Cross-disciplinary Numbas initiative at the University of Glasgow

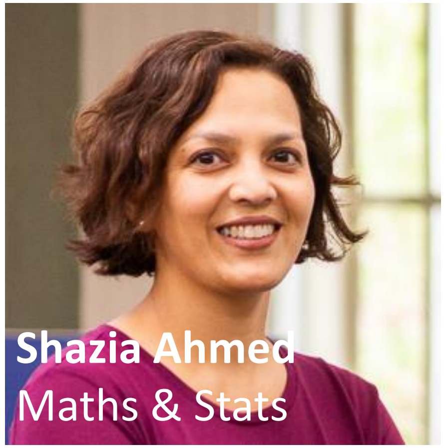
NUMBAS

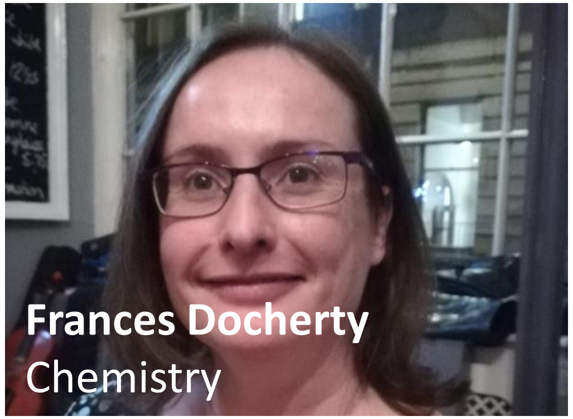
NUMBAS User Meeting Spring 2022

Numbas at Glasgow

- Previous projects (Chemistry, Life Sciences)
- Other existing use (Geospatial, Access)
- Further potential (Maths Support, more questions, other subject areas)
- Project team and Chancellor's Fund
- Recruitment of undergraduate student project assistants
    - Named appointments
    - 3 x 80 hours (~5 hours a week for 4 months)
    - Support from Newcastle

Project Team





Project team existing/development interests

Recap: some Numbas possibilities

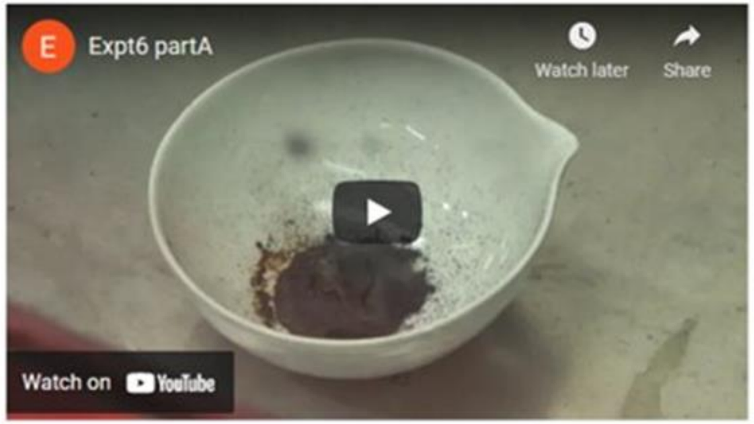
Consider strategy/needs carefully, test, evaluate including student feedback

Use	Randomisation
Additional optional student resource	Students can keep practicing areas they find difficult
Formative testing	Allows repeated tests
Low credit summative testing	Allows repeated tests and keep max score.
Summative testing – can be review tests	Numerical answers can be different for each student
Diagnostic testing	Numerical answers can be different for each student

Frances Docherty & Beth Paschke, Chemistry:

- Maths support for chemists
- Online lab reporting
- Practice exercises on lecture material,

Procedure A: Oxidation of Glycerol by Potassium Permanganate



1. Weigh out 1.5g of potassium permanganate (See APPENDIX A on weighing), into a white crucible using the balance in the fumehood.

2. Make a conical pile of your crystlas in the centre of the crucible and make a small indentation in the top of the pile.

3. Using a teat pipette, carefully add SIX DROPS of glycerol (this is about the amount you calculated in the prelab part) into the indentation.

4. Remove the glycerol bottle, lower the fume cupboard window and observe and record what happens. Notice the colour of the flames (The reaction may take a little time to commence).

5. When the lump of charred material has cooled, (i.e after a couple of minutes) add a few drops of 5M sulfuric acid to it. Record your observations and attempt to relate them to the expected reaction products. (**Do not smell any gasses evolved**).

6. Leave the crucible at the back of the fumehood for specialist disposal by technical staff.

v)

Why were the flames purple?

- ○ Due to the atomic emission by potassium atoms
- ○ Due to atomic emission by sodium atoms
- ○ Refraction of light
- ○ Presence of permangante ion
- ○ Due to absorption of potassium ions

vi)

The reaction was slow to begin with because [ ] but once initiated, the [ ] produced in this [ ] reaction h

- of a lack of catalyst
- of waiting for the reactants to mix
- only a small fraction of molecules having the activation energy

Submit part

Score: 0/0.75

Unanswered

Frances Docherty & Beth Paschke, Chemistry:

Maths support for **Science Fundamentals** course;

- **Compulsory course for Life Sciences students if no Higher Chemistry with substantial mathematical component**
- **Wide range of mathematical backgrounds & abilities**
- **Feedback requests for additional (practice) support**
- **Topics** : Fractions, Percentages, Scientific notation, Unit conversion, Equations of lines, Simultaneous equations, Quadratic equations, Powers and indices, Differentiation, Integration, Trigonometric functions, Logarithms, Exponential functions

Elizabeth Petrie - Geospatial PGT mixed experience maths

- Numbas approach evolved and tested over three years
- Assessment 10% of 20 credit module
- 10 weekly tests (minimal credit, repeat as wish before deadline)
- 2 summative review tests (single timed sitting, most of credit)
- Current project will improve range and standard of questions available

Ruth Douglas, Maths Support & Access

- Additional resources for students from other subject backgrounds requiring extra practice on particular topics
- Supplementing existing graduate numeracy resources
- Access Maths formative tests and practice exercises
- Pre-Access diagnostic test and revision materials for prospective students (Clare Brown, Lifelong Learning)

William Finlay, Adam Smith Business School

- Large intake Foundations of Finance course
- Very mixed maths ability
- Building maths confidence with lower staff involvement
- Creating an accessible learning environment

Coordinating a joint project and collegiality

- Chancellor's Fund application
- L&T conference
- Minimum useful content
- Managing interns

Provisional student work packages

Name	Name	Name
Basic algebra, equation rearranging – 10-20 q	units, rounding	Differentiation - basic
Logs and exponentials	Trigonometry – sin, cos, tan	Differentiation - product and quotient
Quadratics – completing the square	Pythagoras 2D and 3D	Z-tests, Percentage returns
Graphs - linear	Trigonometry – sine rule cosine rule	Integration – basic, definite, indefinite
Graphs - Quadratic	Vectors and polar Coordinates	Integration – area under/between curves

Student interns

- Recruitment
- Training
- Collecting material
- Creating new material and meeting a standard

Glasgow Numbas Question Pool

Glasgow Numbas Question Pool

Undergraduate Project Assistants

+ New: Folder | Question | Exam

8 items in this folder.

Select all   Select none

Status	Name	Type	Last modified
☐	Basic Algebra Skills		
☐	Basic Statistics		
☐	Basic Trigonometry and Pythagoras		
☐	Linear Graphs		
☐	Logs and Exponentials		
☐	Numeracy		
☐	Quadratics		
☐	Roots and Indices		

Anna Cartlidge

Tess Lynn

Michael O'Connor

Copyright and existing material

- Want to be efficient and not recreate the wheel if it exists already
- But want to meet licence terms
- Want to consider Open Resource library

Question quality

- Advice completed
- Consider hints, adaptive marking
- Single questions
- Tested by another person
- Metadata

Questions?

Contact one of the project team at:

Ruth Douglas	Ruth Douglas@glasgow.ac.uk
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William Finlay	William.Finlay@glasgow.ac.uk
Shazia Ahmed	Shazia.Ahmed@glasgow.ac.uk
Beth Paschke	Beth.Paschke@glasgow.ac.uk
Frances Docherty	Frances.Docherty@glasgow.ac.uk
Clare Brown	Clare.Brown.2@glasgow.ac.uk

Thanks for listening!

Appendix - Examples

NUMBAS logs Explore

65 results for "logs".

Show results for

- Questions
- Exams

Refine by

Status

- Any status
- Draft
- Ready to use
- Should not be used
- Has some problems
- Doesn't work
- Needs to be tested

Author

Equations involving logs

Ready to use

Exam (5 questions) in Martin's workspace by Martin Jones

Solve equations involving logs and exponential functions, by using inverse operations.

Equations involving logs

Ready to use

Exam (5 questions) in Glasgow Numbas Question Pool by Tess Lynn and 1 other

Solve equations involving logs and exponential functions, by using inverse operations.

Solving exponential equations using logs

Ready to use

Question in Glasgow Numbas Question Pool by Tess Lynn and 1 other

No description given

Combining use of multiple laws of logarithms into one equation

Ready to use

Question in Glasgow Numbas Question Pool by Tess Lynn and 3 others

Given a sum of logs, all numbers are integers,

$\log_b(a_1) + \alpha \log_b(a_2) + \beta \log_b(a_3)$ write as $\log_b(a)$ for some fraction a.

Also calculate to 3 decimal places $\log_b(a)$.

Example Question

€ 67.15 *Round your answer to 2 decimal places.*

You were awarded **1** mark.

You scored **1** mark for this part.

Score: 1/1

Answered

Submit answer

Answer the question below:

PV_bond

A government bond issued in France has a coupon rate of 2.1%, face value of €100 and the bond matures in 30 years.

Assuming that the coupons are paid on an annual basis. Calculate the price of a bond (in euro) if the yield to maturity is 4%.

€ ______ *Round your answer to 2 decimal places.*

Submit answer | **Score: 0/1** | Try another question like this one | Reveal answers

Examples

Foundations of FINANCE

Writing the question in NUMBAS:

Write advice

Advice

In order to solve this question, we need to recognize that we are trying to solve the present value of a government bond.

To calculate the price of a bond:

$$PV bond = coupon * \left(\frac{1}{r} - \frac{1}{r(1+r)^n}\right) + \frac{Par}{(1+r)^n}$$

Using the information provided in the question:

The coupon is {currency({coupon_payment},"€","p")}, this is calculated as {coupon}% of the face value of €{face}. The number of periods in this problem is {period_years} and the yield to maturity is {ytm}%.

Therefore to solve the value of this bond from {place}:

$$PV bond = \{coupon\_payment\} * (\frac{1}{\{ytm\_dec\}} - \frac{1}{\{ytm\_dec\}(1+\{ytm\_dec\})^{\{period\_years\}}}) + \frac{\{face\}}{1+\{ytm\_dec\}^{\{period\_years\}}}$$

The present value of the bond = {currency(PV_bond,"€","cents")}

Click to edit

Examples

Foundations of FINANCE

Student facing NUMBAS:

The question

Answer the question below:

PV_bond

A government bond issued in France has a coupon rate of 2.1%, face value of €100 and the bond matures in 30 years.

Assuming that the coupons are paid on an annual basis. Calculate the price of a bond (in euro) if the yield to maturity is 4%.

€ ____ *Round your answer to 2 decimal places.*

Submit answer | **Score: 0/1** | Try another question like this one | Reveal answers

€ 67.15 *Round your answer to 2 decimal places.*

✔ You were awarded **1** mark.

You scored **1** mark for this part.

Score: 1/1 ✔

Answered

Submit answer | **Score: 1/1** ✔

Examples

Foundations of FINANCE

Student facing NUMBAS:

Advice

Advice

In order to solve this question, we need to recognize that we are trying to solve the present value of a government bond.

To calculate the price of a bond:

$$PV\,bond = coupon * \left(\frac{1}{r} - \frac{1}{r(1+r)^n}\right) + \frac{Par}{(1+r)^n}$$

Using the information provided in the question:

The coupon is €2.10, this is calculated as 2.1% of the face value of €100. The number of periods in this problem is 30 and the yield to maturity is 4%.

Therefore to solve the value of this bond from France:

$$PV\,bond = 2.1 * \left(\frac{1}{0.04} - \frac{1}{0.04(1+0.04)^{30}}\right) + \frac{100}{1+0.04^{30}}$$

The present value of the bond = €67.15

Examples

Foundations of FINANCE

Student facing NUMBAS:

Infinite number of questions

PV_bond

A government bond issued in Germany has a coupon rate of 1.8%, face value of €100 and the bond matures in 27 years.

Assuming that the coupons are paid on an annual basis. Calculate the price of a bond (in euro) if the yield to maturity is 5.9%.

PV_bond

A government bond issued in France has a coupon rate of 3.4%, face value of €100 and the bond matures in 2 years.

Assuming that the coupons are paid on an annual basis. Calculate the price of a bond (in euro) if the yield to maturity is 13.6%.

PV_bond

A government bond issued in Italy has a coupon rate of 9%, face value of €100 and the bond matures in 30 years.

Assuming that the coupons are paid on an annual basis. Calculate the price of a bond (in euro) if the yield to maturity is 10.2%.

PV_bond

A government bond issued in the Netherlands has a coupon rate of 6.3%, face value of €100 and the bond matures in 36 years.

Assuming that the coupons are paid on an annual basis. Calculate the price of a bond (in euro) if the yield to maturity is 15.6%.

PV_bond

A government bond issued in Italy has a coupon rate of 3.6%, face value of €100 and the bond matures in 5 years.

Assuming that the coupons are paid on an annual basis. Calculate the price of a bond (in euro) if the yield to maturity is 16.8%.

PV_bond

A government bond issued in the Netherlands has a coupon rate of 4.6%, face value of €100 and the bond matures in 8 years.

Assuming that the coupons are paid on an annual basis. Calculate the price of a bond (in euro) if the yield to maturity is 3.4%.

PV_bond

A government bond issued in Italy has a coupon rate of 9.5%, face value of €100 and the bond matures in 26 years.

Assuming that the coupons are paid on an annual basis. Calculate the price of a bond (in euro) if the yield to maturity is 19.3%.

Examples

Foundations of FINANCE

Writing advice

Advice

Edit Insert View Format Table Tools

Formats

```
In order to solve this question, you need to identify that we are solving for this equation: $FV=PV(1+r)^n$

Therefore to solve for the future value:

$FV=PV(1+r)^n$

We know that the PV is £{num_PV}million, we know that r = {num_return*100}% and we have {num_period} periods of compounding.  Therefore:

\(FV = PV(1+r)^n\)

\(FV = \var{num_PV}(1+\var{num_return})^\var{num_period}\)

\(FV = \var{answer}\text{million}\)

Alternative approach to solving:

You may also solve this question using the financial tables.

The future value factor (FVF) of {num_return*100}% for {num_period} periods is: {factor} or {factor_rounded} to 4 decimal places.

\(FV = PV * FVF(\var{num_return*100} \text{%,} \var{num_period})\)
\(FV = \var{num_PV}*\var{factor_rounded}\)
\(FV = \var{answer}\text{million}\)
```

Give a worked solution to the whole question.

Advice

In order to solve this question, you need to identify that we are solving for this equation: $FV = PV(1+r)^n$

Therefore to solve for the future value:

$$FV = PV(1+r)^n$$

We know that the PV is £{num_PV}million, we know that r = {num_return*100}% and we have {num_period} periods of compounding. Therefore:

$$FV = PV(1+r)^n$$

$$FV = \{\texttt{num}_{PV}\}(1+\{\texttt{num\_return}\})^{\{\texttt{num\_period}\}}$$

$$FV = \{\texttt{answer}\}\text{ million}$$

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The future value factor (FVF) of {num_return*100}% for {num_period} periods is: {factor} or {factor_rounded} to 4 decimal places.

$$FV = PV * FVF(\{\texttt{num\_return} \times 100\}\ \%, \{\texttt{num\_period}\})$$

$$FV = \{\texttt{num}_{PV}\} * \{\texttt{factor\_rounded}\}$$

$$FV = \{\texttt{answer}\}\text{ million}$$

Click to edit