Module 4

Junior Certificate Co-ordinate Geometry

Ordinary Level

Co-ordinating the plane

Properties of lines and line segments including mid-point, slope, distance and equation of a line in the form of $y - y_1 = m(x - x_1)$ *and* $y = mx + c$ *where c is an integer and m is the slope of the line.*

Learning Outcomes:

Students should explore the properties of points, lines and line segments including the equation of a line.

Intersection of Lines

Learning Outcomes:

Students should be able to find the point of intersection of two lines.

Translations, Central Symmetry and Axial symmetry

Learning Outcomes:

1. *Students should be able to locate axes of symmetry of simple shapes.*
2. *Students should be able to recognise images of points and objects under translations, central symmetry and axial symmetry(intuitive approach).*

Extra on Higher Level

Co-ordinating the plane:

Equation of a line also in the form of $ax + by + c = 0$, *where a, b and c are integers and m is the slope of the line.*

Learning Outcomes:

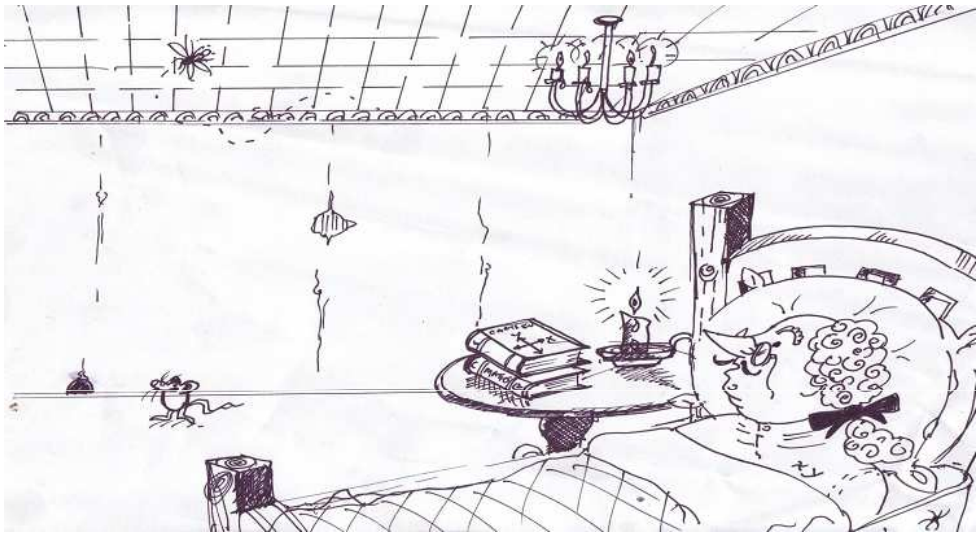
Students should explore the properties of points, lines and line segments including the equation of a line.

Intersection of Lines

Learning Outcomes:

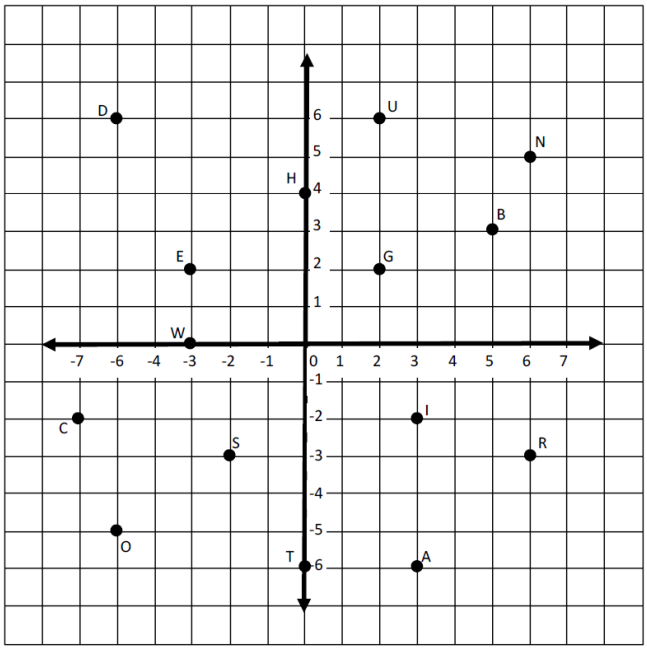
1. *Students should be able to find the point of intersection of two lines, including algebraically.*
2. *Students should be able to find the slopes of parallel and perpendicular lines.*

Activity for CIC



A very famous mathematician called ***Rene Descartes*** *lay in bed one night. As he lay there, he looked up at the ceiling in his bedroom. He noticed a fly was asleep on the ceiling. Descartes, being a mathematician, wondered if he could figure out a way of stating where exactly the fly was on the ceiling. Obviously it has to be a precise description he thought. I can't really say, "To the left" or "Near the right "or "In the middle".*

Break the Code



(5,3)	(−3,2)	(−7,−2)	(3,−6)	(2,6)	(−2,−3)	(−3,2)

(0,4)	(−3,2)	(6,−3)

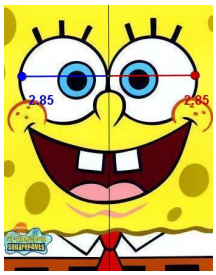
(−2,−3)	(0,−6)	(2,6)	(−6,6)	(−3,2)	(6,5)	(0,−6)	(−2,−3)

(−3,0)	(−3,2)	(6,−3)	(−3,2)

(−2,−3)	(−6,−5)

(5,3)	(6,−3)	(3,−2)	(2,2)	(0,4)	(0,−6)

Axis of Symmetry and Translations

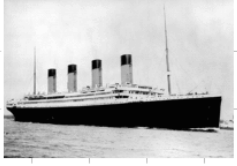


Axis of Symmetry

Interactive

Translation

Interactive



Original Image

Symmetry

Interactive

Leaving Certificate Co-ordinate Geometry

Foundation Level

Co-ordinate Geometry

Learning Outcomes:

Students should be able to use slopes to show that two lines are

- *parallel*
- *perpendicular*

Transformation Geometry

Learning Outcomes:

1. *Students should be able to investigate enlargements paying attention to*
   - *centre of enlargement.*
   - *scale factor k where, $0 < k < 1$, $k > 1$, $k \in Q$.*
   - *Area*
2. *Solve problems involving enlargements*

Ordinary Level

Co-ordinate Geometry

Learning Outcomes:

1. *Students should be able to calculate the area of a triangle.*
2. *Students should be able to recognise the fact that the relationships $y = mx + c$, $y - y_1 = m(x - x_1)$ & $ax + by + c = 0$ are linear*
3. *Students should be able to solve problems involving slopes of lines.*
4. *Students should be able to 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 with centre (h, k) & radius r.*
5. *Students should be able to solve problems involving a line and a circle of centre (0,0)*

Higher Level

Co-ordinate Geometry

Learning Outcomes:

1. *Students should be able to solve problems involving*
   - *the perpendicular distance from a point to a line*
   - *the angle between two lines*
2. *Students should be able to divide a line segment in a ratio of m:n*
3. *Students should be able to 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 $r = \sqrt{(g^2 + f^2 - c)}$*
4. *Students should be able to solve problems involving a line and a circle*

Foundation Level Project Maths Sample Paper 2010

Question 5

The line l_1 passes through the points (4, 5) and (7, –1).

The line l_2 has equation $y = \frac{2}{3}x + 1$.

The line l_3 has equation $2x - 3y + 12 = 0$.

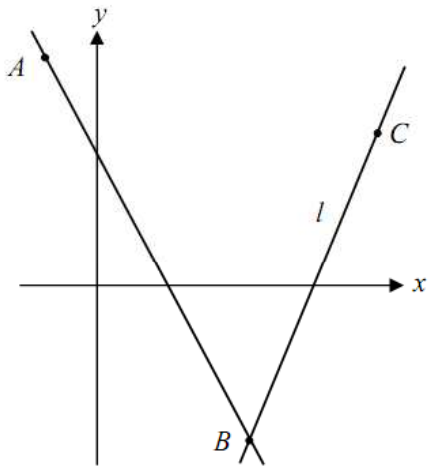
(a) Find the slopes of the three lines l_1, l_2, and l_3.

Higher Level Project Maths Paper 2010

Question 6 **(25 marks)**

Three points A, B and C have co-ordinates:
$A(-2,9)$, $B(6,-6)$ and $C(11,6)$.

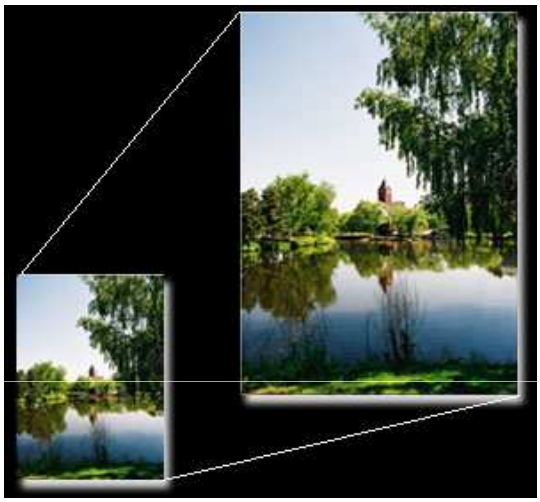
The line l passes through B and has equation $12x-5y-102=0$.



(a) Verify that C lies on l.

(b) Find the slope of AB, and hence find $\tan(\angle ABC)$, as a fraction.

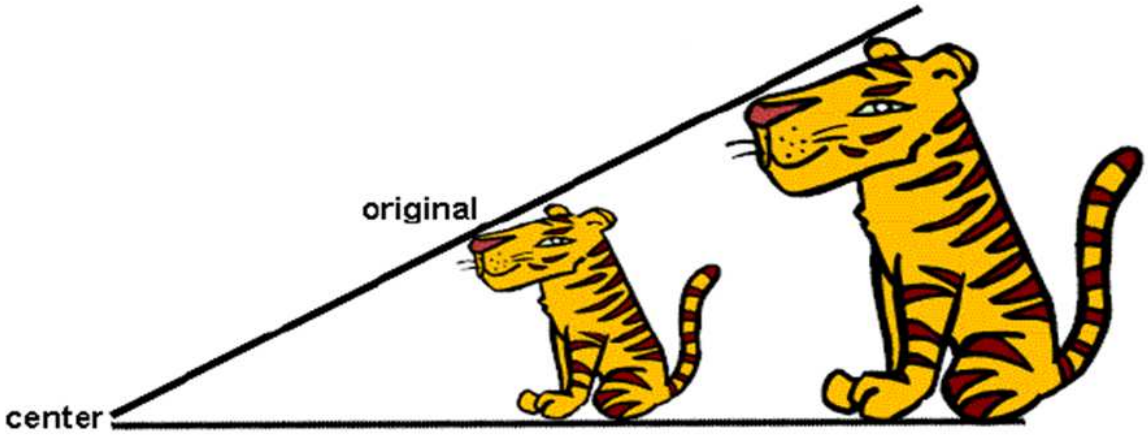
Enlargements



***A dilation** is a type of transformation which produces an image which is the **same shape** as the original object but is a **different size** i.e. It has the same proportions as the original object.*

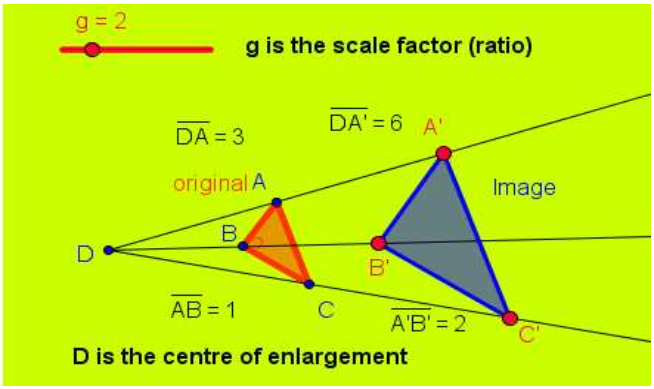
A dilation used to create an image larger than the original is called an enlargement.

A dilation used to create an image smaller than the original is called a reduction.



An object and its image by an enlargement are similar figures.

- *Angle measures remain the same*
- *Parallel lines remain parallel*
- *Distance is not preserved except where the scale factor is 1*



Interactive *Enlargement 1*

Interactive *Enlargement 2*

- *The length of each side of the image is equal to the length of the corresponding side of the original figure multiplied by the scale factor.*
- *The distance from the centre of the dilation to each point of the image is equal to the distance from the centre of the dilation to each corresponding point of the original figure times the scale factor.*
- *The centre of enlargement is a fixed point in the plane about which all points are expanded or contracted. It is the only invariant point under a dilation.*