SPIRIT Maths ExTrA: The Journey Continues …

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EAMS, June 2022

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SPIRIT Maths ExTrA - Students' Perceptions Informing and Redefining Innovative Teaching of Mathematics in Higher Education – ExTending Targeted Resources aimed at University wide Adoption

SPIRIT Maths

- NF 2019 SATLE funding
- Rolled over in MTU 2019-2020

SPIRIT Maths ExTrA

- NF 2020 SATLE funding
- Started in MTU in September 2021

SPIRIT Maths 2023

- Work in Progress

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Student survey

- Online survey was administered twice, in June 2020 (2019 intake) and February 2021 (2020 intake);

- First year Business degree and Engineering students (N=1633 students)

- 310 respondents
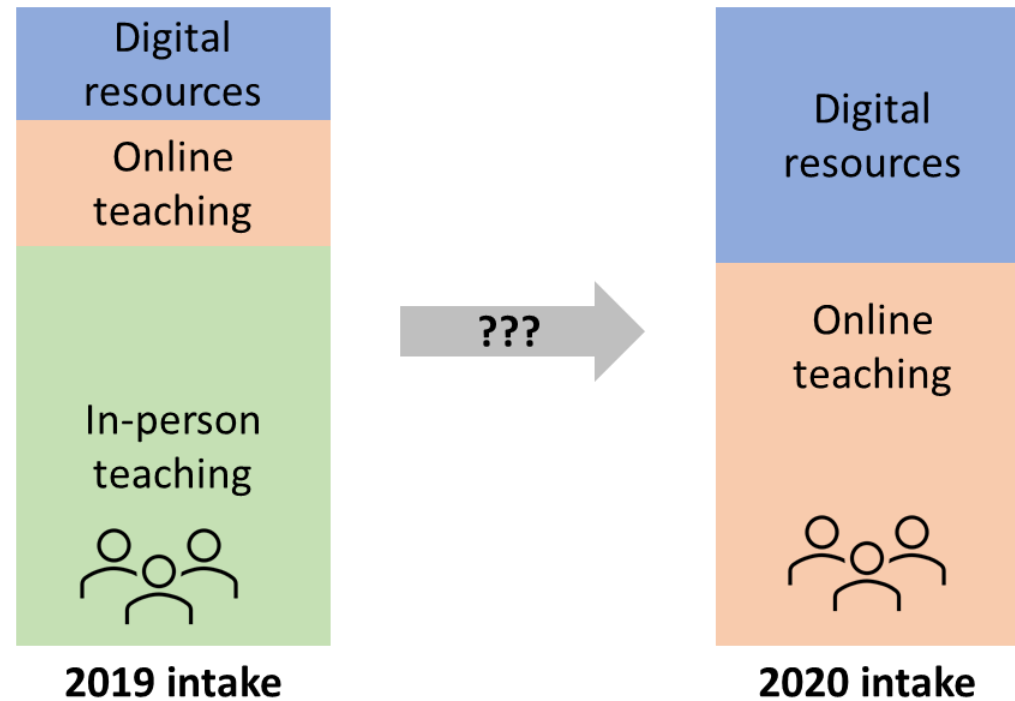
❏ No statistically significant difference between two surveys.

❏ This allowed us to combine the data from two surveys.

Several strands of SPIRIT Maths Project:
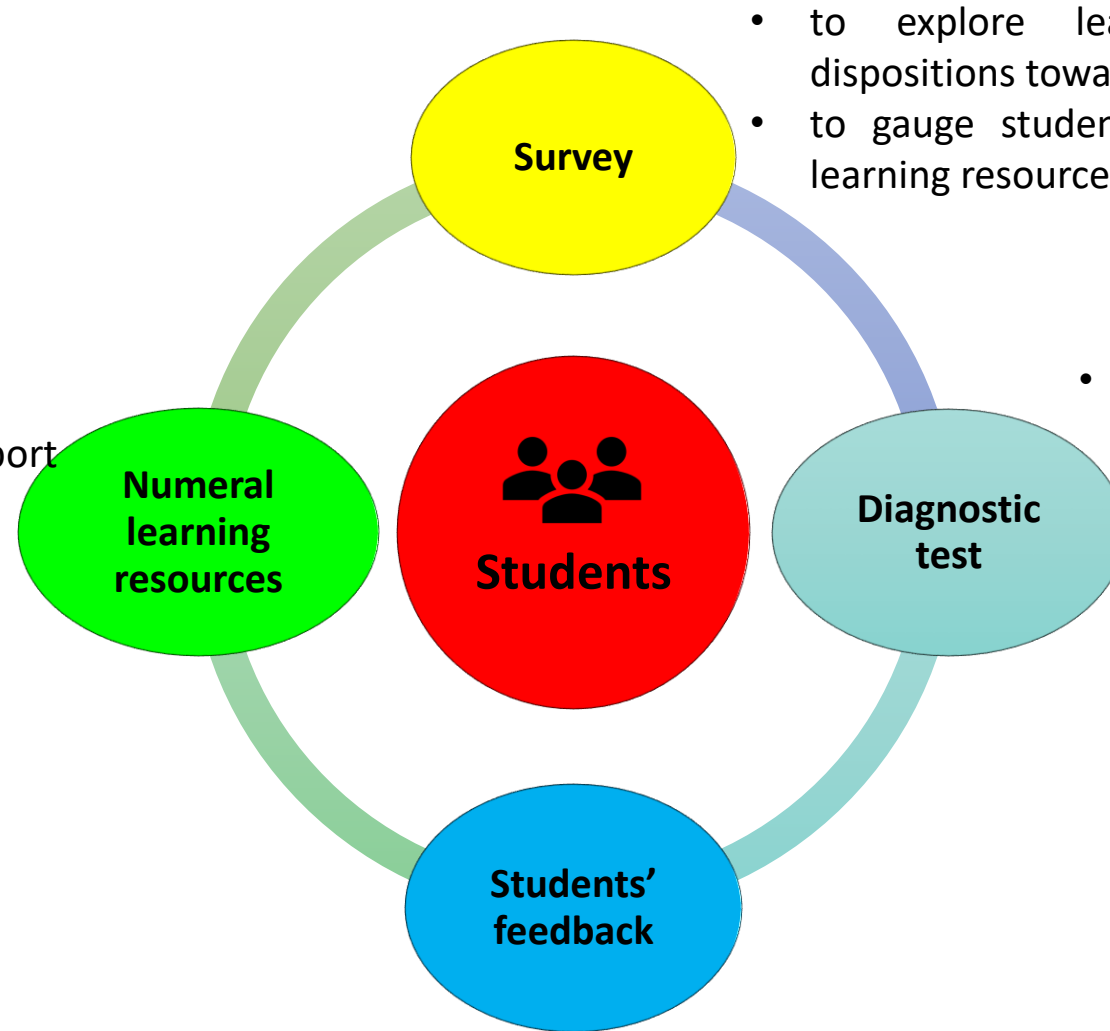
- to explore learners' perceptions and dispositions towards mathematics;
- to gauge students' preferences for digital learning resources

- to identify students at risk of failing first year maths; to alert and direct them to targeted resources

Survey

Numeral learning resources

Students

Diagnostic test

Students' feedback

- to develop digital tools to support learning of mathematics

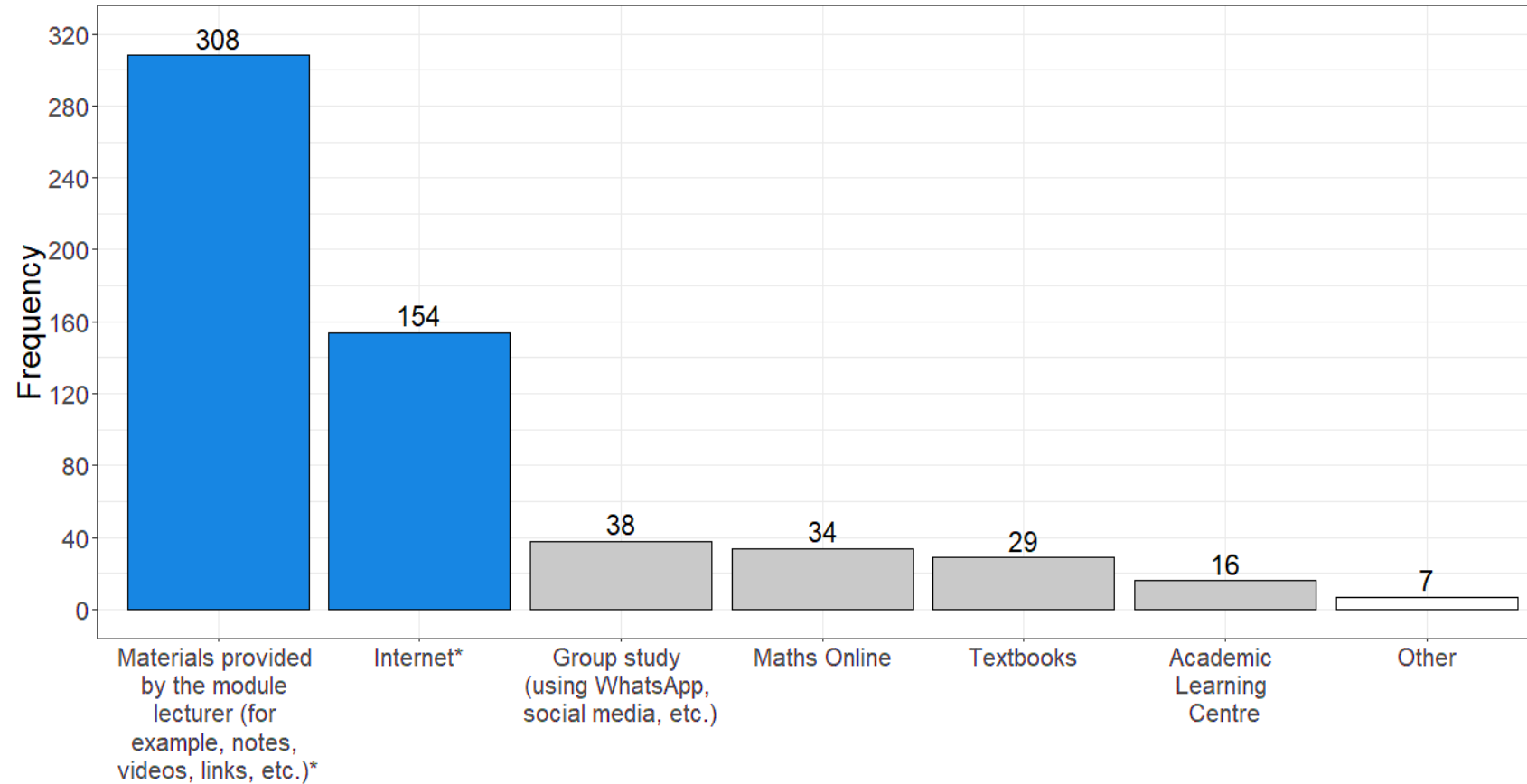- to gather students' feedback on resources and inform the rollout

What students want

Most effective resources to help you master your Maths at MTU
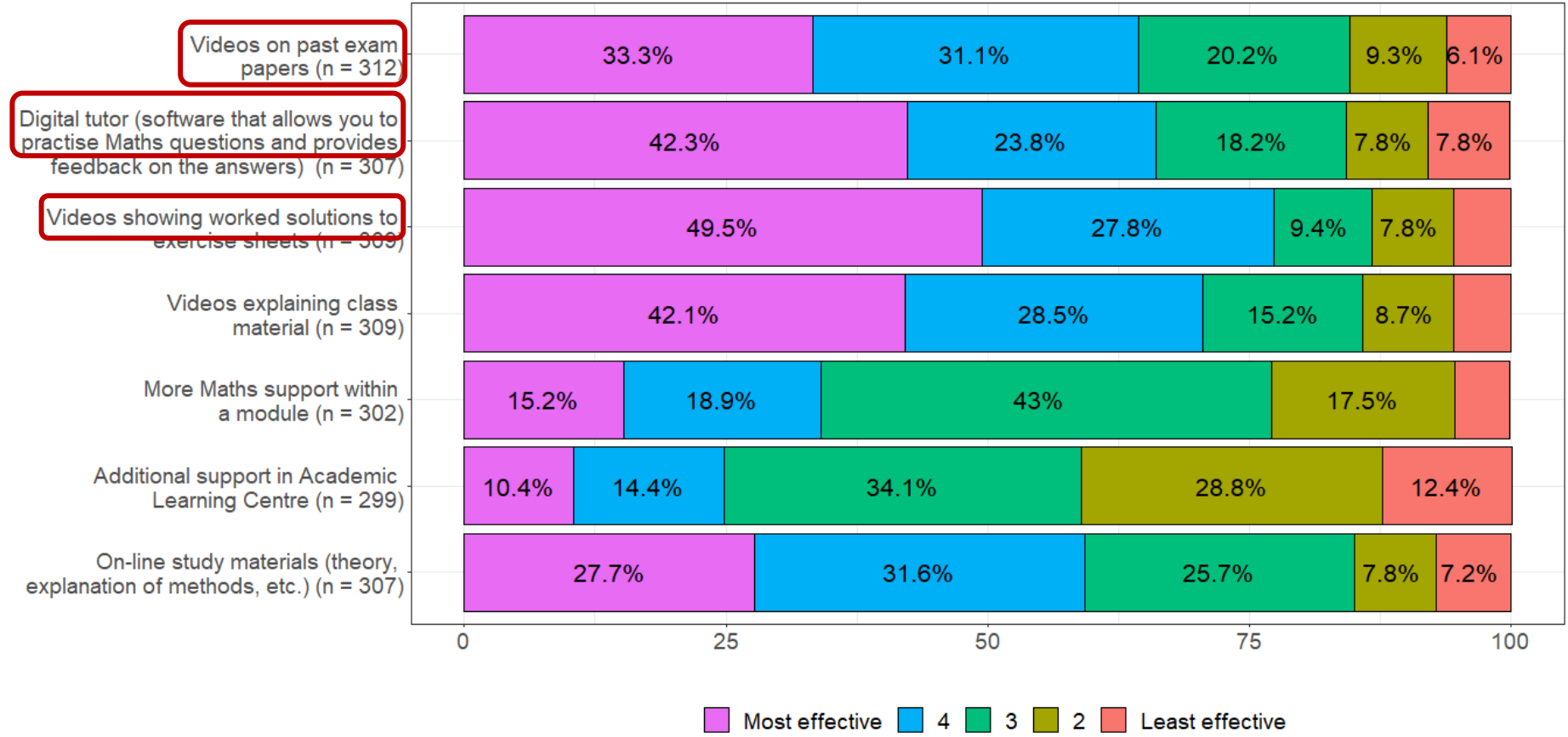
☐ **Students want digital practice resources**
☐ **Videos explaining worked solutions**

How students use available materials and resources

❑ Students are very focused on using lecturers' material.

❑ Any new resources have to be linked from the platform used by the lecturer.

Interlinked Digital Resources

Exercise : Solve for x in the following equation, rounding your answer to 3 decimal places:

$$6e^{3.1x} = 23$$

Write in your answer below.

$x =$ [ ]

✓ Check

Interlinked Digital Resources

Exercise : Solve for x in the following equation, rounding your answer to 3 decimal places:

$$6e^{3.1x} = 23$$

Write in your answer below.

x = ☐

✓ Check

↓

2. Video: Watch a video of a worked solution.

Solve for x in the following equation, rounding your answer to 3 decimal places:

$$3e^{-2.7x} = 8$$

$$3e^{-2.7x} = 8$$

$$\frac{3e^{-2.7x}}{3} = \frac{8}{3} \qquad \{\text{Divide both sides by } 3\}$$

MULTIPLICATION by 3 cancels DIVISION by 3

0:24 / 1:38

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SPIRIT Maths

Interlinked Digital Resources

1. H5P: Work out your answer and check if it's correct.

Exercise : Solve for x in the following equation, rounding your answer to 3 decimal places:

$$6e^{3.1x} = 23$$

Write in your answer below.
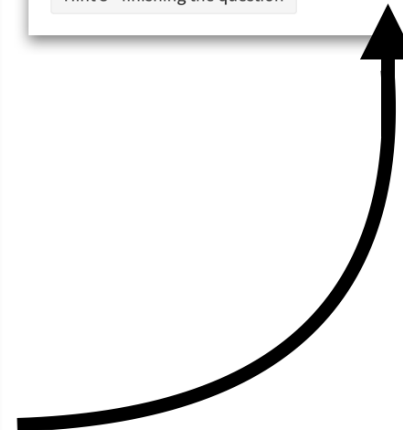
$x =$ [_____]

✓ Check

3. NUMBAS: Practise more questions of this type, get hints and instant feedback.

Solve for x in the following equation, giving your answer to 3 decimal places:

$$5e^{-8.8x} = 4$$

$x =$ [_____] *Round your answer to 3 decimal places.*

Or, you could:

Hint 1 - how to start

Hint 2 - a little more help

Hint 3 - finishing the question

2. Video: Watch a video of a worked solution.

Solve for x in the following equation, rounding your answer to 3 decimal places:

$$3e^{-2.7x} = 8$$

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MULTIPLICATION by 3
cancels
DIVISION by 3

0:24 / 1:38

H5P animations

We designed silent animated videos of a detailed written solution.

Videos

Videos were kept short and focused on key problem solving steps.

NUMBAS

- Numbas questions created to match videos.

- Student can enter their answer to see if they are correct.

- If they require help, they can click on one of a number of hints.

- Hints follow the steps from the video solution.

- At each stage, the student can choose to return to answer the question or request another hint.

- The student can also reveal a fully worked solution.

- For further practice, the student can select "Try another question like this one".

Question progress: **Solve for x**

Solve for x in the following equation, giving your answer to 3 decimal places:

$$9e^{8.4x} = 4$$

$x =$ [____] *Round your answer to 3 decimal places.*

Submit part

Or, you could:

Hint 1 - how to start

Hint 2 - a little more help

Hint 3 - finishing the question

Solve for x 0/2

Total   0/2

Try another question like this one   Reveal answers

SPIRIT Maths - Digital Learning Resources

Work out your answer and enter it to check if it's correct

Exercise : Solve for x in the following equation, rounding your answer to 3 decimal places:

$$6e^{3.1x} = 23$$

Write in your answer below.

$x =$ [ ]

✓ Check

Q1 (b)

A car was purchased for €17,500. It depreciates at a rate of 1.2% per month. Calculate the value of the car after 4 years. Round your answer to the nearest cent.

€ [ ]

✓ Check

H5P

Practise more questions of this type, get hints and instant feedback

Question progress: *Solve for x*

Solve for x in the following equation, giving your answer to 3 decimal places:

$$3e^{0.8x} = 5$$

$x =$ [ ] *Round your answer to 3 decimal places.*   Submit part

Or, you could:

Hint 1 - how to start

Hint 2 - a little more help

Hint 3 - finishing the question

Solve for x 0/2
Total   0/2

Try another question like this one   Reveal answer

A car was purchased for €28500. It depreciates at a rate of 2.25% per month.

Calculate the value of the car after 3 years. Round your answer to the nearest cent.

Value of the car after 3 years: € [ ]

Advice

The formula for depreciation is:

$$A = P(1 - i)^n$$

where:

A represents the value of the asset after n months

P represents the original value of the asset

i represents the rate of depreciation per month

n represents the number of months

In this example:

$P = €28500$

$i = 0.0225$

$n = 12 \times 3 = 36$

then

$A = €28500(1 - 0.0225)^{36} = €12561.7$

NUMBAS

Watch a video of worked solution

Worked Example Video:

Solve for x in the following equation, rounding your answer to 3 decimal places:

$$3e^{-2.7x} = 8$$

$3e^{-2.7x} = 8$

$\dfrac{3e^{-2.7x}}{3} = \dfrac{8}{3}$ {Divide both sides by 3

MULTIPLICATION by 3 cancels DIVISION by 3

0:24 / 1:38

(b) A car was purchased for €17,500. It depreciates at a rate of 1.2% per month. Calculate the value of the car after 4 years? Round your answer to the nearest cent.

(4 marks)
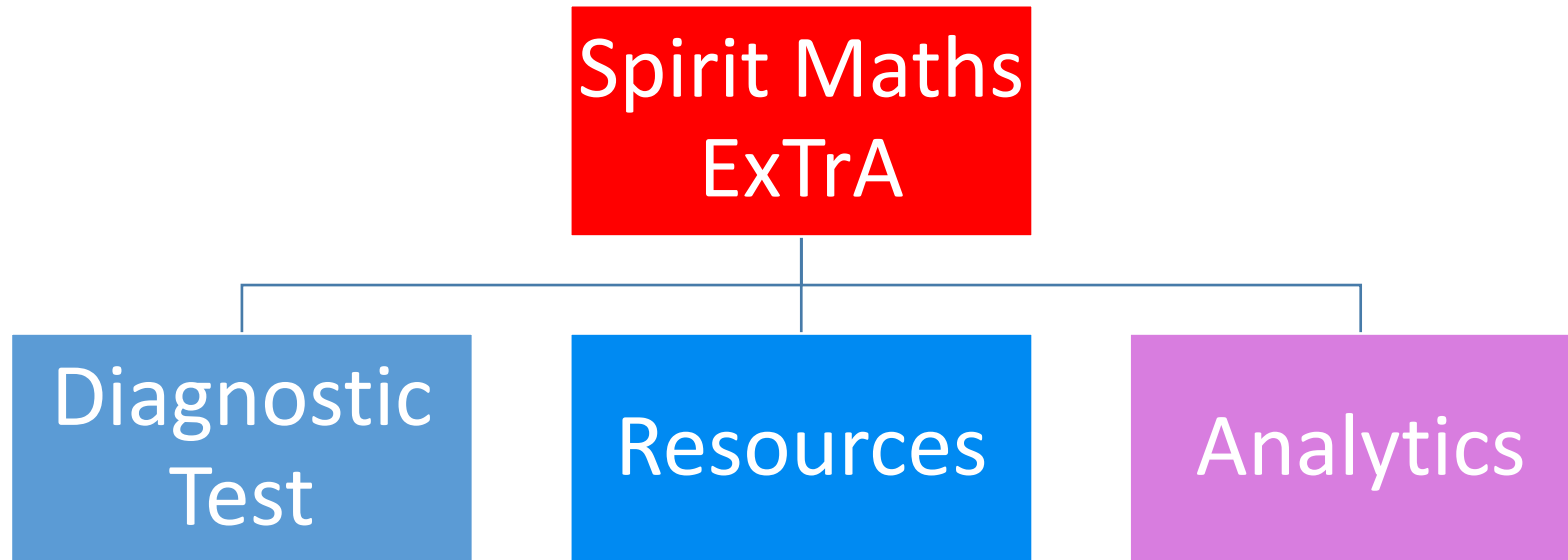
$A = P(1-i)^n \rightarrow$ age of asset (in months)

PRICE of the asset

monthly rate of depreciation

In this example,
$P = 17500$
$i = 1.2\% = 0.012$

Current value of asset (after n months)

Video

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SPIRIT Maths ExTrA Essential Toolkit Quiz

- **15 questions**
- **30 minutes to complete**
- **No calculator allowed**

➢ Accessed through **Maths Online** module on Canvas, a hub for all things maths-related at MTU.

➢ All first-year students that have a maths or stats module are automatically enrolled.

SPIRIT Maths ExTrA Essential Toolkit Quiz

➢ Based on core skills and knowledge.

➢ Helps students identify areas they need help with.

➢ Points them towards helpful resources.

➢ Invite the students to book a session in ALC

Feedback

Based on answering incorrectly
You might need some help with expanding products. If you would like some help with this, the Academic Learning Centre can help.

General Feedback
Academic Learning Centre

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9 1 point

Solve for a and b:

$$4a - 2b = 10$$
$$6a + 3b = 9$$

a= [type your answer...] and b= [type your answer...] .

---

10 1 point

To *factor* is to write a sum as a product. For example,

$$2x^2 + 9x - 5 = (x + 5) \cdot (2x - 1).$$

Factor $x^2 - x - 20$:

= [type your answer...]

---

11 1 point

(Without the use of a calculator) simplify the expression on the left, and hence find the value of p:

$$\frac{492^{84} \times 492^7}{492^{13}} = 492^p$$

p= [type your answer...] .

SPIRIT Maths ExTrA Essential Toolkit Quiz

1 | 1 point

Calculate, without the use of a calculator:

$$5 + 5 \times 4 - 6 \div 3$$

Type your answer...

2 | 1 point

Put the following numbers in order from smallest to largest:

1 ⠿ 0.847

2 ⠿ 0.31275

SPIRIT Maths ExTrA Essential Toolkit Quiz

Questions that students answer incorrectly have associated resources:

e.g. NUMBAS

Feedback

Based on answering incorrectly
You might need some help with simultaneous equations. Below find a resource to help you get up to speed on simultaneous equations.

General Feedback
Simultaneous Equations Tool

a)

Find the x and y values that satisfy both of the following equations.

$$y = 3 - 5x \qquad (1)$$
$$y = -4x \qquad (2)$$

$x = \boxed{}$, $y = \boxed{}$

Show steps *(Your score will not be affected.)*

Submit part

Score: 0/2
Unanswered

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SPIRIT Maths ExTrA Essential Toolkit Quiz

➢ The resources and the diagnostic test itself can be developed organically all the time.

➢ Diagnostic Test will go live in Semester 1 2022

➢ The quiz can also be imported into modules by lecturers in order to help them identify areas the class as a whole might need help with.

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SPIRIT Maths ExTrA Essential Toolkit Quiz

IMSLN tutorials:

SPIRIT Maths ExTrA Essential Toolkit Quiz

➢ Lecturers can import the quiz into a module and use Quiz Analytics on Canvas to see the areas that the class have issues with.

➢ Lecturers can initiate an intervention, be it in ordinary class time or perhaps in consultation with the Academic Learning Centre.
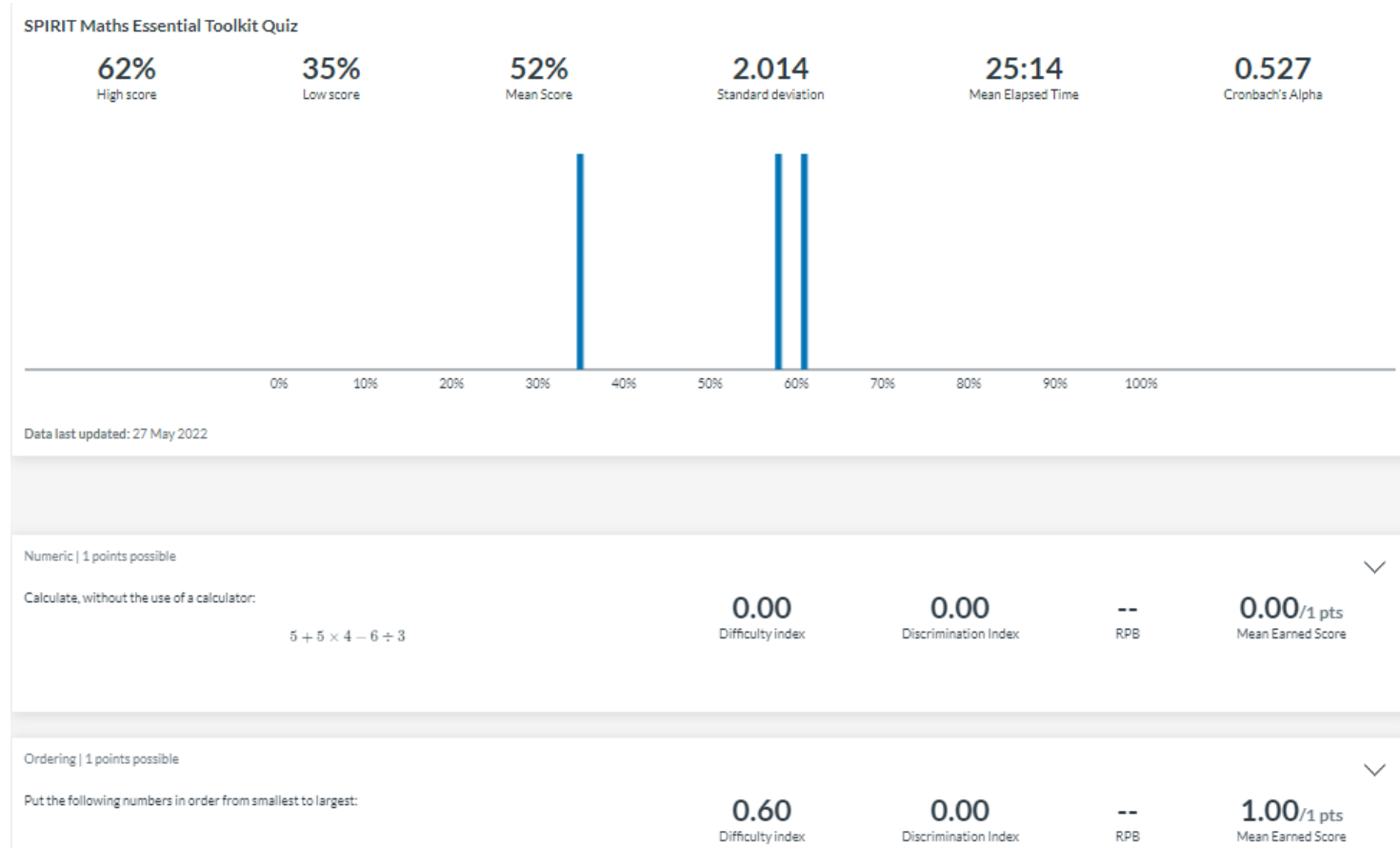
SPIRIT Maths ExTrA Resources – PILOT
MATH 6051 - Essential Maths and Stats for Business

- Department of Management and Marketing - MTU Cork

- 227 First Year Students in the 2021-2022 academic year

- 6 Academic Staff from Maths Department

❑ Canvas announcement with links sent out before reading week

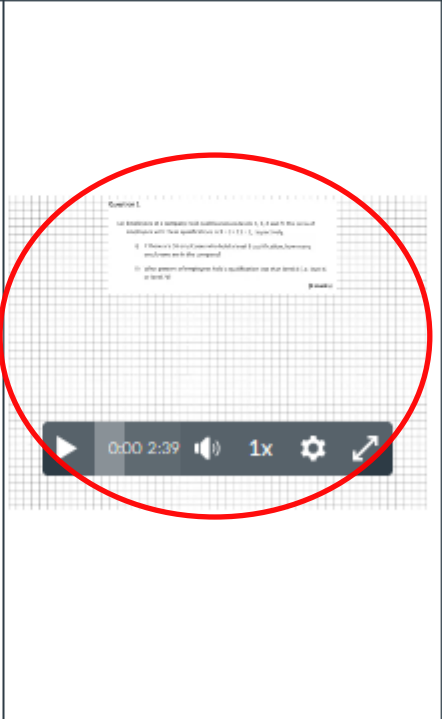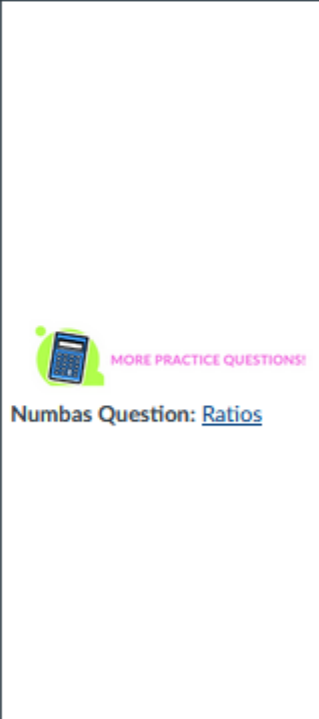❑ Lecturers gave an overview of the resources during class time

Videos

- For each part of the exam question, there is a video demonstrating how to solve the question.

- Videos created using Explain Everything.

- The videos are embedded in the web page, but can be viewed in full screen mode.

MATH6051 Past Paper Winter 2019 Q1

Instructions: The following materials consist of **exercise + worked example pairs**. You should begin by attempting the exercise yourself and if you are stuck then refer to the worked example video below it. Links to additional practice questions using Numbas are provided in the third column of the table.

Question	Video Solution	Link to a Similar Practice Question in Numbas
Q1 (a) Employees at a company hold qualifications in levels 6, 7, 8 and 9. The ratio of employees with these qualifications is 3:8:11:2, respectively. **(i)** If there are 36 employees who hold a level 9 qualification, how many employees are in the company? **(ii)** What percent of employees hold a qualification less than level 8 (i.e. level 6 or level 7)? (i) [_____] (ii) [_____] % ✔ Check	▶ 0:00 2:39 🔊 1x ⚙ ⤢	MORE PRACTICE QUESTIONS! Numbas Question: Ratios

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Measuring engagement with the resources for MATH6051

- ❑ 226 students in total

- ❑ 71 (31.4%) students used SPIRIT Maths resources

- ❑ 48 (21.2%) students used SPIRIT Maths **Numbas** resources

- ❑ 42 (18.6%) students used SPIRIT Maths **video** resources

- ❑ 19 (8.4%) students used **both** SPIRIT Maths Numbas and video resources

SPIRIT Maths ExTrA

MATH 6051 - Essential Maths and Stats for Business

n=226	Average Module Mark Semester 1 2021	Average LC Points **	Average Lecture Views *
MATH 6051 students that **USED** SPIRIT Maths resources	51.0	32.4	67.7
MATH 6051 students that **DID NOT USE** SPIRIT Maths resources	43.4	34.9	42.6

* **Lecture views are average views of the pre-recorded lectures on Canvas – 22 lectures in total**

** Leaving Cert Points Conversion

Measuring impact of resources for MATH 6051

❏ Response variable

- Students final grade for MATH 6051 (%)

- proxy for mathematics understanding

❏ Explanatory variables

- Students leaving certificate points

- Video lectures views

- Written notes views

- Exercise sheets views

- SPIRIT Maths Numbas grade

- SPIRIT Maths videos views

Linear Model

Variable	Coefficient Estimate	Standard Error	t-value	P-value
Points	0.677	0.082	8.209	<0.001
Lecture Videos	0.067	0.025	2.664	0.008
Notes	0.060	0.085	0.705	0.482
Exercises	0.138	0.091	1.511	0.133
SPIRIT Numbas	0.021	0.01	2.107	0.037
SPIRIT Videos	-0.030	0.289	-0.102	0.917

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www.spiritmaths.com

#spiritmaths

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