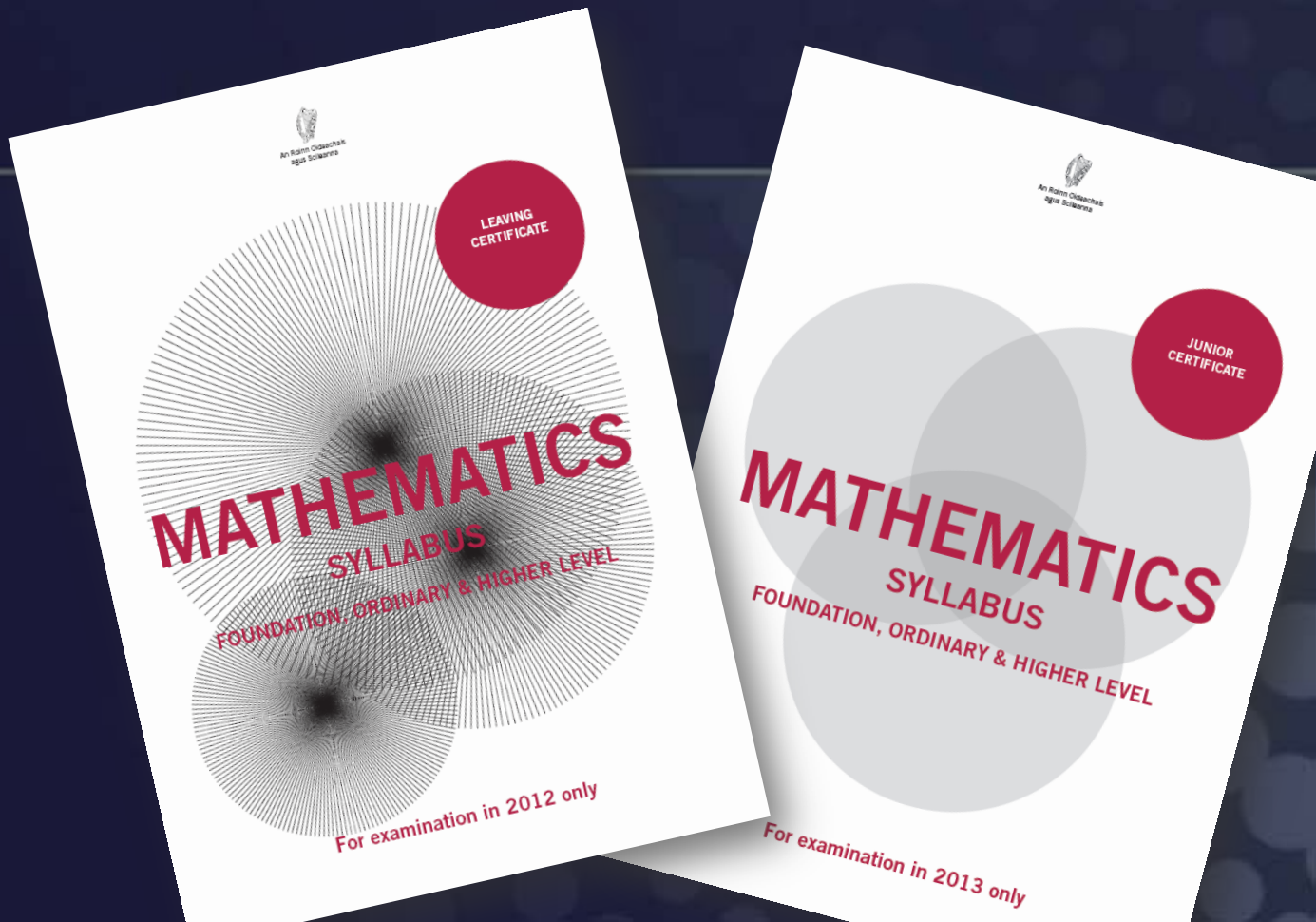
Syllabus & Resources



Junior Certificate Syllabus

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Leaving Certificate Syllabus

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Junior Cert Strand 1 Probability

Topic	Description of topic Students learn about	Learning outcomes Students should be able to
1.1 Counting	Listing outcomes of experiments in a systematic way.	– list all possible outcomes of an experiment – apply the fundamental principle of counting
1.2 Concepts of probability	The probability of an event occurring: student progress from informal to formal descriptions of probability. Predicting and determining probabilities. Difference between experimental and theoretical probability.	– decide whether an everyday event is likely or unlikely to occur – recognise that probability is a measure on a scale of 0-1 of how likely an event is to occur **– use set theory to discuss experiments, outcomes, sample spaces** – use the language of probability to discuss events, including those with equally likely outcomes – estimate probabilities from experimental data – recognise that, if an experiment is repeated, there will be different outcomes and that increasing the number of times an experiment is repeated generally leads to better estimates of probability – associate the probability of an event with its long-run, relative frequency
1.3 Outcomes of simple random processes	Finding the probability of equally likely outcomes.	– apply the principle that, in the case of equally likely outcomes, the probability is given by the number of outcomes of interest divided by the total number of outcomes (examples using coins, dice, spinners, urns with different coloured objects, playing cards, etc.) **– use binary / counting methods to solve problems involving successive random events where only two possible outcomes apply to each event**

T & Ls 1, 2, 4, 5

Student's CD

Leaving Cert Strand 1 Probability

Students learn about	Students working at FL should be able to	In addition, students working at OL should be able to	In addition, students working at HL should be able to
1.1 Counting	– list outcomes of an experiment – apply the fundamental principle of counting	– count the arrangements of n distinct objects ($n!$) – count the number of ways of arranging r objects from n distinct objects	– count the number of ways of selecting r objects from n distinct objects
1.2 Concepts of probability	– decide whether an everyday event is likely or unlikely to happen – recognise that probability is a measure on a scale of 0-1 of how likely an event is to occur – connect with set theory; discuss experiments, outcomes, sample spaces – use the language of probability to discuss events, including those with equally likely outcomes – estimate probabilities from experimental data – recognise that, if an experiment is repeated, there will be different outcomes and that increasing the number of times an experiment is repeated generally leads to better estimates of probability – associate the probability of an event with its long run relative frequency	– discuss basic rules of probability (AND/ OR, mutually exclusive) through the use of Venn Diagrams – calculate expected value and understand that this does not need to be one of the outcomes – recognise the role of expected value in decision making and explore the issue of fair games	– extend their understanding of the basic rules of probability (AND/ OR, mutually exclusive) through the use of formulae • Addition Rule: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ • Multiplication Rule (Independent Events): $P(A \cap B) = P(A) \times P(B)$ • Multiplication Rule (General Case): $P(A \cap B) = P(A) \times P(B \mid A)$ – solve problems involving conditional probability in a systematic way – appreciate that in general $P(A \mid B) \neq P(B \mid A)$ – examine the implications of $P(A \mid B) \neq P(B \mid A)$ in context

T & Ls 1, 2, 3, 4, 5

Student's CD

Leaving Cert Strand 1 Probability cont.

Students learn about	Students working at FL should be able to	In addition, students working at OL should be able to	In addition, students working at HL should be able to
1.3 Outcomes of random processes	– construct sample spaces to show all possible outcomes for two independent events – apply the principle that in the case of equally likely outcomes the probability is given by the number of outcomes of interest divided by the total number of outcomes (examples using coins, dice, spinners, urns with coloured objects, playing cards etc.)	– find the probability that two independent events both occur – apply an understanding of Bernoulli trials* – solve problems involving up to 3 Bernoulli trials – calculate the probability that the 1st success occurs on the n^{th} Bernoulli trial where n is specified	– solve problems involving calculating the probability of k successes in n repeated Bernoulli trials (normal approximation not required) – calculate the probability that the k^{th} success occurs on the n^{th} Bernoulli trial – use simulations to explore the variability of sample statistics from a known population and to construct sampling distributions – solve problems involving reading probabilities from the normal distribution tables

T & Ls 2, 3, 4, 5

Student's CD

Probability

- Teaching & Learning Plans
- Student's CD
- Handbooks

All available on projectmaths.ie

- Student Resources

Available on ncca.ie/projectmaths

- Content Course Modules 3, 4 & 5

JUNIOR CERTIFICATE

1. Probability Scale
2. Relative Frequency
3. Fundamental Principle of Counting
4. Outcomes of simple random processes
5. Basic set theory (HL)
6. Equally likely outcomes
7. Single Events questions
8. Multiple event questions
9. Tree Diagrams (HL)

LEAVING CERTIFICATE

1. All Junior Certificate Content
2. Arrangements and Selections
3. Set theory
4. Conditional Probability
5. Expected Value
6. Bernoulli Trials
7. Normal Distribution
8. Empirical Rule
9. Standard Normal Distribution (HL)
10. Standard Scores (z values) (HL)
11. Hypothesis Testing using Margin of Error (HL)

Junior Cert Strand 1 Statistics

Topic	Description of topic Students learn about	Learning outcomes Students should be able to
1.4 Statistical reasoning with an aim to becoming a statistically aware consumer	The use of statistics to gather information from a selection of the population with the intention of making generalisations about the whole population. They consider situations where statistics are misused and learn to evaluate the reliability and quality of data and data sources.	– engage in discussions about the purpose of statistics and recognise misconceptions and misuses of statistics – work with different types of data (categorical/ numerical/ordinal discrete/continuous) in order to clarify the problem at hand **– evaluate reliability of data and data sources**
1.5 Finding, collecting and organising data	Formulating a statistics question based on data that vary allows for distinction between different types of data.	– clarify the problem at hand – formulate one (or more) questions that can be answered with data – explore different ways of collecting data – generate data, or source data from other sources including the internet **– select a sample (Simple Random Sample)** **– recognise the importance of representativeness so as to avoid biased samples** – design a plan and collect data on the basis of above knowledge – summarise data in diagrammatic form including spread sheets

Data Handling Cycle

Junior Cert Strand 1 Statistics cont.

Topic	Description of topic Students learn about	Learning outcomes Students should be able to
1.6 Representing data graphically and numerically	Methods of representing data. Students develop a sense that data can convey information and that organising data in different ways can help clarify what the data have to tell us. They see a data set as a whole and so are able to use fractions, quartiles and median to describe the data. **Mean of a grouped frequency distribution.**	Graphical – select appropriate graphical or numerical methods to describe the sample (univariate data only) – evaluate the effectiveness of different displays in representing the findings of a statistical investigation conducted by others – use pie charts, bar charts, line plots, histograms (equal intervals), stem and leaf plots to display data **– use back-to-back stem and leaf plots to compare data sets** Numerical – use a variety of summary statistics to analyse the data: central tendency – mean, median, mode variability – range **– use stem plots to calculate quartiles and inter-quartile range**
1.7 Analysing, interpreting and drawing conclusions from data	Drawing conclusions from data; limitations of conclusions.	– interpret graphical summaries of data – relate the interpretation to the original question **– recognise how sampling variability influences the use of sample information to make statements about the population** **– draw conclusions from graphical and numerical summaries of data, recognising assumptions and limitations**

Data Handling Cycle

Student's CD

Leaving Cert Strand 1 Statistics

Students learn about	Students working at FL should be able to	In addition, students working at OL should be able to	In addition, students working at HL should be able to
1.4 Statistical reasoning with an aim to becoming a statistically aware consumer	– engage in discussions about the purpose of statistics and recognise misconceptions and misuses of statistics – discuss populations and samples – decide to what extent conclusions can be generalised – work with different types of data (categorical/numerical/ ordinal, discrete/continuous) in order to clarify the problem at hand	– work with different types of bivariate data	
1.5 Finding, collecting and organising data	– clarify the problem at hand – formulate one (or more) questions that can be answered with data – explore different ways of collecting data – generate data, or source data from other sources including the internet – select a sample (Simple Random Sample) – recognise the importance of randomisation and the role of the control group in studies – design a plan and collect data on the basis of above knowledge	– discuss different types of studies: sample surveys, observational studies and designed experiments – design a plan and collect data on the basis of above knowledge	– recognise the importance of representativeness so as to avoid biased samples – recognise biases, limitations and ethical issues of each type of study – select a sample (stratified, cluster, quota, etc. – no formulae required, just definitions of these) – design a plan and collect data on the basis of above knowledge

Data Handling Cycle

Leaving Cert Strand 1 Statistics cont.

Students learn about	Students working at FL should be able to	In addition, students working at OL should be able to	In addition, students working at HL should be able to
1.6 Representing data graphically and numerically	**Graphical** – select appropriate graphical or numerical methods to describe the sample (univariate data only) – evaluate the effectiveness of different displays in representing the findings of a statistical investigation conducted by others – use stem and leaf plots and histograms (equal intervals) to display data **Numerical** – use a variety of summary statistics to decribe the data • central tendency: mean, median, mode • variability: range	**Graphical** – describe the sample (both univariate and bivariate data) by selecting appropriate graphical or numerical methods – explore the distribution of data, including concepts of symmetry and skewness – compare data sets using back to back stem and leaf plots – determine the relationship between variables using scatterplots – recognise that correlation is a value from -1 to +1 and that it measures the extent of linear relationship between two variables – match correlation coefficient values to appropriate scatter plots **Numerical** – recognise standard deviation as a measure of variability – use a calculator to calculate standard deviation – use a stem and leaf plot to calculate quartiles and the interquartile range	**Graphical** – analyse plots of the data to explain differences in measures of centre and spread – draw the line of best fit by eye – make predictions based on the line of best fit – calculate the correlation coefficient by calculator and understand that correlation does not imply causality **Numerical** – recognise the existence and effect of outliers – use percentiles to assign relative standing – use the interquartile range appropriately when analysing data

Document

Data Handling Cycle

Document

Statistics

- Data handling Cycle
- Student CD
- “How to use Census at School”
- ICT Course
- Handbooks

All available on projectmaths.ie

- Student Resources

Available on ncca.ie/projectmaths

- Content Course Modules 1 & 2

Statistics

(a) Primary sources:
- **(i)** Observational studies (JCHL, LCOL)
- **(ii)** Designed experiments (JC)

(b) Secondary sources

Sampling:
- **(i)** Random (JC)
- **(ii)** Stratified (LCHL)
- **(iii)** Cluster (LCHL)
- **(iv)** Quota (LCHL)

1. Pose a question (C@S)
2. Generate & Collect Data (C@S)
3. Analyse the Data
4. Interpret the Results

(a) Reliability of Data (JCHL)
(b) Summarise Data (Spreadsheets)
(c) Types of Data JC

Types of data:
Categorical/Numerical(JC)

(a) Univariate Categorical (JC)
- Pie Charts (JC)
- Bar Charts (JC)
- Line Plots (JC)

Univariate Numeric
- Histograms (JC)
- Stem and Leaf(JC)
- Back to Back (JCHL)
- Line plots (JC)

(b) Bivariate (LC)

Bivariate Numeric
- Scatter plots (LCOL)
- Correlation (LCOL)

(a) Central Tendency
- Mean (JCHL)
- Median (JC)
- Mode (JC)

(b) Spread
- Range (JCOL)
- Interquartile (JCHL)
- Standard Deviation (Calculator)

(c) Histograms
- Symmetry (LCOL)
- Skewness (LCOL)

(d) Line of best fit (LCHL)
- Correlation Coefficient
- Meaning of (LCOL)
- Calculate (LCHL)

Misuses and Misconceptions

Census at School (C@S)

Synthetic Geometry

- Theorems and Constructions on Student's CD
- Student Activities
- Theorems in your own words

All available on projectmaths.ie

- Teachers
  - Strand 2
    - Junior Cycle (Senior Cycle)
      - Supplementary Material

Junior Cert Strand 2 Geometry & Trigonometry

Topic	Description of topic Students learn about	Learning outcomes Students should be able to
2.3 Co-ordinate Geometry	Co-ordinating the plane. Properties of lines and line segments including midpoint, slope, distance and the equation of a line in the form. $y - y_1 = m(x - x_1)$ $y = mx + c$ $ax + by + c = 0$ where a, b, c, are integers and m is the slope of the line Intersection of lines. **Parallel and perpendicular lines and the relationships between the slopes.**	– explore the properties of points, lines and line segments including the equation of a line – find the point of intersection of two lines, **including algebraically** **– find the slopes of parallel and perpendicular lines**
2.4 Trigonometry	Right-angled triangles: theorem of Pythagoras. Trigonometric ratios **Trigonometric ratios in surd form for angles of 30°, 45° and 60°** **Right-angled triangles** **Decimal and DMS values of angles.**	– apply the result of the theorem of Pythagoras to solve right-angled triangle problems of a simple nature involving heights and distances – use trigonometric ratios to solve problems involving angles (integer values) between 0° and 90° **– solve problems involving surds** **– solve problems involving right-angled triangles** **– manipulate measure of angles in both decimal and DMS forms**

T & Ls Co-ordinate Plane (Teachers) & Distance

T & L 8

Leaving Cert Strand 2 Geometry & Trigonometry

Students learn about	Students working at FL should be able to	In addition, students working at OL should be able to	In addition, students working at HL should be able to
2.2 Co-ordinate geometry	– use slopes to show that two lines are • parallel • perpendicular	– calculate the area of a triangle – recognise the fact that the relationships $y= mx+c$, $y-y_1 = m(x- x_1)$ and $ax + by + c = 0$ are linear – solve problems involving slopes of lines – recognise that $(x-h)^2 + (y-k)^2 = r^2$ represents the relationship between the x and y co-ordinates of points on a circle centre (h, k) and radius r – solve problems involving a line and a circle with centre (0, 0)	– solve problems involving • the perpendicular distance from a point to a line • the angle between two lines – divide a line segment in a given ratio m:n – recognise that $x^2+y^2 +2gx+2fy+c = 0$ represents the relationship between the x and y co-ordinates of points on a circle centre (-g,-f) and radius r where $r = \sqrt{(g^2+f^2 -c)}$ – solve problems involving a line and a circle

Student's CD

Leaving Cert Strand 2 Geometry & Trigonometry cont.

Students learn about	Students working at FL should be able to	In addition, students working at OL should be able to	In addition, students working at HL should be able to
2.3 Trigonometry	– solve problems that involve finding heights and distances from right-angled triangles (2D only) – use of the theorem of Pythagoras to solve problems (2D only) – solve problems that involve calculating the cosine, sine and tangent of angles between 0° and 90°	– use trigonometry to calculate the area of a triangle – use the sine and cosine rules to solve problems (2D) – define sin θ and cos θ for all values of θ – define tan θ – calculate the area of a sector of a circle and the length of an arc and solve problems involving these calculations	– use trigonometry to solve problems in 3D – graph the trigonometric functions sine, cosine, tangent – graph trigonometric functions of type $a\sin n\theta$, $a\cos n\theta$ for $a, n \in \mathbb{N}$ – solve trigonometric equations such as $\sin n\theta = 0$ and $\cos n\theta = \frac{1}{2}$ giving all solutions – use the radian measure of angles – derive the trigonometric formulae 1, 2, 3, 4, 5, 6, 7, 9 (see appendix) – apply the trigonometric formulae 1-24 (see appendix)
2.4 Transformation geometry	– investigate enlargements paying attention to • centre of enlargement • scale factor k, where $0<k<1$, $k>1$ $k \in Q$ • area – solve problems involving enlargements		

T & L 8

T & L 9

Student's CD

Student's CD

T & L 10

End of T & L 9 is start of this section

T & L Radians (Teachers)

Common Introductory Course for First Years

Strand	Learning outcomes Students should be able to
Strand 1: 1.1 Counting	– list outcomes of an experiment – apply the fundamental principle of counting
Strand 1: 1.2 Concepts of probability It is expected that the conduct of experiments (including simulations), both individually and in groups, will form the primary vehicle through which the knowledge, understanding and skills in probability are developed.	– decide whether an everyday event is likely or unlikely to happen – appreciate that probability is a quantity that gives a measure on a scale of 0 - 1 of how likely an event is to occur
Strand 1: 1.5 Finding, collecting and organising data	– pose a question and reflect on the question in the light of data collected – plan an investigation involving statistics – select a sample and appreciate the importance of representativeness so as to avoid biased samples – design a plan and collect data on the basis of above knowledge
Strand 1: 1.6 Representing data graphically and numerically	– select appropriate graphical or numerical methods to describe the sample (univariate data only) – use stem and leaf plots, line plots and bar charts to display data

T & L 1

Student's CD

Data Handling Cycle

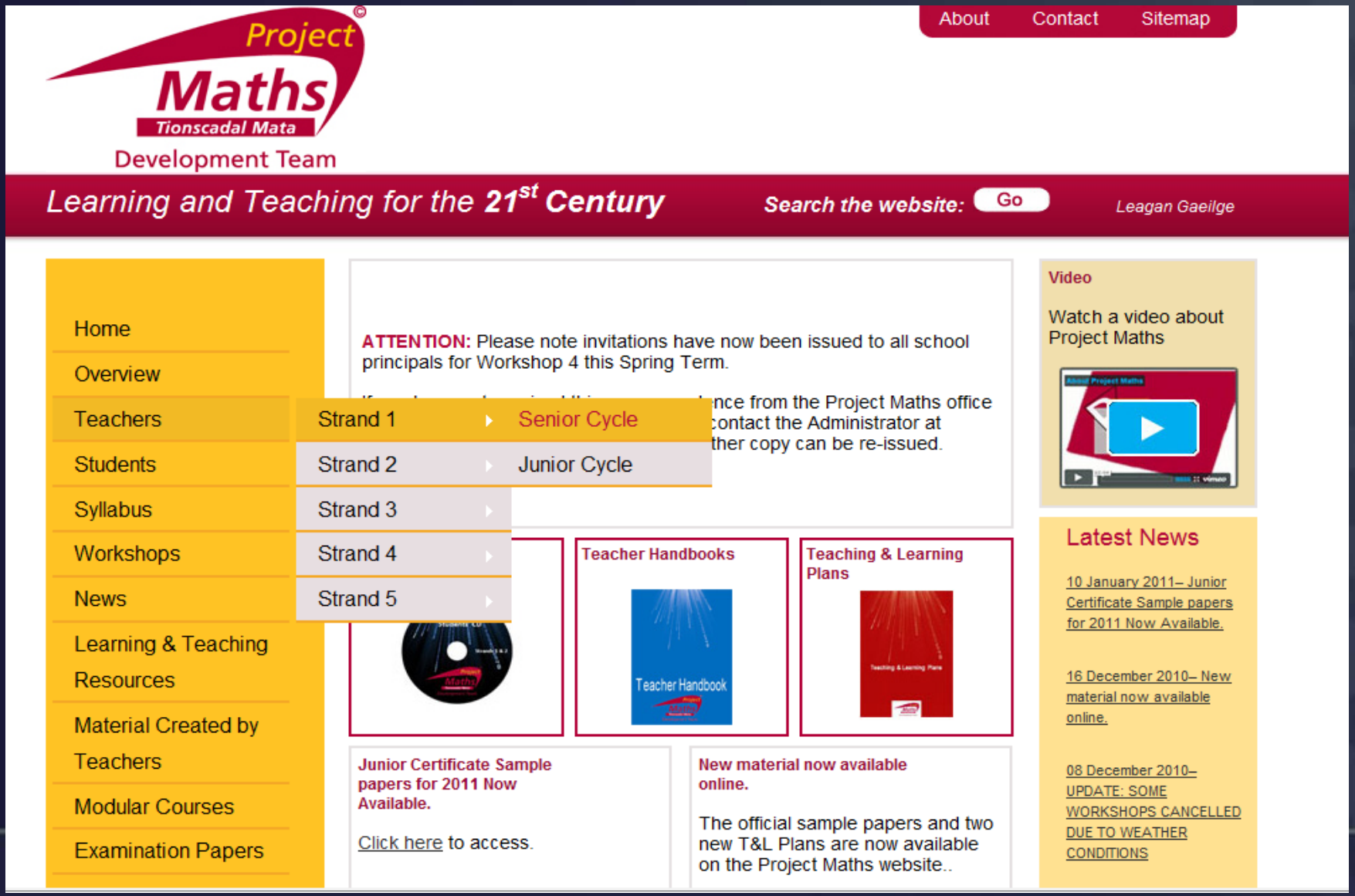
Common Introductory Course for First Years cont.

Strand	Learning outcomes Students should be able to
Strand 2: 2.1 Synthetic Geometry (see *Geometry Course for Post-primary School Mathematics*) The geometrical results should be first encountered through discovery and investigation.	– convince themselves through investigation that theorems 1-6 are true – construct 1. the bisector of a given angle, using only compass and straight edge 2. the perpendicular bisector of a segment, using only compass and straight edge 4. a line perpendicular to a given line l, passing through a given point on l 5. a line parallel to a given line l, through a given point 6. divide a line segment into 2, 3 equal segments, without measuring it 8. a line segment of given length on a given ray
Strand 2: 2.2 Transformation geometry	– use drawings to show central symmetry and axial symmetry
Strand 2: 2.3 Co-ordinate geometry	– coordinate the plane – locate points on the plane using coordinates

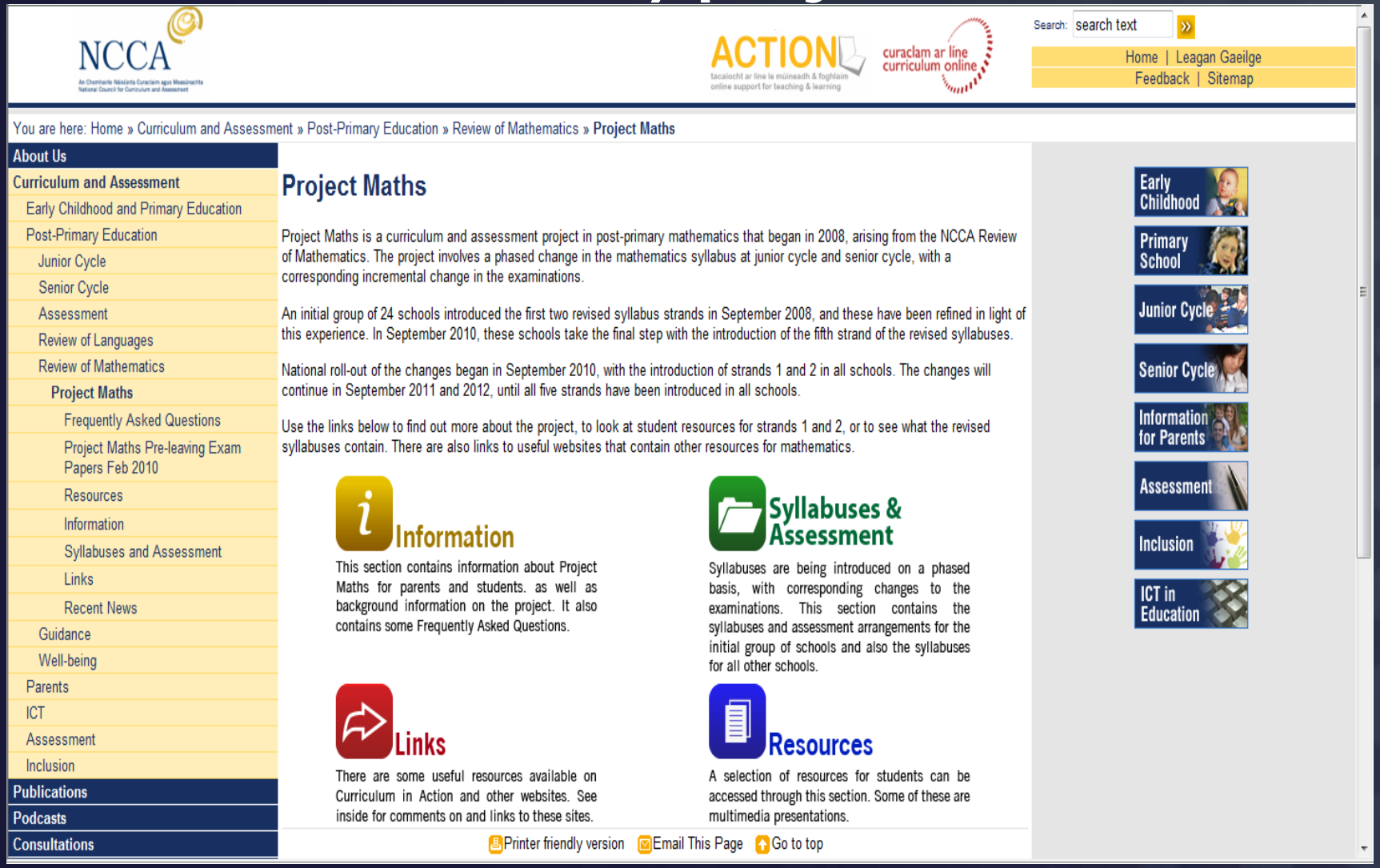
Student's CD

T & L Co-ordinate Plane (Teachers)

www.projectmaths.ie



www.ncca.ie/projectmaths



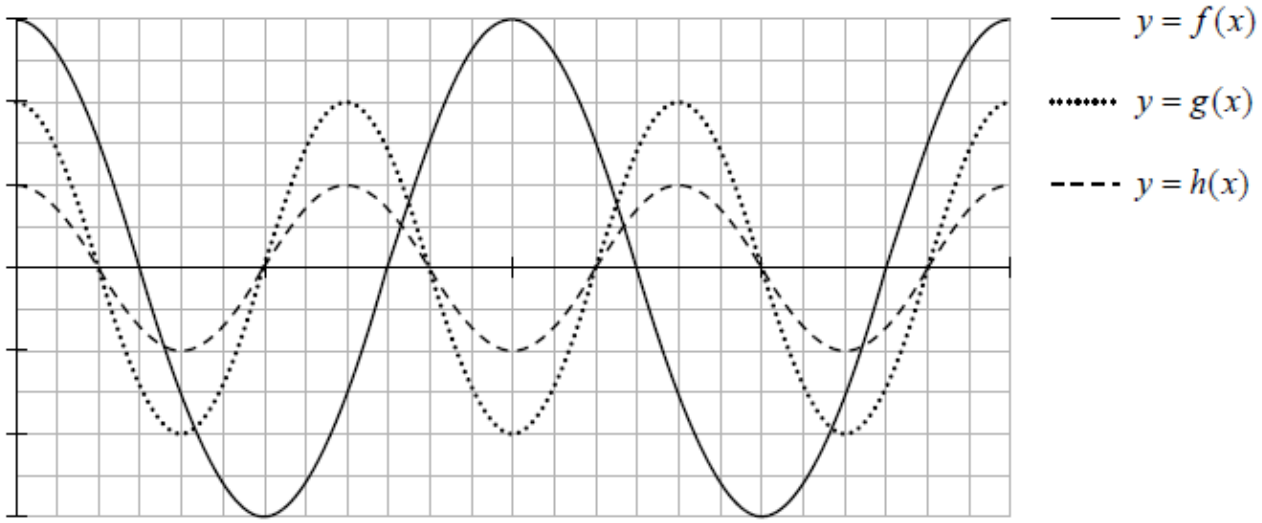
Question 5

Leaving Cert. Higher Level June 2010

(b) The graphs of three functions are shown on the diagram below. The scales on the axes are not labelled. The three functions are:

$$x \to \cos 3x$$
$$x \to 2\cos 3x$$
$$x \to 3\cos 2x$$

Identify which function is which, and write your answers in the spaces below the diagram.



$f : x \to$ _____ $g : x \to$ _____ $h : x \to$ _____

(c) Label the scales on the axes in the diagram in part **(b)**.

T & L 10

Student's CD

Question 5

Leaving Cert. Ordinary Level June 2010

(b) **(i)** Two fair coins are tossed. What is the probability of getting two heads?

(ii) Two fair coins are tossed 1000 times. How often would you expect to get two heads?

T & L 4

(c) Síle hands Pádraig a fair coin and tells him to toss it ten times. She says that if he gets ten heads then she will give him a prize. The first nine tosses are all heads. How likely is it that the last toss will also be a head? Tick the correct answer, and give a reason.

- Extremely unlikely ☐
- Fairly unlikely ☐
- 50-50 chance ☐
- Fairly likely ☐
- Almost certain ☐

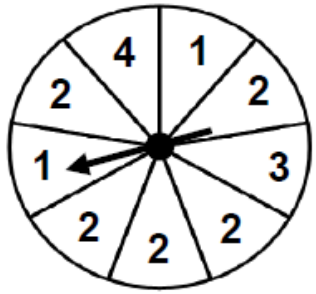
Reason:

T & L 1

Question 3

Leaving Cert. Foundation Level June 2010

(b) A fair spinner is divided into nine equal sections.
The sections are numbered as shown.



Michael says:
"There's a greater than even chance that you'll get a 2."

State whether Michael is correct and give a reason for your answer.

Answer: _____

Reason:

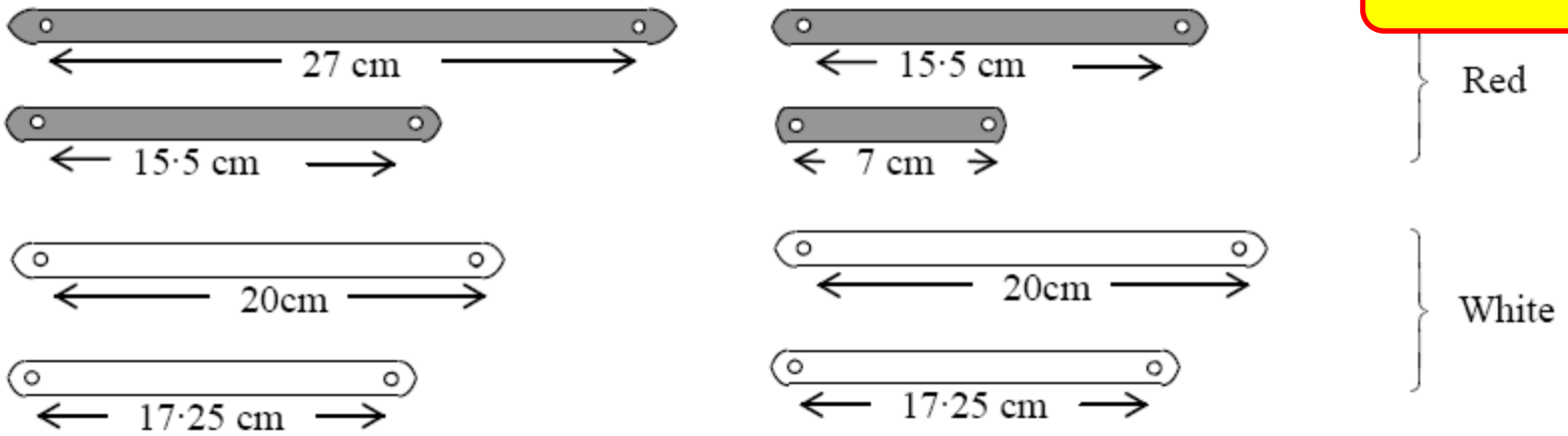
NCCA Student Resources

Junior Cert. Foundation Level Sample 2011

Question 14 **(suggested maximum time: 5 minutes)**

Mary and John have a set of red and white plastic strips of various lengths. These strips can be joined together with pins through small holes at their ends.

GeoStrips



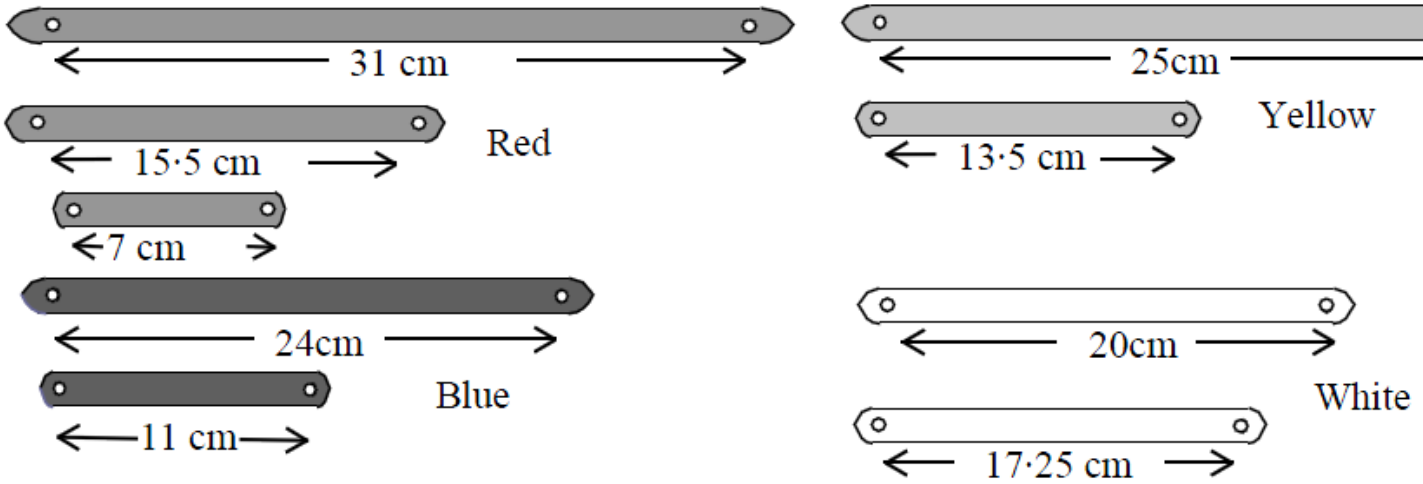
(a) John wants to make an isosceles triangle using three of the four red strips. Can he do this? Give a reason for your answer.

(b) Mary thinks that she can form a parallelogram by using the four white strips. Can she do this? Give a reason for your answer

Junior Cert. Higher Level Sample 2011

Question 8 **(Suggested maximum time: 10 minutes)**

Monica has a set of nine coloured plastic strips (long red, middle red, short red, etc.) as shown below. The strips can be joined together by pins through small holes at their ends.



GeoStrips

(a) Is it possible to make an isosceles triangle using any three of the nine strips? _____
Explain your answer.

(b) Monica would like to join four strips together to form a parallelogram. Explain why it is not possible to do this.

Junior Cert. Ordinary Level Sample 2011

Question 5 **(suggested maximum time: 10 minutes)**

The following question was asked on the phase 9 *CensusAtSchool* questionnaire:

"Approximately how many hours per week do you spend on social networking sites?"

The data below are from two samples of students chosen at random from the UK and Ireland.

Number of hours	UK Number of students	Ireland Number of students
1		
2	1	1
3	2	3
4	1	2
5	2	2
6	7	2
7		3
8		
9	1	5
10		2
11		3
12		3
13	4	4
14	1	2
15	5	
16	5	5
17	2	1
18	4	2
19	5	4
20	3	2
21	2	
22	3	
23	1	
24		
25	1	4

(a) How many students are in each sample? UK _____ Ireland _____

CensusAtSchool

Junior Cert. Ordinary Level Sample 2011

Question 6 **(suggested maximum time: 10 minutes)**

A bag contains red disks, blue disks and white disks. In an experiment, each student in a class of 24 takes out a disk, records the colour and replaces it. This is repeated ten times.
The results from the class are recorded in the table below.

Colour	Red	Blue	White	Total
Frequency	123	78	39	
Relative frequency: $\frac{\text{frequency}}{\text{total}}$				
% of total (Relative frequency × 100)				

(a) In your opinion, why is the number for red greater than for blue or white?

(b) Complete the table above.

T & L 2

Junior Cert. Higher Level Sample 2011

Question 2 **(Suggested maximum time: 10 minutes)**

In an experiment, Anne tossed a die 600 times.
The results are partially recorded in the table below.

Number on die	1	2	3	4	5	6
Frequency	92	101	115	98		105

(a) Calculate the number of times that a 5 appeared. Write your answer in the table above.

(b) After looking at the results, Anne claims that the die is unbiased (fair).
Do you agree with her? Give a reason for your answer.

(c) If this die is tossed 300 times, how many times would you expect to get an even number as a result? Give a reason for your answer.

T & L 2

Junior Cert. Ordinary Level Sample 2011

Question 12 **(suggested maximum time: 5 minutes)**

During a trigonometry lesson a group of students made some predictions about what they expected to find for the values of the trigonometric functions of some angles. They then found the sine, cosine and tangent of $25°$ and $50°$.

T & L 8

(a) In the table given, show, correct to three decimal places, the values they found.

$\sin 25° =$	$\cos 25° =$	$\tan 25° =$
$\sin 50° =$	$\cos 50° =$	$\tan 50° =$

(b) **(i)** Maria had said "The value from any of these trigonometric functions will always be less than 1". Was Maria correct? Give a reason for your answer.

Answer:

Reason:

(ii) Sharon had said "If the size of the angle is doubled then value from any of these trigonometric functions will also double." Was Sharon correct? Give a reason for your answer.

Junior Cert. Higher Level Sample

Question 15 **(Suggested maximum time: 10 minutes)**

During a trigonometry lesson a group of students write down some statements about what they expected to happen when they look at the values of trigonometric functions of some angles. They then find the Sin, Cos and Tan of some angles, correct to three decimal places, to test their ideas. Here are some of the things they wrote down.

(i) The value from any of these trigonometric functions will **always** be less than 1.

(ii) If the size of the angle is doubled then value from the trigonometric functions will not double.

(iii) The value from all of the trigonometric functions will increase if the size of the angle is increased.

(iv) I do not need to use a calculator to find Sin $60°$. I can do it by drawing an equilateral triangle. The answer will be in surd form.

T & L 8

(a) Do you think that (i) is correct? Give an example to justify your answer.

Answer:

Example:

(b) Do you think that (ii) is correct? Give an example to justify your answer.

Syllabus & Resources