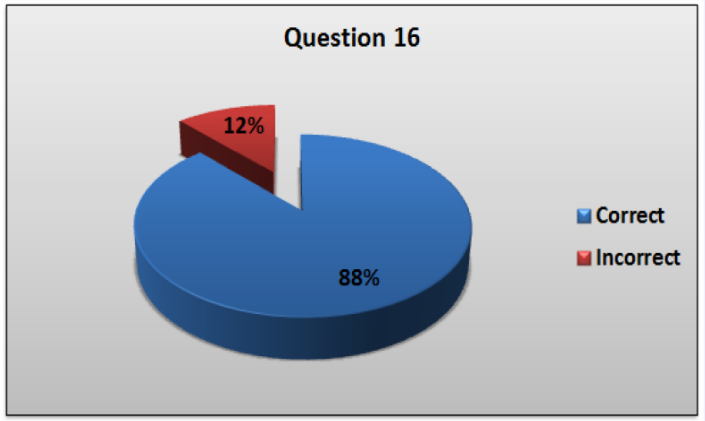
Question 1

David spent 25% of his pocket money in one shop and then he spent one third of the remainder in another shop. If he had €5.50 left, how much had he at first?



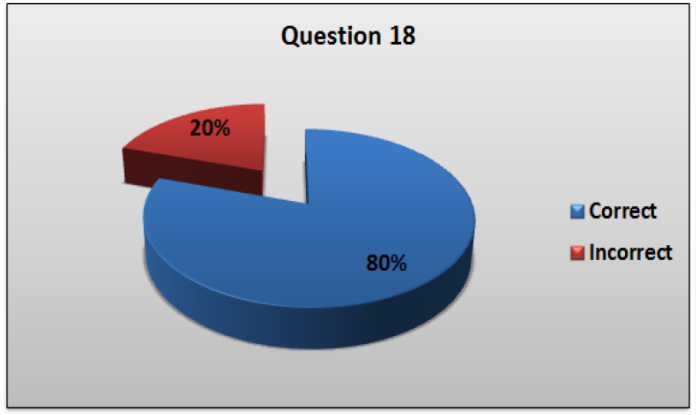
Question 16

The sum of Jim and Simon's ages is 68. If Simon is 12 years older than Jim, how old is Jim?



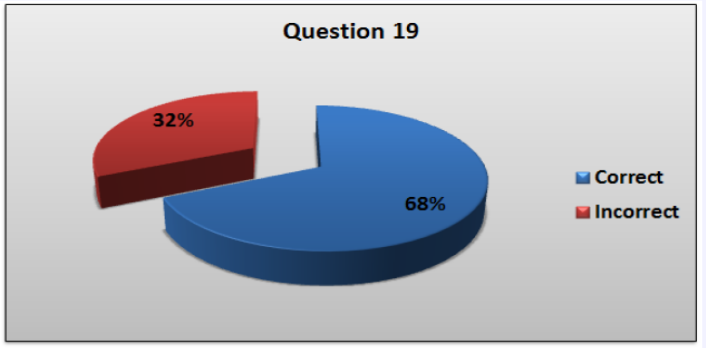
Question 18

Two apples and one orange together cost 65 cent. One apple and two oranges together costs 70 cent. How much does one orange cost?



Question 19

A student's grade in Biology is made up of an exam at Christmas contributing 30%, an exam in Summer contributing 30% and a continuous assessment component contributing 40%. Each of the three components are marked out of 100. A randomly selected student obtained 67 marks out of 100 in the Christmas exam, 55 marks out of 100 in the Summer exam and 33 marks out of 100 in the continuous assessment. What is the students overall mark (out of 100)? Enter your answer correct to one decimal place.



Summary of NUIG

- Performance was poor in general. Engineers did better than e.g. Science, but still worse than expected.
- In NUIG there is a high entry maths requirement for engineers (Min C Higher level Maths ILC, equiv to low B A level).
- But about 20% of them have problems with basic numeracy at the outset.
- Results much worse amongst groups with lower entry requirements.
- **Positive:** In the end, through repeated engagement with support available the students overcame their difficulties.

Plans for 2015/16 at UoW

- A paper based test to be delivered during week 1 covering maths and numeracy. (Not all the students attended Welcome Week sessions…)
- To be marked by the staff lecturing on first year mathematics module
- A greater emphasis on problem areas (trig, algebra)
- Hopefully increase uptake of Maths Support provision at Telford campus (and free up some capacity of the provision at City campus)
- To be rolled out to include Civil engineers in 2016/17 if successful