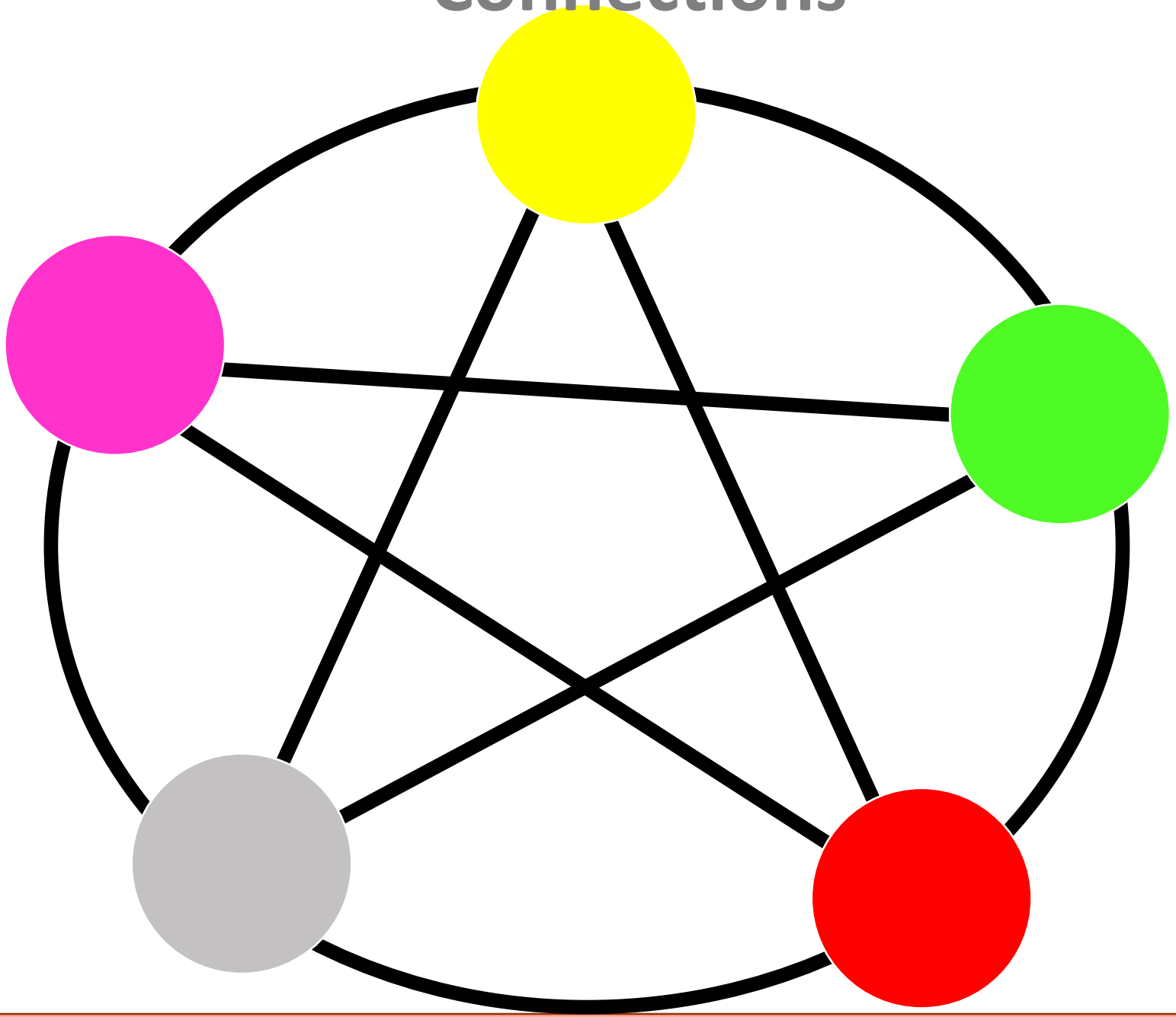
Connections

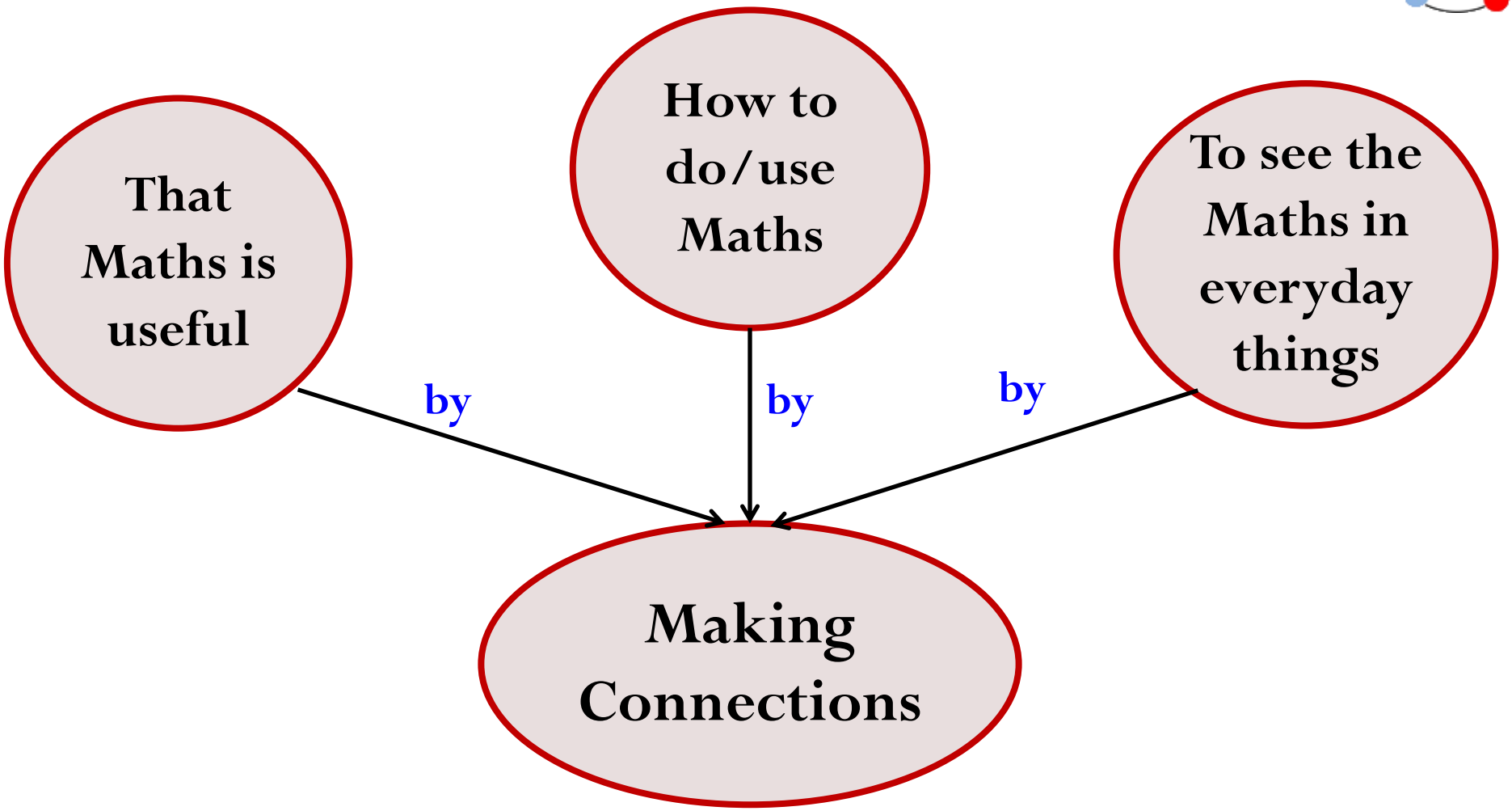


Purpose

The purpose of this section is:

- To identify the importance for Teaching & Learning of making connections
- To consider the types of connections it is beneficial to make
- To alert us as a community of educators to the importance of connecting with the school literacy and numeracy policy.

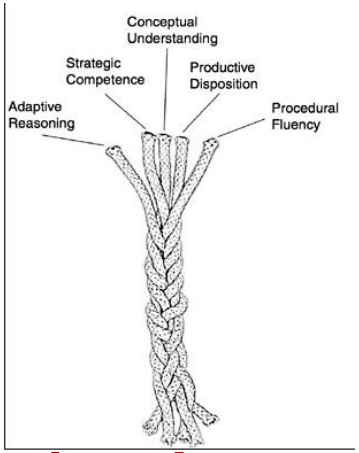
What should students learn in Maths at school



"It is essential to make connections in mathematics if one intends to develop mathematical understanding."

Hiebert and Carpenter (1992)

Mathematical understanding involves …



- knowing-*that* (stating)
- knowing-*how* (doing)
- knowing-*why* (explaining)
- knowing-*when* (applying)

Among the objectives of Junior Certificate Mathematics are to develop

•• *procedural fluency—skill in carrying out procedures flexibly, accurately, efficiently, and appropriately*

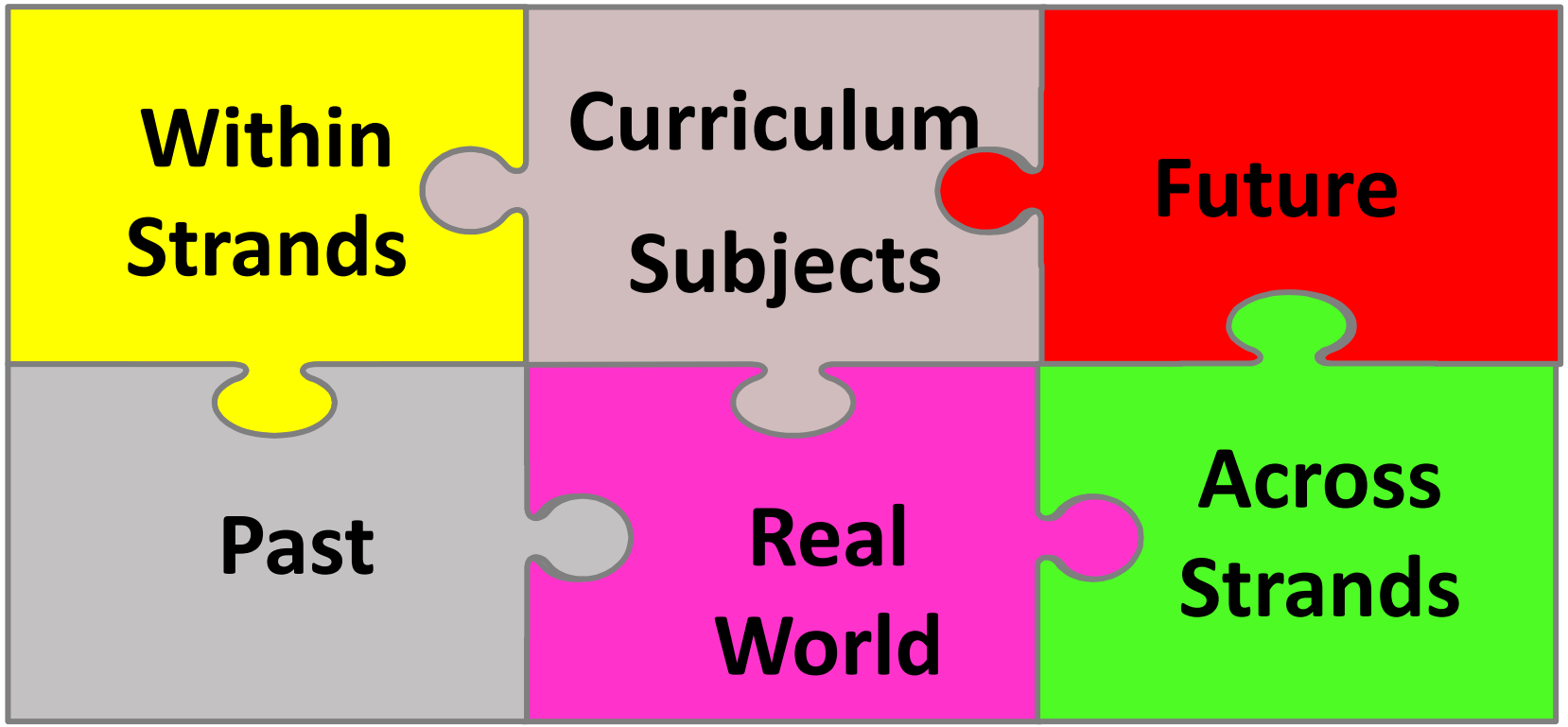
•• *adaptive reasoning—capacity for logical thought, reflection, explanation, justification and communication*

•• *strategic competence—ability to formulate, represent, and solve mathematical problems in both familiar and unfamiliar contexts*

To Make Connections in Mathematics

What does this mean for you?

Connections in Mathematics



Connections in Mathematics

Making connections is an important human activity.

"Seeking patterns and connections is the natural activity of the brain."

Caine &Caine 1990

Isolated pieces of information require more time to assimilate than learning experiences that are connected with a person's prior knowledge.

Connections in Mathematics

Past

Making the connection to this prior knowledge is valuable because it:

- assists students in relating ne… to what they alre…
- allows for the surfacing of misconceptions that may impede learning
- identifies gaps in knowledge or skills that may exist

Many lessons began with the good practice of reviewing previously covered material, reinforcing students' learning.

Connections in Mathematics

The History of Mathematics

"No subject loses more when divorced from its history than mathematics"

Bell E.T

Connections in Mathematics

Past

The History of Mathematics

- Humanises Mathematics
- Students' problems have been present in history
- Cultural links
- Foundation for better understanding
- Highlights interaction between mathematics & society

Connections in Mathematics

Without an explicit focus on connections, students may view their learning of mathematics as the accumulation of unrelated and discrete ideas.

"Mathematical learning is cumulative with work at each level building on and deepening what students have learned at the previous level to foster the overall development of understanding."

Junior Certificate Mathematics Syllabus

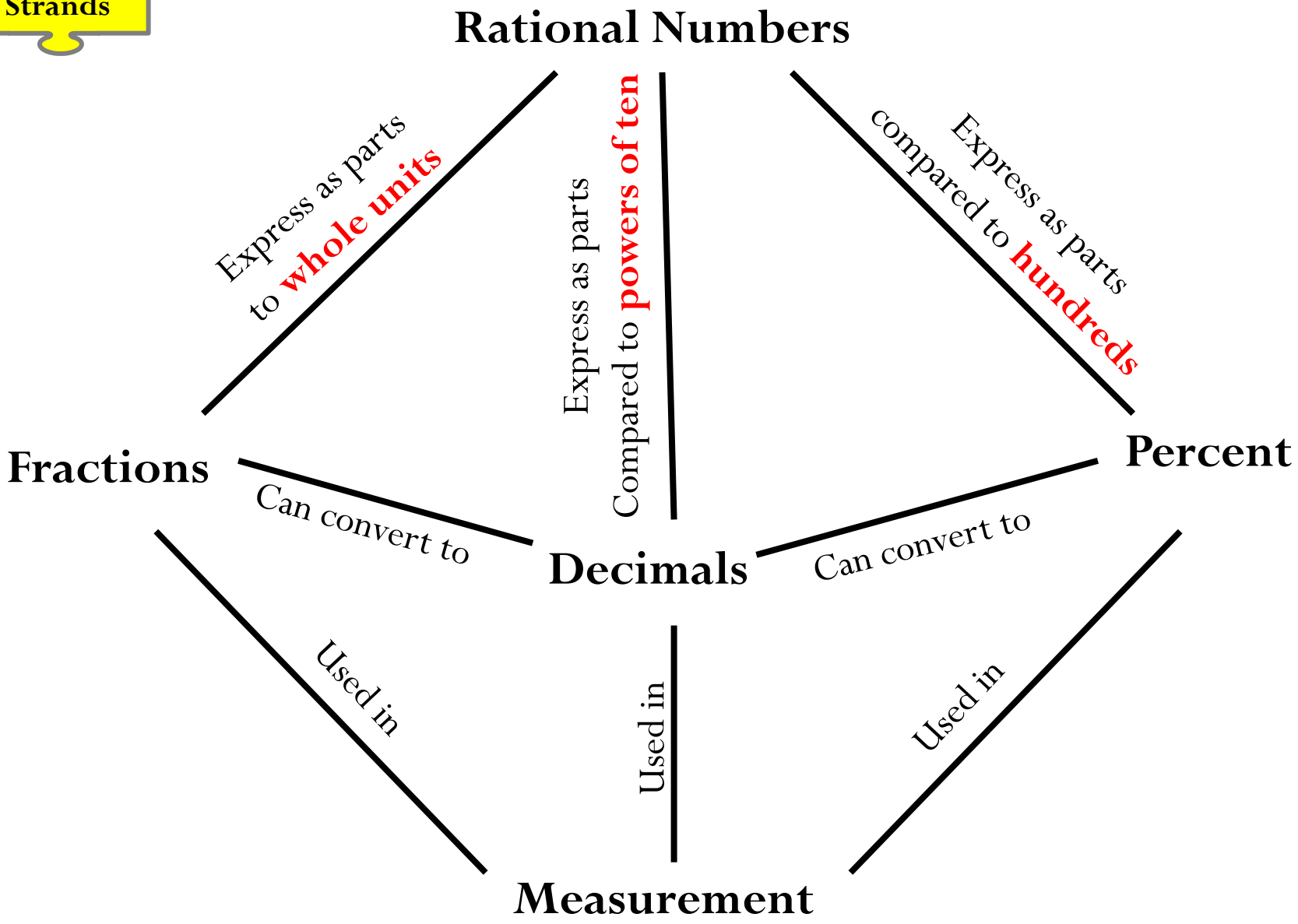
Connections in Mathematics

Within Strands

Connections that draw together key ideas and topics within a strand help students develop a more coherent understanding of the concept or process they are learning.

Connections in Mathematics

Within Strands



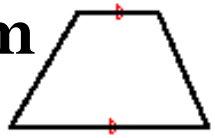
Connections in Mathematics

Within Strands

quadrilateral

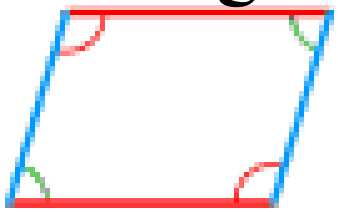
With one pair of sides parallel

Trapezium



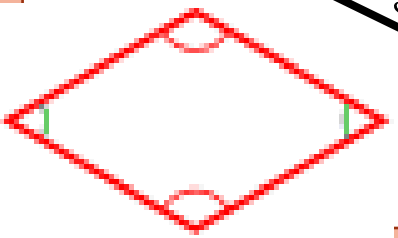
With opposite sides parallel

Parallelogram



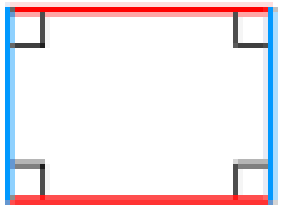
With all sides congruent

Rhombus



With all Angles congruent

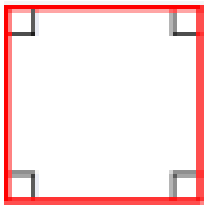
Rectangle



With all Angles congruent

With all sides congruent

Square



Connections in Mathematics

"To students, the typical curriculum presents an endless array of facts and skills that are unconnected, fragmented, and disjointed…"

Beane, 1991

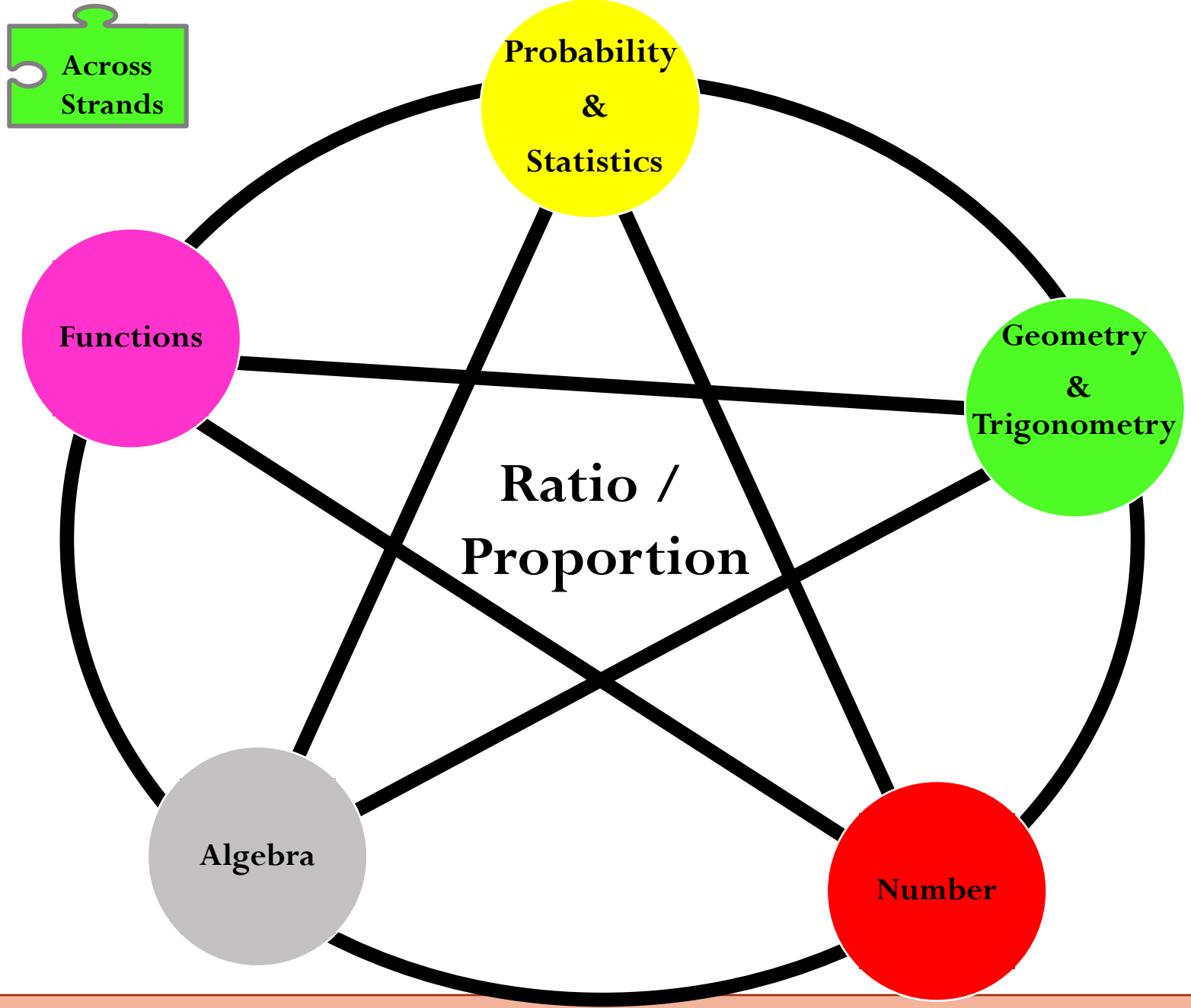
Connections in Mathematics

The strand structure of the syllabus should not be taken to imply that topics are to be studied in isolation.

Where appropriate, connections should be made within and across the strands and with other areas of learning."

Junior & Leaving Certificate Mathematics Syllabus

Connections in Mathematics



Connections in Mathematics

Ratio / Proportion

Connections in Mathematics

Ratio / Proportion

Trigonometry

All trig functions are ratios

Division

The ratio of 2 to 3 can be written as division relationships

Scale

The scale of a map is 2cm per 1km. We write this as the ratio 1:50 000

Probability

All probabilities can be expressed as ratios

Slope

The ratio of the rise to the run is ⅕

Comparisons

The ratio of sunny days to rainy days is greater in Dublin than in Dingle

Geometry

The ratio of the circumference of a circle to its diameter is always π

Unit Price

125g/€19.95. that is €39.90 for 250g or €159.60 per kg

Business

Profit and loss are figured as ratios of income to total cost

Any two similar figures have corresponding measurements that are proportional (in the same ratio)

Connections in Mathematics

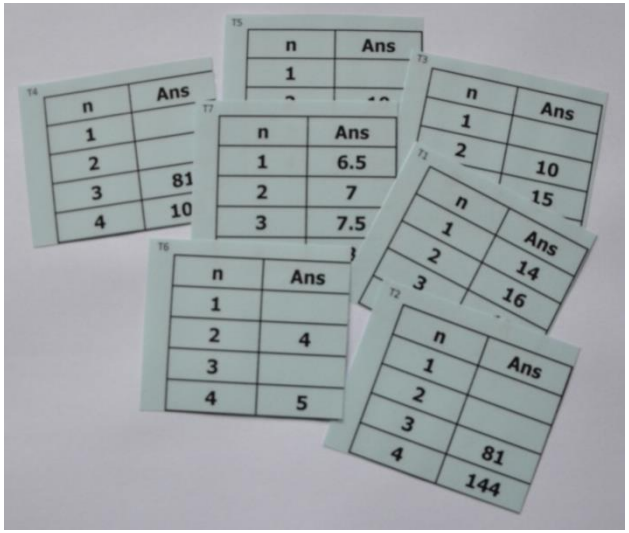
Across Strands

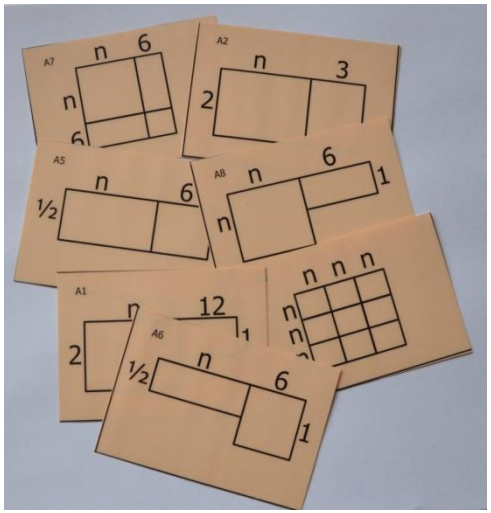
Connections to, and translations between, different representations of a concept are important cognitive processes which lead to a more robust understanding of concepts.

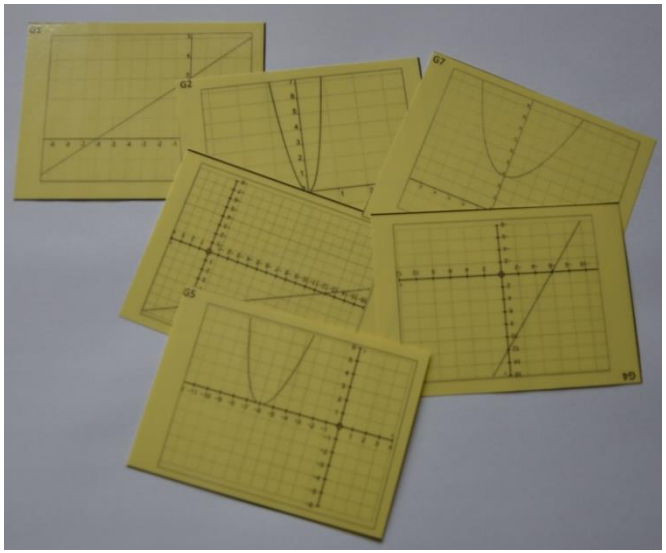
Connections in Mathematics

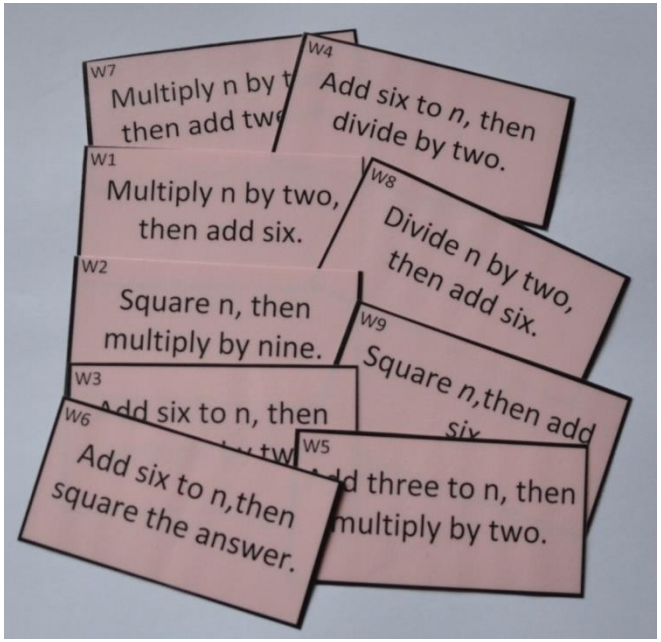
Connections in Mathematics

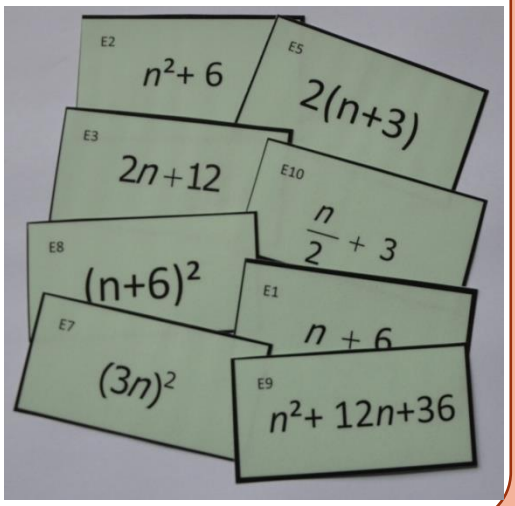
Across Strands



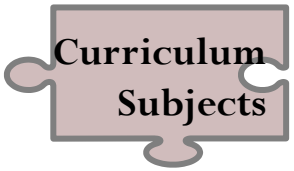








Connections in Mathematics



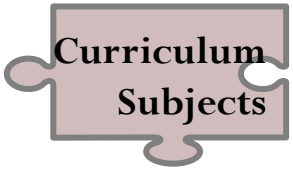
Mathematics is not learned in isolation. It has significant connections with other curriculum subjects.

Junior Certificate Syllabus

Science learners are expected to be able to work with data, produce graphs, and interpret patterns and trends.

In **Technical Graphics**, drawings are used in the analysis and solution of 2D and 3D problems through the rigorous application of geometric principles.

Connections in Mathematics



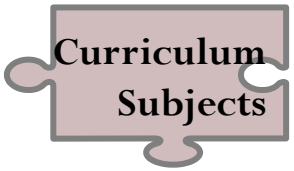
Mathematics is not learned in isolation. It has significant connections with other curriculum subjects.

Junior Certificate Syllabus

In **Geography**, learners use ratio to determine scale; graphs and statistics to analyse data

In **Home Economics** learners use mathematics when budgeting and making value for money judgements

Connections in Mathematics



Mathematics is not learned in isolation. It has significant connections with other curriculum subjects.

Junior Certificate Syllabus

In **Business Studies** learners see how mathematics can be used by business organisations in budgeting, consumer education, financial services, enterprise, and reporting on accounts.

In **Music** the graph of the sound wave of a tuning fork playing a note looks like a perfect sine wave.

Connections in Mathematics

Curriculum Subjects

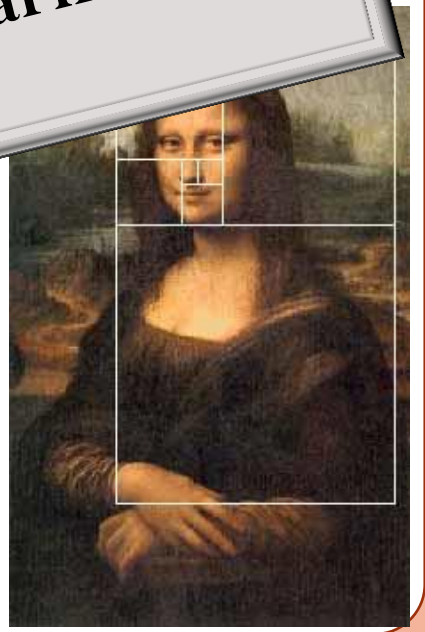
Mathematics is not learned in isolation. It has significant connections with other curriculum subjects.

llabus

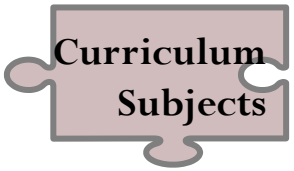
In **Art** techniques li

ratio a

In many instances, teachers and students frequently made cross-curricular links, demonstrating appropriately that mathematics is a series of interconnected themes rather than topics learnt in isolation.



Connections in Mathematics



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labus

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Curriculum Subjects

Connections in Mathematics

Accounting 2013 HL

Provide for depreciation on plant and machinery at the annual rate of 10% of cost from the date of purchase to the date of sale.

A provision for bad debts to be created equal to 4% of debtors.

The purchase price was discharged by granting the seller 380,000 shares at €1 each in Cooper Ltd at a premium of 20c per share.

On the same day goods were sold on credit to Galvin for €450. This was a mark-up on cost of 25%.

Kelly borrowed €72,000 on 1/7/2012, part of which was used to purchase an adjoining warehouse costing €60,000. It was agreed that the sum borrowed would be repaid in 12 equal instalments over a six year period commencing on the 1 January 2013. Interest was to be charged at the rate of 10% per annum and paid monthly.

Curriculum Subjects

Connections in Mathematics

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Curriculum Subjects

Connections in Mathematics

Accounting 2013 OL LC

Required:

(a) Prepare a statement showing Ryan's **Net Worth/Capital** on 01/01/2012. (30)

Ryan also supplied the following additional information on 31/12/2012:

(i) During the year €14,000 was transferred from a personal bank account to the business bank account.

(ii) During the year, Ryan had paid €6,400 out of business funds for private house repairs and had also taken goods to the value of €400 per month for private use.

Ryan estimated that on 31/12/2012 the business assets and liabilities were €960,000 and €80,000 respectively, before allowing for depreciation on furniture and equipment at the rate of 20% of cost, depreciation on motor vehicles at the rate of 10% of book value and before allowing for expenses due of €940.

(b) Prepare **a statement** showing Ryan's **Profit or Loss** for the year ended 31/12/2012. (30)

(60 marks)

Curriculum Subjects

Connections in Mathematics

Accounting 2013 OL LC

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Curriculum Subjects

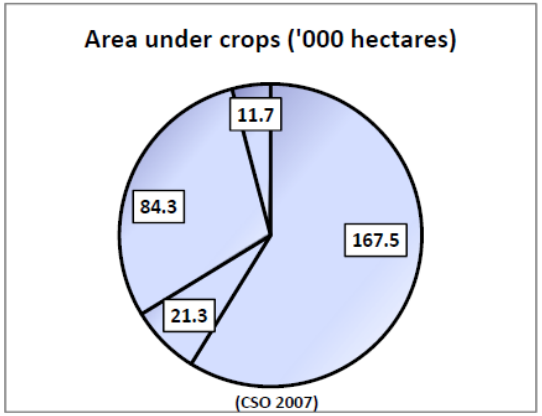
Connections in Mathematics

Agricultural Economics 2013 HL LC

In Ireland approximately 285,000 hectares of land is used for crop production. The pie chart on the right shows the number of hectares under each of the four main crop types. Complete the table below by filling in the number of hectares used for each crop type.

(one entry is completed for you)

Crop	Area ('000 hectares)
Barley	
Oats	
Potatoes	11.7
Wheat	



Using the above table construct a total product curve, placing the amount of fertilizer used on the horizontal x-axis and the crop yield on the vertical y-axis.

If a farm has a liquidity ratio of 0.67:1 and a net worth ratio of 0.66:1, which of the following best describes the financial position of the farm?

Write TRUE or FALSE after each of the following statements:

Real interest rates are nominal interest rates adjusted for inflation.
Nominal interest rates are real interest rates adjusted for inflation.
Real interest rates are negative if the inflation rate is less than nominal interest rates.

Calculate the **loan repayment capacity** of a farmer with a total annual income of €60,000 and annual family living expenses of €40,000 if the annual repayment on a €1,000 loan is €250.

Curriculum Subjects

Connections in Mathematics

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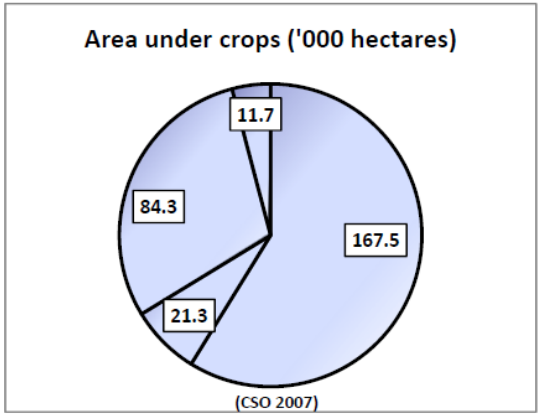

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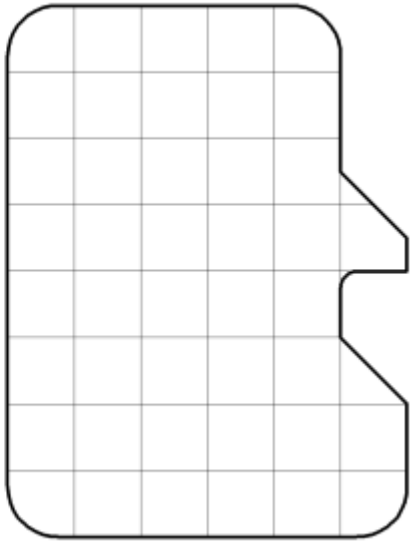
Curriculum Subjects

Technical Graphics 2013 JC OL

7. The outline of a memory card is shown.
Also shown is a 3D graphic of the card.



Write down the area of the memory card in square units.

1 square = 1 square unit.

Area of the card: _____ **square units**.

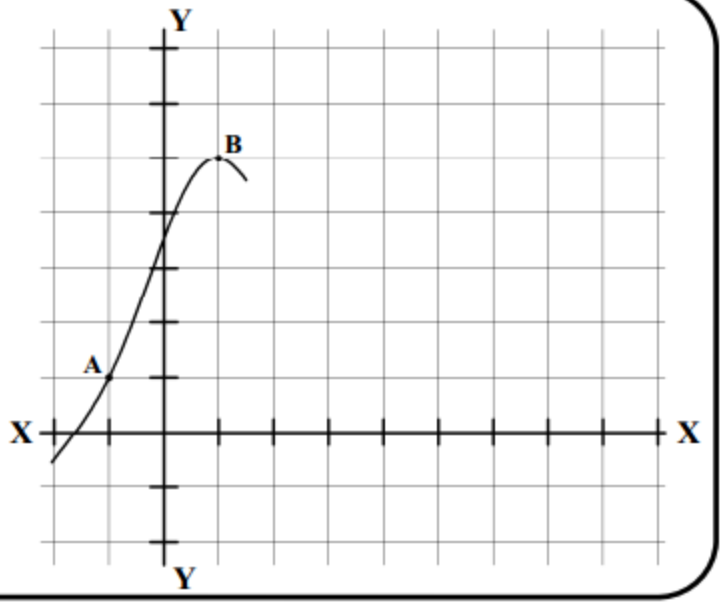
Curriculum Subjects

Technical Graphics 2013 JC HL

15. The **X** and **Y** axes shown are marked in single-unit intervals.

Complete the graph using the following coordinates:

A - (-1,1)
B - (1,5)
C - (3,2)
D - (5,0)
E - (6,1)
F - (8,6)



Curriculum Subjects

Business 2013 LC HL

Question 5

Audrey Stapleton is an employee at BAT Resources Ltd and earns a gross annual salary of €78,000. Her employer provides her with a holiday voucher worth €2,000. This is treated as a benefit-in-kind for tax purposes and is taxed accordingly.

The standard rate band for a single taxpayer is €32,800. (This means that the first €32,800 is taxed at the 20% standard tax rate, and the remainder is taxed at the higher tax rate of 41%.)

Audrey has the following tax credits: Single Person Tax Credit €1,650, PAYE Tax Credit €1,650 and Rent Tax Credit €320.

The Universal Social Charge (USC) rates on Audrey's gross income are 2% on the first €10,036, 4% on the next €5,980 and 7% on the balance of her gross income. Audrey pays employee PRSI at 4% of her gross income.

(A) Calculate Audrey Stapleton's net **monthly** take-home pay. (20 marks)

(B) Explain the different types of financial **and** non-financial rewards for employees in a business. (20 marks)

(C) **(i)** Outline **two** reasons why a household should prepare a cash flow forecast.

(ii) Illustrate how a household can overcome cash flow problems. (20 marks)

(60 marks)

Curriculum Subjects

Connections in Mathematics

Chemistry 2012 HL

Calculate, correct to two decimal places, the concentration of the hydrochloric acid solution in

(*i*) moles per litre,

(*ii*) grams per litre.

Loss of mass / g	0.00	0.10	0.18	0.29	0.35	0.39	0.41	0.41
Time / s	0	20	40	80	120	160	220	240

Plot a graph to show the mass of carbon dioxide produced (loss of mass) *versus* time. (12)

Use your graph to find the instantaneous rate of the reaction at 60 seconds in terms of g/s carbon dioxide produced. (6)

Mark clearly on your graph the curve you would expect to obtain if the reaction were repeated using 50 cm^3 of a 1 M solution of hydrochloric acid. Justify the shape and position of this curve relative to the graph you have plotted. (9)

Connections in Mathematics

Design & Communication Graphics 2013 HL

It is planned to package the cube, without the stand, in a plastic sphere. Determine the diameter of the smallest possible sphere that will contain the cube and draw that sphere in the end view.

2012 HL

A similar cam imparts this motion to a follower:

- 0° to 90° Rise 60mm with uniform velocity
- 90° to 180° Dwell
- 180° to 360° Fall 60mm with simple harmonic motion.

Draw the displacement diagram.

Note: *It is not necessary to draw the profile of the cam.*

Scale 1:1

Curriculum Subjects

Connections in Mathematics

Economics 2012 HL

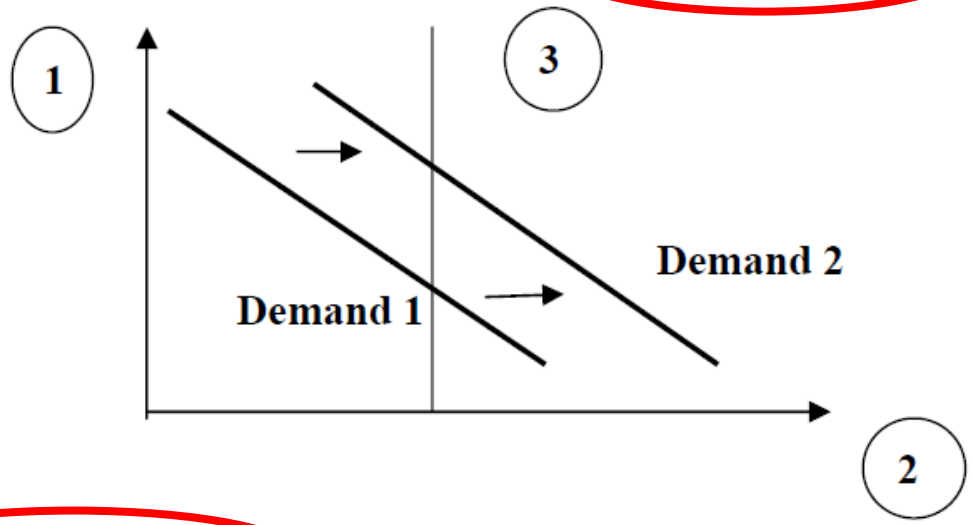
The formula for measuring Price Elasticity of Demand is as follows:

$$\frac{\Delta Q}{\Delta P} \times \frac{P_1 + P_2}{Q_1 + Q_2}$$

Complete the following table to indicate what each of the above symbols stands for:

ΔQ	Change in the quantity demanded of the good.
ΔP	

Assume the demand for these match tickets shifts to the right as shown below.

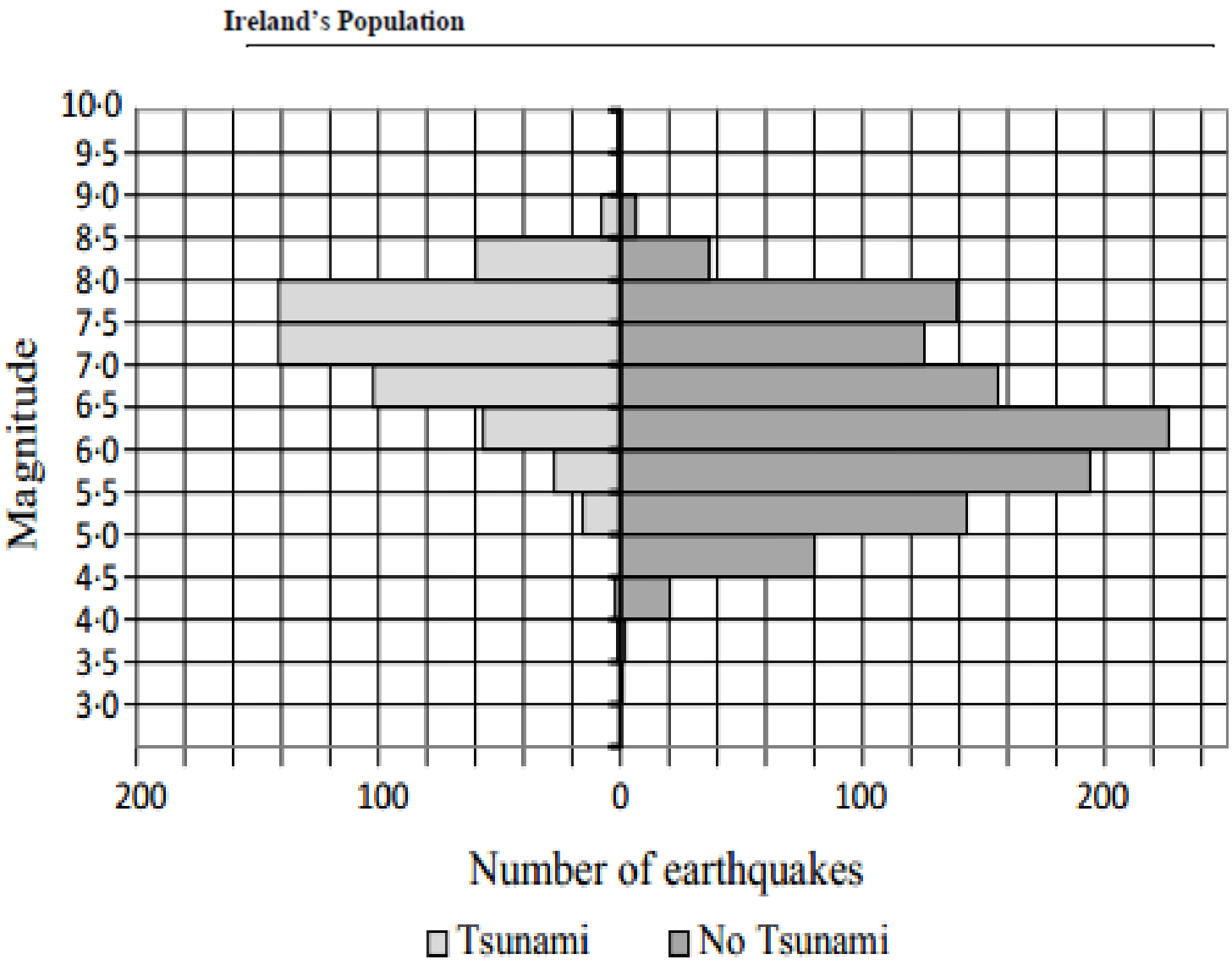


(i) State and explain **two** possible reasons why the demand curve for these tickets may shift to the right as illustrated above.

Curriculum Subjects

Connections in Mathematics

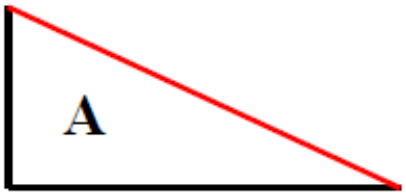
Mathematics 2011 paper 2 LCHL Q7

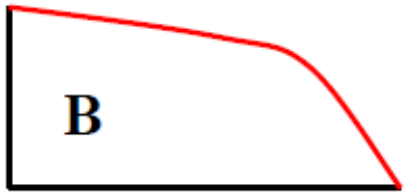


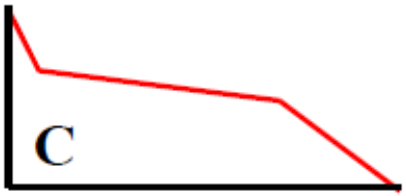
Connections in Mathematics

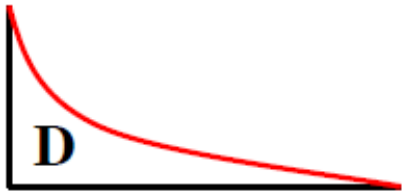
10 Slope Types

Match each of the following slope types with its correct letter in the diagram









Concave Slope	
Convex Slope	
Stepped Slope	
Even Slope	

Curriculum Subjects

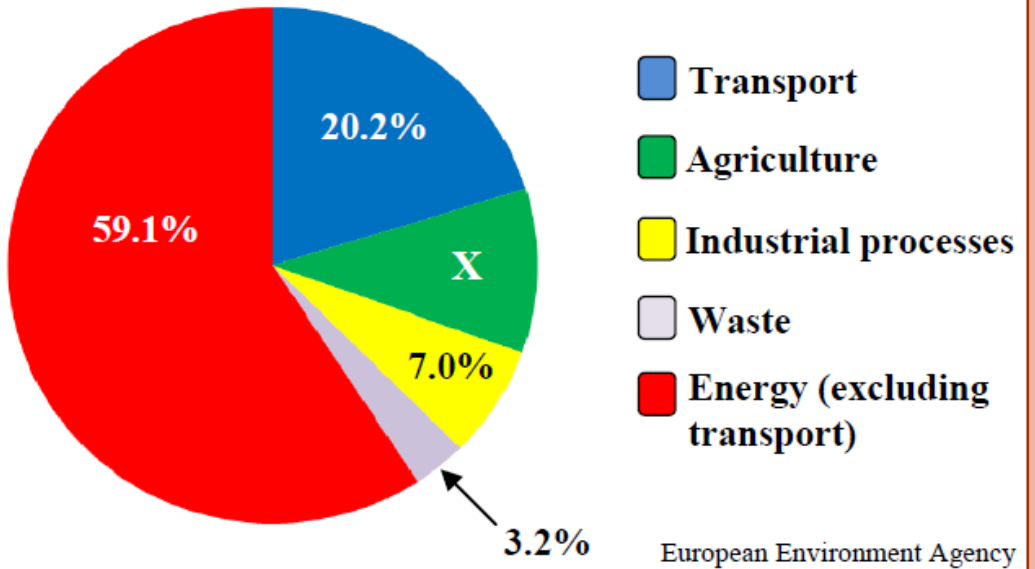
Connections in Mathematics

Geography 2012 LC HL

Total CO_2 (Greenhouse Gas) Emissions, 2009	
Region	**CO_2 Emissions** (million metric tons)
Africa	1,056
North America	6,954
Middle East	1,505
Asia and Oceania	11,219
Central & South America	1,384
Europe	4,720
Total	26,838

SAGE

Greenhouse Gas Emissions by Source Sector in Europe in 2009



European Environment Agency

Examine the information above and answer the following questions.

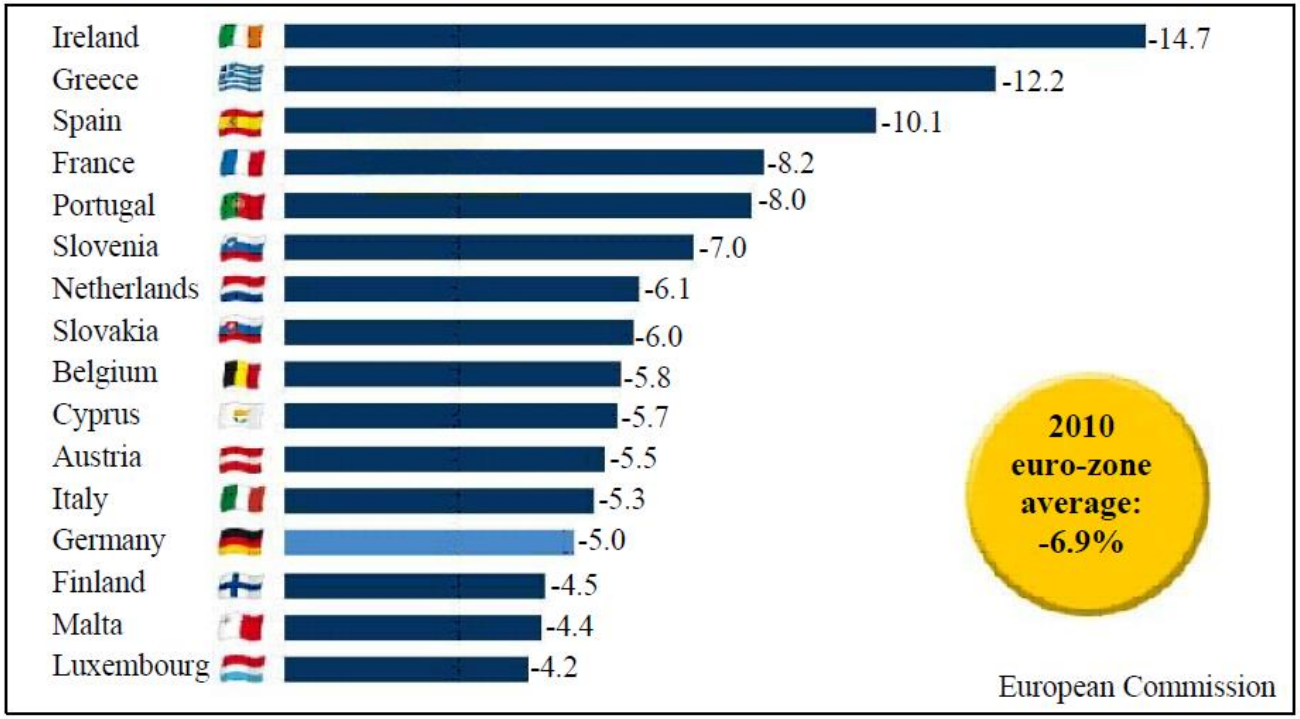
(i) Which region had the highest CO_2 (greenhouse gas) emissions and which region had the lowest CO_2 (greenhouse gas) emissions in 2009?

(ii) Calculate **X**, the percentage of greenhouse gas emissions generated by agriculture in Europe in 2009.

Connections in Mathematics

Geography 2012 LC HL

Budget deficits (as a percentage of gross domestic product) of euro-zone countries in 2010



Examine the graph above and answer the following questions.

(i) How many euro-zone countries had a budget deficit greater than the euro-zone average in 2010?

(ii) What was the difference in the budget deficit (as a percentage of gross domestic product) between Ireland and Austria in 2010?

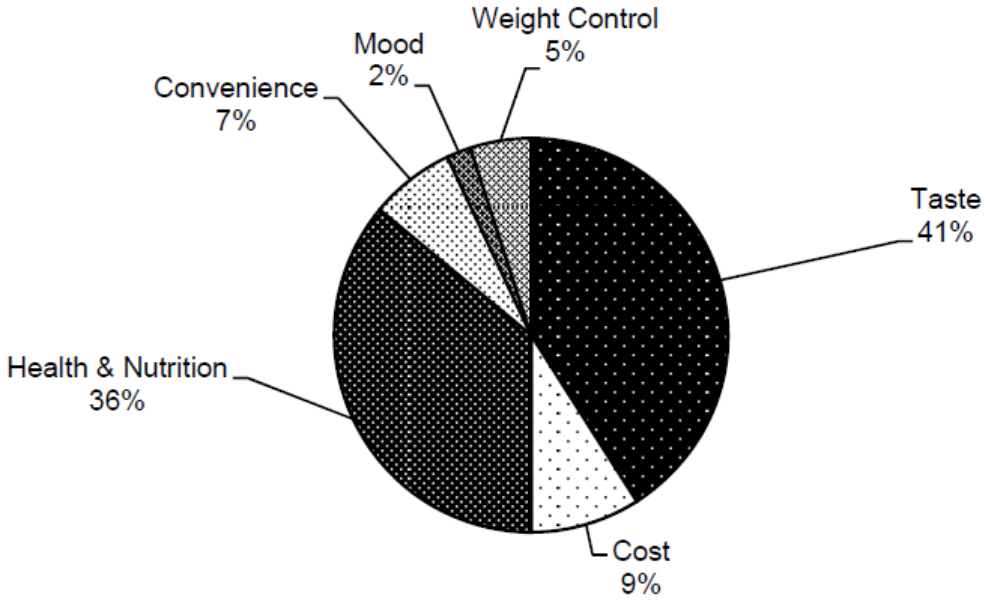
Connections in Mathematics

Home Economics Scientific & Social 2012 HL

	2006	2007	2008	2009	2010	2011
Unemployment rates in Ireland	4.4%	4.5%	6.4%	11.8%	13.7%	14.2%

(Seasonally adjusted standardised unemployment rates. Central Statistics Office)

(i) Having regard to the information provided above, discuss unemployment in Ireland.



Connections in Mathematics

Physics 2012 HL

In an experiment to investigate the variation of the fundamental frequency f of a stretched string with its length l, the following data were recorded.

f/Hz	95	102	114	126	141	165	194	232
l/m	0.603	0.553	0.503	0.453	0.403	0.353	0.303	0.253

Using the data, draw a suitable graph on graph paper to show the relationship between the fundamental frequency of the stretched string and its length.

Cork and Sligo are about 330 km apart by road. Using the map of Ireland shown on page 4, estimate the displacement of Sligo from Cork. The scale of the map is 1 cm to 37.5 km.

The European aerospace group EADS is developing a hypersonic jet aircraft that will fly at four times the speed of sound, 330 m s^{-1}. Express the speed of the aircraft in kilometre per hour.

(radius of earth $= 6.36 \times 10^6$ m; mass of earth $= 5.97 \times 10^{24}$ kg)

Explain the shape of your graph.

Curriculum Subjects

Connections in Mathematics

Physics 2012 OL

The following table shows the values recorded for the current I and the corresponding potential difference V during the experiment.

V/V	0	1.0	2.0	3.0	4.0	5.0	6.0
I/A	0	0.4	0.8	1.2	1.6	2.0	2.4

Using the data in the table, draw a graph on graph paper to show the variation of current with potential difference.

Calculate the slope of your graph.

A plug is used to connect an electrical appliance in the home to the 230 volt mains supply. Modern plugs contain a small fuse which comes with a rating of 1A, 2A, 3A, 5A or 13A. The electrical energy supplied to the home is measured in kW h (*kilowatt-hour*).

If the vacuum cleaner is used for 90 minutes, calculate

(vii) the number of units of electricity used;

(viii) the cost of the energy used if the price of each unit of electricity is 22 cent.

Curriculum Subjects

Connections in Mathematics

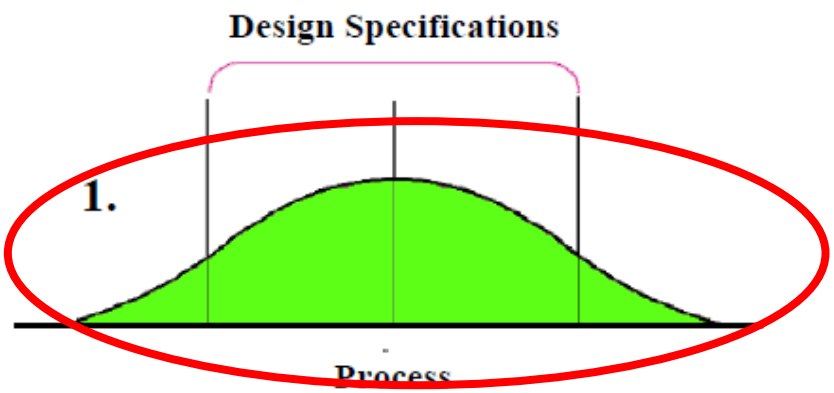
Technology 2012 HL

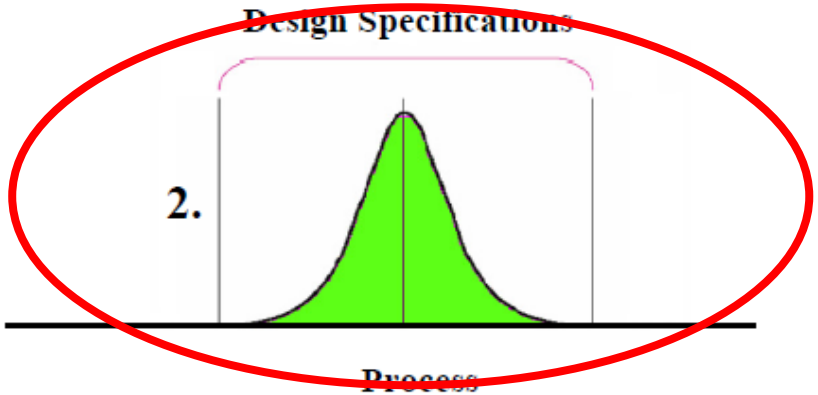
Calculate the *Process Capability Index* for each manufacturer

where $C_p = \dfrac{\textit{Tolerance Range}}{6\sigma}$

Which manufacturer should be chosen so that the bearings will always meet design specifications? Give **one** reason for your answer.

Identify the graph which best represents the Process Capability of **each** manufacturer.





(a) Draw a graph to show the costs of each method of engraving the medals.

(b) Determine the **BEQ** from the graph or otherwise.

Curriculum Subjects

Connections in Mathematics

Technology 2013 HL

Day	July 11th	July 12th	July 13th	July 14th	July 15th	July 18th	July 19th
No. of defects	10	8	11	10	9	10	12

(i) For the data above and assuming $\sigma = 1.29$, calculate the following:

- The mean of the process
- The UCL
- The LCL.

(ii) Draw a suitable control chart for the above data.

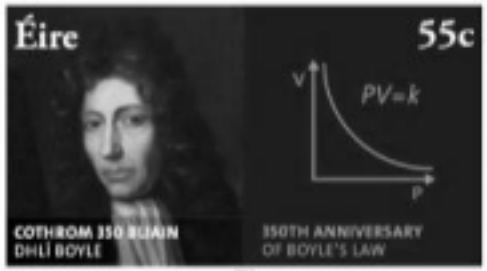
(iii) Interpret the control chart drawn at (ii) above and comment on the control state of the process.

Curriculum Subjects

Connections in Mathematics

Chemistry 2013 LC HL

5. (*a*) The 350th anniversary of Robert Boyle's discovery of the relationship between the pressure and the volume of a fixed mass of gas at constant temperature is commemorated in this Irish stamp issued in 2012.



Boyle also contributed to the development of the use of the term *element* in Chemistry.

What was his understanding of this term? (5)

(*b*) Use Bohr's atomic theory of 1913 to account for the emission spectrum of the hydrogen atom. (15)

Explain, in terms of atomic structure, why different flame colours are observed in flame tests using salts of different metals. (6)

What colour is observed in a flame test on lithium chloride?

Describe the testing procedure. (9)

(*c*) Further research and scientific discoveries, including Heisenberg's uncertainty principle (1927), led to significant modification of Bohr's original atomic structure theory of 1913.

Explain the underlined term.

Give **one** other factor that also contributed to the need for modification of Bohr's 1913 theory.

These modifications included the introduction of the idea of atomic orbitals.
What is an *atomic orbital*? (15)

Connections in Mathematics

Curriculum Subjects

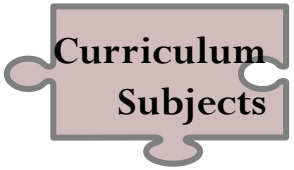
Numeracy encompasses the ability to use mathematical understanding and skills to solve problems and meet the dem of day-to-day living in complex social settings. T a young person needs to be ab e quantitatively, to m o und ise situations w pplied to solve problems.

Discussion at department meetings should take place to identify and develop agreed approaches to the teaching of common procedures in Mathematics.

Lite ludes the capacity to read, understand and critically appreciate various forms of communication including spoken language, printed text, broadcast media, and digital media.

LITERACY AND NUMERACY FOR LEARNING AND LIFE The National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020

Connections in Mathematics

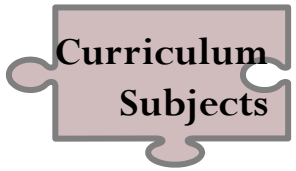


Numeracy encompasses the ability to use mathematical understanding and skills to solve problems and meet the demands of day-to-day living in complex social settings. To have this ability, a young person needs to be able to think and communicate quantitatively, to make sense of data, to have a spatial awareness, to understand patterns and sequences, and to recognise situations where mathematical reasoning can be applied to solve problems.

Literacy includes the capacity to read, understand and critically appreciate various forms of communication including spoken language, printed text, broadcast media, and digital media.

LITERACY AND NUMERACY FOR LEARNING AND LIFE The National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020

Connections in Mathematics



Vocabulary Difficulties

Are you a mean teacher if you do not tell your students what the mean means?

I am right when I say, in your right hand you are holding a right angle

On foot of measuring the man's foot I know that it is a foot long.

Connections in Mathematics

Curriculum Subjects

Vocabulary Difficulties

Are you a m nts what the mean means

I am right w ing a right angle

On foot of r a foot long.

IT SAID PUT IT IN THE OVEN AT 130 DEGREES

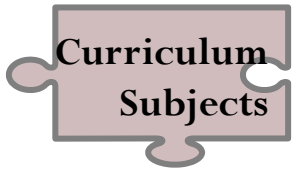
Connections in Mathematics

Curriculum Subjects

Vocabulary Difficulties

Category of difficulty	Examples
Some words are shared by mathematics and everyday English, but have different meanings in the two contexts	Right angle versus right answer Right angle versus right hand Reflection as flipping over a line versus reflection as thinking about something Foot as twelve inches versus the foot of a leg
Some mathematical words are shared with English and have comparable meanings, but the mathematical meaning is more precise	Difference as the answer to subtraction versus difference as a general comparison Even as divisible by two versus even as smooth
Some mathematical terms are found only in mathematical contexts	Quotient, decimal, denominator, quadrilateral, parallelogram,isoceles

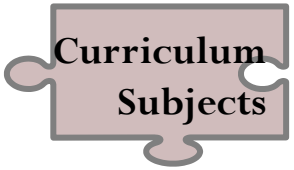
Connections in Mathematics



Vocabulary Difficulties

Category of difficulty	Examples
Some words have more than one mathematical meaning	Round as a circle versus to round an answer Square as a shape versus square as a number times itself Second as a measure of time versus second as a location in a set of ordered items Side of a rectangle as a line segment versus side of a prism as a rectangle

Connections in Mathematics



Vocabulary Difficulties

Category of difficulty	Examples
Some mathematical terms are homonyms with everyday English words	Sum versus some Arc versus ark Pi versus pie Graphed versus graft
Some mathematical words are related but students may confuse their distinct meanings	Factor and multiple, hundreds and hundredths, numerator and denominator
Some mathematical concepts are verbalised in more than one way	Skip count by threes versus say the multiples of three One quarter versus one fourth Cubed root versus third root Squared versus power of two

Connections in Mathematics

Curriculum Subjects

Vocabulary Difficulties

Category of difficulty	
Student may adopt an infor… as if it …	

The literacy needs of the students were met through the use of key words and judicious use of graphical material. In one instance, students were encouraged to formulate their own questions. This innovative approach meant that students developed both their communication skills and their understanding of the lesson content.

Connections in Mathematics

Curriculum Subjects

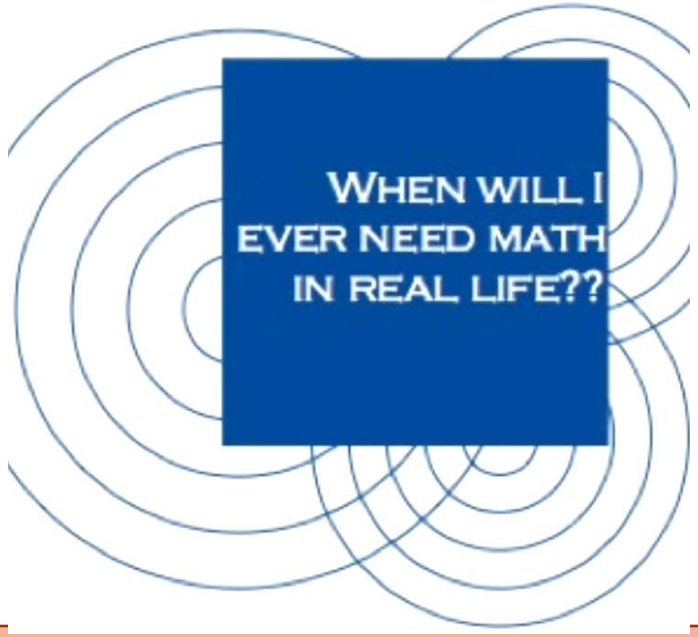
Vocabulary Difficulties

Category of difficulty	Examples
Student may adopt an informal term as if it is a mathematical term	Diamond for rhombus Corner for vertex
English spelling and usage has many irregularities	Four has a u but forty does not Fraction denominators such as sixth, fifth, fourth, third are like ordinal numbers but rather than second the next fraction is half

Connections in Mathematics

"Mathematical knowledge and understanding would be enhanced and become more coherent for learners if they could establish connections between the 'networks' of out-of-school experiences and those of in-school mathematics"

Carraher et al, 1985, 1987

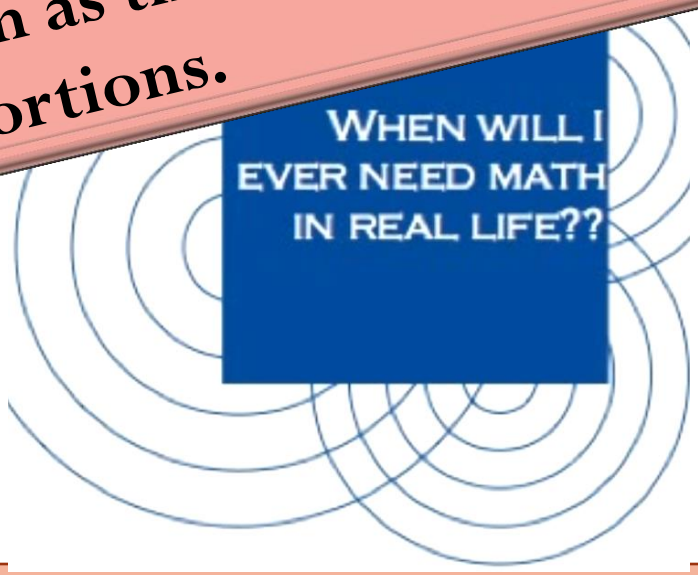


Connections in Mathematics

"Mathematical knowledge and understanding would be enhanced and become more coherent for learners if they could establish connections between the [illegible] out-of-school experiences [illegible] mathematics"

Carraher et al, 1985, 1987

Equally effective was the setting of Mathematics in real-life context such as the use of a cooking recipe to teach ratio and proportions.



Connections in Mathematics

"In each strand, and at each syllabus level, emphasis should be placed on making connections between the strands and on appropriate contexts and applications of mathematics so that learners can appreciate its relevance to current and future life."

Junior Certificate Syllabus

Review

- Identified the importance for Teaching & Learning of making connections
- Considered the types of connections it is beneficial to make
- Alerted ourselves as educators to the importance of connecting with the school literacy and numeracy policy.

Connections in Mathematics

Conclusion