1. Co-ordinates of points

The **system of reference** is :

- a **fixed point** O, called the **origin**,
- a pair of perpendicular axes through O.

The horizontal line is called the ***x*-axis**, the vertical line is called the ***y*-axis**.
The **rectangular Cartesian coordinates** of a point M are given as an **ordered pair** of numbers (***a*** ; ***b***);

a is the **abscissa**, or the ***x*-coordinate**

b is the **ordinate**, or the ***y*-coordinate**

<u>*Exercise 1*</u>

a) *Within the plan ($\mathcal{P}$), draw a set of orthogonal axes, with origin* O*, and* ***scale*** *each of them using one square to one unit on each axis.* ***Plot*** *(or mark) the points* A, B, C, D *whose coordinates are given below :*

A(–3 ; 5) B(2; 3) C(–1; –4) D(3; –2)

b) A *is* 3 *squares to the left of* O *and* 5 *squares above the x-axis*
D *is* 3 *squares to the right of* O *and* 2 *squares below the x-axis*
Write in the same way two sentences with B *and* C.

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2. Coordinates of vectors

A **vector** is defined by its **Direction**, its **Sense** and its **Length** (also called **magnitude** or **modulus**) : D.S.L.
A **located** vector is one that can be described by an ordered pair of points in space : $\overrightarrow{AB}$ from point A to B.

<u>*Exercise 2*</u>

a) *As in exercice 1, plot* A*(1; 1)* B*(5; 4)* C*(–3; 2)* D*(–1; –2)*

b) *As you go from* A *to* B*, you move 4* ***across to the right*** *and* ***3 up****, then* $\overrightarrow{AB}(\mathbf{4}\,;\,\mathbf{3})$
As you go from A *to* D*, you move 2* ***across to the left*** *and* ***3 down****, then* $\overrightarrow{AD}(\mathbf{-2}\,;\,\mathbf{-3})$
Make four other sentences expressing the coordinates of the vectors $\overrightarrow{AC}$ *and* $\overrightarrow{CD}$ *and their* ***opposite*** *vectors* $\overrightarrow{CA}$ *and* $\overrightarrow{DC}$.

c) *Check your answers with calculations.*

<u>*Exercise 3*</u>

a) *As in exercise 1, plot* A*(5; –2)* B*(2; 4)* C*(–3; 4)*

b) *Using the coordinates of vectors, find* D*(**x** ; **y**) such as* ABCD *is a parallelogram.*

c) *Check your answers working out the coordinates of the mid-points* K *and* L *of* [AC] *and* [BD].

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3. Length of a linear segment

Let $A(x_A ; y_A)$ and $B(x_B ; y_B)$ be two points.

Then the length of the linear segment AB is calculated by the formula : $AB=\sqrt{(x_B - x_A)^2 + (y_B - y_A)^2}$

Use for the next two exercises an orthogonal system of axes, with origin O*, with 1 cm to 1 unit.*

<u>*Exercise 4*</u> *Plot* A*(1; 6) ,* B*(–1; 4)* *and* C*(2; 1)*

a) *Calculate the lengths* AB, BC *and* AC.

b) *Show that* ABC *is a right-angled triangle.*

c) *Calculate its area $\mathcal{A}$ and its perimeter $\mathcal{P}$.*

<u>Vocabulary</u> abscissa (*abscissae*) – across to the (*left / right*) – rectangular Cartesian coordinates – direction – DSL – fixed point – length – located – magnitude – ordered pair – ordinate – opposite – origin – to plot – to scale – sense – system of reference – vector – ***x***-axis – ***y***-axis

Exercise 5 *Plot* A*(7; 3)* B*(–4; 1)* C*(–3; –2)*

a) Show that Δ ABC *(triangle* ABC*) is isosceles.*
b) Give the coordinates of the foot K *of the median* [AK].
c) Calculate the area $\mathcal{A}$ of Δ ABC.

4. Equations of straight lines

The **graph** of a **linear equation** of the form $ax+by+c = 0$, where ***a*** and ***b*** are not both zero, is a straight line.
The slope-intercept form of the equation is $y = mx+c$ where :

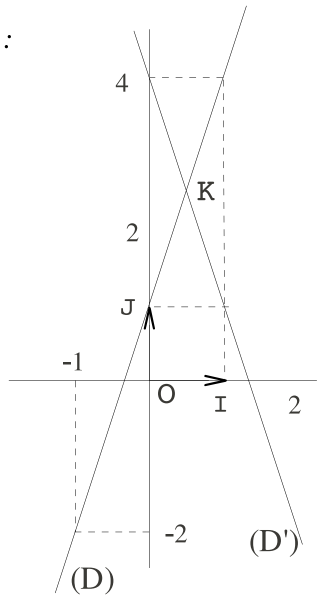
- ***m*** is the **gradient**, which measures the **slope** of the line,
- ***c*** is the ***y*-intercept**, which means that the line cuts the ***y***-axis at the point of coordinates (0 ; ***c***) , and corresponds to lines which are not parallel to the ***y***-axis.

If $m = 0$ then the line is parallel to the ***x***-axis.
If $c = 0$, the line passes through the origin O, its equation is then $y = mx$.

If the gradient is positive, the line is **ascending** and makes an acute angle with the positive ***x***-axis.

Exercise 6
Make two sentences when the gradient is zero or negative, and draw three ***sketches*** *illustrating these cases.*

Exercise 7 – Copy this sketch on your exercise book, then use the graph and evaluate :
b) the gradient, the ***y****-intercept and the equation of* (D)
c) same question with (D')
Without any calculation, use the graph and evaluate :
d) the ordinates of A(1;) *and* B(-1 ;) *if* A ∈ (D) , B ∈ (D)
the ordinates of A'(1;) *and* B'(0 ;) *if* A'∈ (D') , B'∈ (D')
e) the abscissae of E(; 1) *and* F(; -2) *if* E ∈ (D) , F ∈ (D)
the abscissae of E'(; 1) *and* F'(; -2) *if* E'∈ (D') , F'∈ (D')
f) the coordinates of the intersection point K *of* (D) *and* (D')



In all 3 exercises below, use an orthogonal system of axes with origin O*,*
taking 1 cm to 1 unit, and draw figures in each case :

Exercise 8
a) Plot the points A*(-3; 12) and* B*(-1 ; 4)*
*b) Calculate the gradient of (*AB*)*
c) Find the equation of the straight line through A *and* B
d) Does C*(4; -16) lie on (*AB*) ? Why ?*
*e) Which particular point lies on (*AB*) ? Why ?*
*f) Which point lies below or above (*AB*) :* E*(1; -4.1)* F*(-2; 8.2)*

Exercise 9
a) Two lines are parallel if they have the same ____________
*b) Find the equation of the straight line (D) which is parallel to (*AB*), where* A*(-1; 4) and* B*(3 ; 2) and which passes through* C*(4; 0)*
c) Find the coordinates of the points K *and* L *where the line (D) cuts the* ***x****-axis and the* ***y****-axis (use the graph)*

Exercise 10
(D) is the line with equation $y = 4-3x$ *and (D') is the line with equation* $y = 4x-3$
Give the equation of the line (Δ) which is parallel to line (D) and cuts the ***y****-axis in the same point as line (D')*

Vocabulary ascending – gradient – graph – linear equation – sketch – slope – slope-intercept form – ***y***-intercept