ANNO SCOLASTICO 2013-2013
ISTITUTO TECNICO BALDUCCI
SANTA FIORA
VERSO IL CLIL

MATHS IN ENGLISH

1.

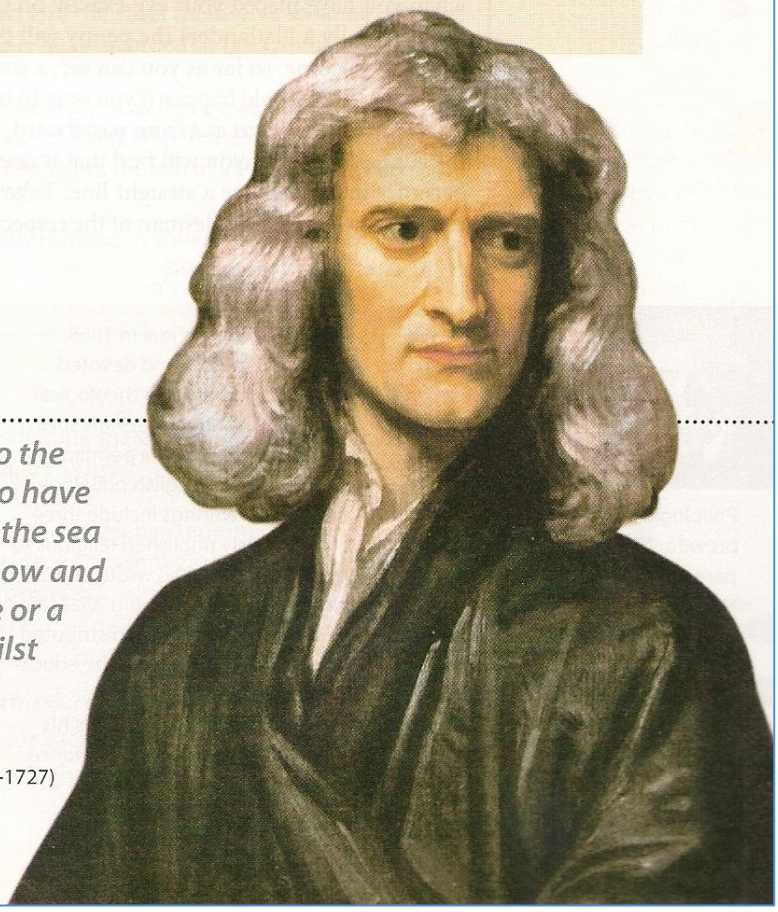
Equation of Straight Line

2.

Parallel & Perpendicular Lines

3.

Intersection of two lines



I don't know what I may seem to the world, but as to myself, I seem to have been only like a boy playing on the sea shore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me.

Isaac Newton (1643-1727)

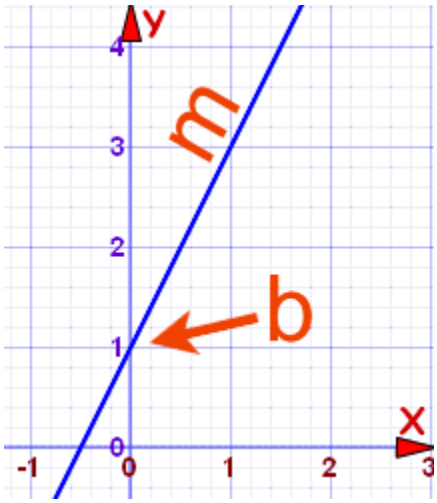
Equation of a Straight Line

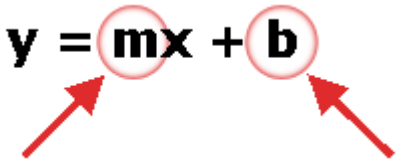
The equation of a straight line is usually written this way:

y = mx + b

(or "y = mx + c" in the UK)

What does it stand for?





Slope or gradient Y Intercept

y = how far up

x = how far along

m = Slope or Gradient (how steep the line is)

b = the Y Intercept (where the line crosses the Y axis)

RICORDA:

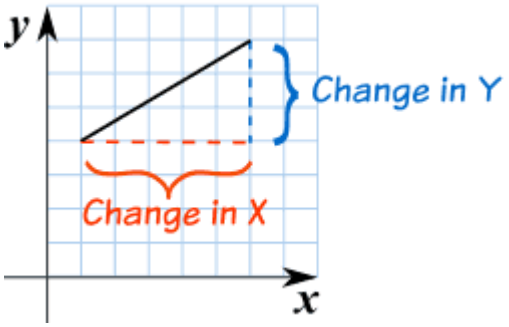
In Italia l'equazione generica di una retta in forma esplicita è: y=mx+q

Dove m è il coefficiente angolare , ossia l'inclinazione della retta rispetto all'asse e q è l'intercetta all'origine, cioè il punto in cui la retta incontra l'asse y. NOTA: Le definizione sono molto simili a quelle inglesi!!!

How do you find "m" and "b"?

- b is easy: just see where the line crosses the Y axis.
- m (the Slope) needs some calculation:

$$\mathbf{m} = \frac{\text{Change in Y}}{\text{Change in X}}$$



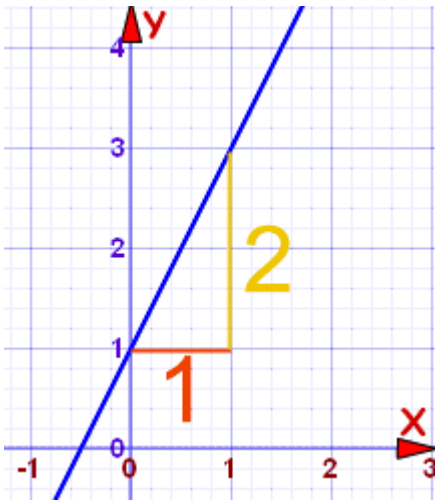
RICORDA:

Il coefficiente angolare di una retta che passa per i punti $A(x_1,y_1)$ $B(x_2,y_2)$ si calcola attraverso la formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Knowing this we can work out the equation of a straight line:

Example 1



$$m = \frac{2}{1} = 2$$

b = 1 *(where the line crosses the Y-Axis)*

Therefore y = 2x + 1

With that equation you can now ...

... choose any value for x and find the matching value for y

For example, when x is 1:

$$y = 2\times\mathbf{1} + 1 = 3$$

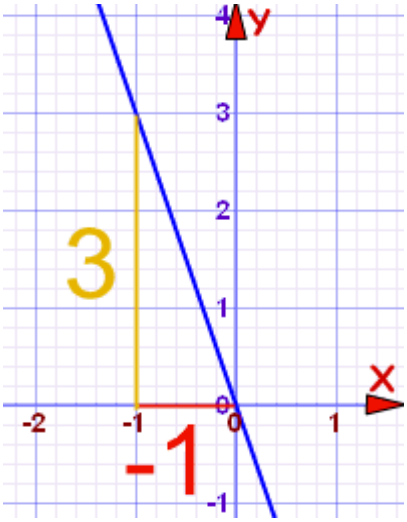
Check for yourself that $x=1$ and $y=3$ is actually on the line.

Or we could choose another value for x, such as 7:

$$y = 2\times\mathbf{7} + 1 = 15$$

And so when $x=7$ you will have $y=15$

Example 2



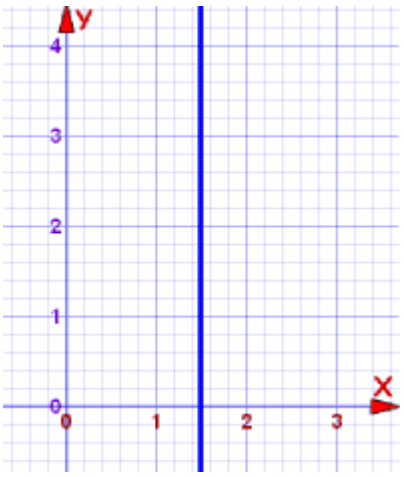
$$m = \frac{3}{-1} = -3$$

$$b = 0$$

This gives us **y = −3x + 0**
We do not need the zero!

Therefore y = −3x

Example 3: Vertical Line



What is the equation for a vertical line?

The slope is **undefined** ... and where does it cross the Y-Axis?

In fact, this is a **special case**, and you use a different equation, not "**y=...**", but instead you use "**x=...**".

Like this:

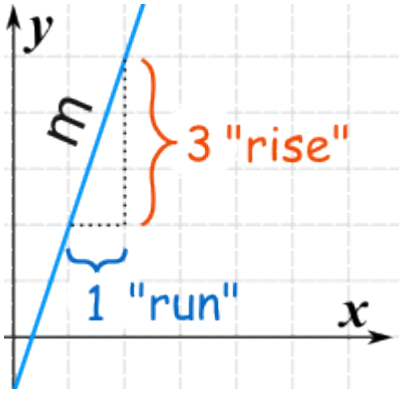
$$x = 1.5$$

Every point on the line has **x** coordinate **1.5**,
that's why its equation is **x = 1.5**

Rise and Run

Sometimes the words "rise" and "run" are used.

- Rise is how far up
- Run is how far along



And so the slope "m" is:

$$m = \frac{\text{rise}}{\text{run}}$$

You might find that easier to remember

Other Forms

We have been looking at the "slope-intercept" form. The equation of a straight line can be written in **many other ways**.

Footnote

Country Note:

Different Countries teach different "notation" (as sent to me by kind readers):

In the **US**, **Australia, Canada, Egypt, Eritrae**, **Iran**,**Mexico**, **Portugal**, **Philippines** and **Saudi Arabia** the notation is:	$y = mx + b$
In the **UK, Australia (also), Bahamas, Bangladesh, Belgium, Brunei, Bulgaria, Cyprus, Germany, Ghana, India, Indonesia, Ireland, Jamaica, Kenya, Kuwait, Malaysia, Malawi, Malta, Nepal, Netherlands, New Zealand, Nigeria, Pakistan, Peru, Poland, Singapore, Solomon Islands, South Africa**, **Sri Lanka**, **Turkey, UAE, Zambia** and **Zimbabwe**	$y = mx + c$
In **Afghanistan, Albania, Brazil, Catalonia, Czech Republic, Denmark, Ethiopia, France, Lebanon, Holland, Kosovo, Kyrgyzstan**, **Romania**, **Tunisia** and **Viet Nam:**	$y = ax + b$
In **Azerbaijan, China**, **Finland**, **Russia** and **Ukraine**:	$y = kx + b$
In **Greece**:	$\psi = \alpha\chi + \beta$
In **Italy**:	$y = mx + q$
In **Japan**:	$y = mx + d$
In **Israel**:	$y = mx + n$
In **Latvia**:	$y = jx + t$
In **Romania**:	$y = gA + C$
In **Sweden**:	$y = kx + m$
In **Serbia** and **Slovenia**:	$y = kx + n$

... but it all means the same thing, just different letters.

How to find the equation of perpendicular(parallel) line?

Example 4: Find the equation of the line that is perpendicular(parallel) to 4x+3y=6 and that passes through the point (-1,-4).

Parallel lines have the same slope. Perpendicular lines have opposite reciprocal slope.

That is to say, if one line has slope m, the slope of a perpendicular line would be -1/m, the slope of a parallel line would be m.

So start by finding the slope of the given line, which you can do most easily by using algebraic manipulation to change the given equation into the slope-intercept form.

Steps for slope-intercept form:

4x+3y=6 3y=-4x+6 y=(-4/3)x+2

Then take the opposite reciprocal of that slope to get the slope of the perpendicular line, and use it with the given point to generate the point-slope form of the equation for the line you are looking for.

Parallel line: m=(-4/3) Perpendicular line: m=3/4

$$y - y_1 = m(x - x_1)$$

Parallel line y+4=(-4/3)(x+1) Perpendicular line: y+4=(3/4)(x+1).

Intersection of Two Lines

Example 5: *Our example will use these two functions:*

f(x) = 2x + 3

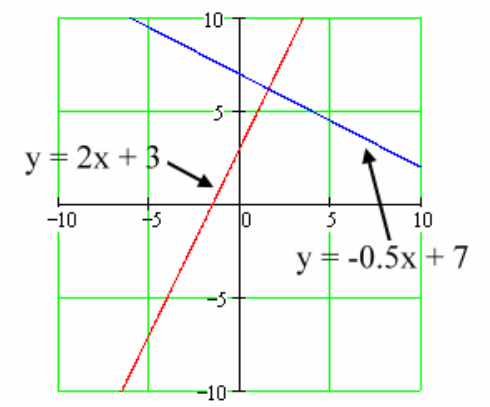
g(x) = -0.5x + 7

We will call the first one Line 1, and the second Line 2. Since we will be graphing these functions on the x, y coordinate axes, we can express the lines this way:

y = 2x + 3

y = -0.5x + 7

These two lines look this way:



Now, we do some algebra to find the x-coordinate at the point of intersection:

$$\begin{cases} y = 2x + 3 \\ y = -0.5x + 7 \end{cases}$$

RICORDA: Sistemi lineari risolti con il metodo del confronto

2x + 3 = -0.5x + 7	We start here.
2.5x + 3 = 7	Add 0.5x to each side.
2.5x = 4	Subtract 3 from each side.
x = 4/2.5	Divide each side by 2.5.
x = 1.6	Divide 4 by 2.5.

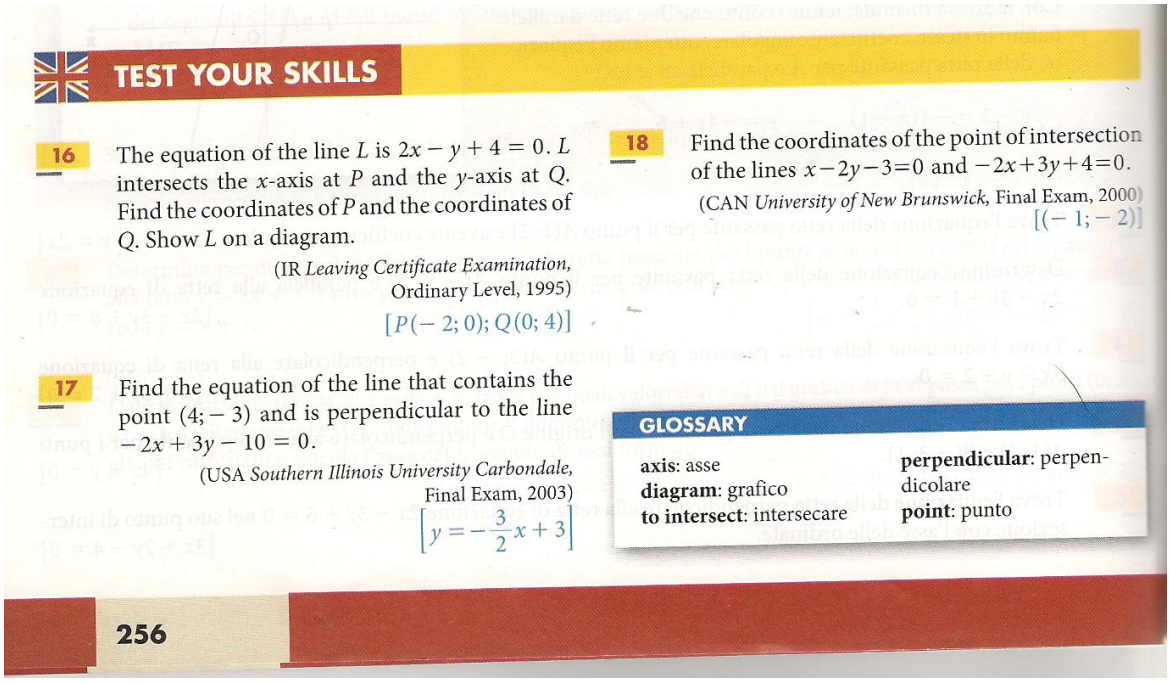
So, we have the x-coordinate for the point of intersection. It's x = 1.6. Now, let's find the y-coordinate. The y-coordinate can be found by placing the x-coordinate, 1.6, into either of the equations for the lines and solving for y. We will first use the equation for Line 1:

y = 2x + 3

y =2(1.6) + 3

y = 3.2 + 3

y = 6.2



TEST YOUR SKILLS

16 The equation of the line L is $2x - y + 4 = 0$. L intersects the x-axis at P and the y-axis at Q. Find the coordinates of P and the coordinates of Q. Show L on a diagram.

(IR *Leaving Certificate Examination*, Ordinary Level, 1995)

$[P(-2; 0); Q(0; 4)]$

17 Find the equation of the line that contains the point $(4; -3)$ and is perpendicular to the line $-2x + 3y - 10 = 0$.

(USA *Southern Illinois University Carbondale*, Final Exam, 2003)

$\left[y = -\frac{3}{2}x + 3\right]$

18 Find the coordinates of the point of intersection of the lines $x - 2y - 3 = 0$ and $-2x + 3y + 4 = 0$.

(CAN *University of New Brunswick*, Final Exam, 2000)

$[(-1; -2)]$

GLOSSARY

axis: asse
diagram: grafico
to intersect: intersecare
perpendicular: perpendicolare
point: punto

256