**COORDINATE GEOMETRY.**

This is a completely simple, logical topic and should not be taught using all those unnecessary formulae involving ***x1, y1, x2, y2.***

**In fact the only formula we need to use is** ***y = mx + c***

Examples.

Suppose P is (2, 4) and Q is (10, 8) Q(10, 8)

 ***p*** 4cm

**(i) Find the length of PQ**

 P (2, 4) 8cm

**DRAW A SMALL SKETCH**

**and use Pythagoras’ Theorem!**

***p2 = 82 + 42***

***p2 = 64 + 16***

***p2 = 80***

***p ≈ 8.94cm***

**(ii) Find the gradient of PQ**

**Just look at the sketch above! *grad = 4 = 1***

 ***8 2***

**(iii) Find the EQUATION of PQ**

 The basic equation is ***y = mx + c***

 We just found the gradient ***m = ½***

 So ***y = x + c***

 ***2***

The graph goes through ( 2, 4) so subs ***x = 2, y = 4***

 ***4 = 1 + c***

 ***3 = c***

 **The equation of PQ is *y = ½ x + 3***

**(iv) Find M, the mid-point of PQ**

 M is the average of (2, 4) and (10, 8)

 ie average 2 and 10 = 12 = 6 and average of 4 and 8 = 6

 2

 Mid point is M = (6, 6)The above techniques are just very basic logic.

The following formulae should be made completely redundant:

 Dist = √ (***x2 – x1)2 + (y2 – y1)2***

 Gradient = ***y2 – y1***

 ***x2 – x1***

 Equation of line ***y – y1 = m(x – x1)***

 OR ***y – y1 = y2 – y1***

 ***x – x1 x2 – x1***

 Mid Point = ***x1 + x2 , y1 + y2***

 ***2 2***

**Whether students/tutors/teachers realise it or not, the use of these formulae does not promote proper “thinking” and “understanding”.**

**N.B. If you told students that the equation of a line was *y + y1 = m(x + x1)***

 **then students would cheerfully use it just as “confidently” and happily**

 **as they would use the correct version.**

 **They may THINK that they understand it but clearly they only**

 **KNOW how to substitute numbers into an equation whether the**

 **equation is correct or not! The “formula” replaces understanding!**

**Parallel lines** : obviously have the same gradient.

eg ***y = 3x + 5*** is parallel to ***y = 3x – 9***

 ***4 4***

**Perpendicular Lines : we need to show examples as follows**

 B

Grad AB = 4

 3

Grad AC = – 3

 4

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  C |  |  |  |  |  | Students will easily realise that the product of perpendicular gradients is – 1  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

A

B

Grad AB = 3

 2

Grad AC = – 2

 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| C |  |  |  |  |
|  |  |  |  |  |
|  |  | A |  |  |

***The following is a model answer for a suitable teaching example for this topic using the logical methods as described above.***

**Using coordinate geometry methods find the properties of the quadrilateral given by A(2, 2), B(8, 4), C(6, 10) and D(0, 8) . As a result of the properties you have found, state what type of quadrilateral this is.**

**Also find the intersection point of the diagonals.**

 C

 B

 2

 A

 6

AB2 = 62 + 22

AB = √40 ≈ 6.32

 D

 B

 C

 2

 D

 6

DC2 = 62 + 22

DC = √40 ≈ 6.32

 A

 D

 6

 A

 2

 6

DA2 = 62 + 22

DA = √40 ≈ 6.32

 C

 6

 B

 2

 6

BC2 = 62 + 22

BC = √40 ≈ 6.32

**Therefore all 4 sides are equal in length**.

Using the above sketches:

Gradient of AB = 2 = 1

 6 3 **So AB is parallel to DC**

Gradient of DC = 2 = 1

 6 3

Gradient of AD = 6 = 3

 2 **So AD is parallel to BC**

Gradient of BC = 6 = 3

 2

Considering the gradients of **adjacent sides** ***Grad AB × Grad BC = – 1***

this means that the **lines are perpendicular**.

This means all the angles are 900, all the sides are equal and opposite sides are parallel so **ABCD MUST be a SQUARE.**

D

4

 B

 8

Grad of DB = – 1

 2

Diagonals C

 D

 B

 A

Equation of DB is of the form ***y = mx + c*** where ***m*** = ***– 1***

 2

and it goes through (0, 8) so substituting:

 ***8 = – 1 × 0 + c so c = 8***

 ***2***

 DB is ***y = – 1x + 8***

 ***2***

 C

 Equ of AC is of the form ***y = mx + c***

 8 where ***m = 2*** and it goes through (2, 2)

 so substituting:

 ***2 = 2×2 + c so c = – 2***

 A 4

Grad of AC = ***2 Equ AC is y = 2x – 2***

The diagonals intersect when ***2x – 2 = – 1 x + 8***

 ***2***

Mult b.s. by 2: ***4x – 4 = – x + 16***

 ***5x = 20***

 ***x = 4 and y = 6***