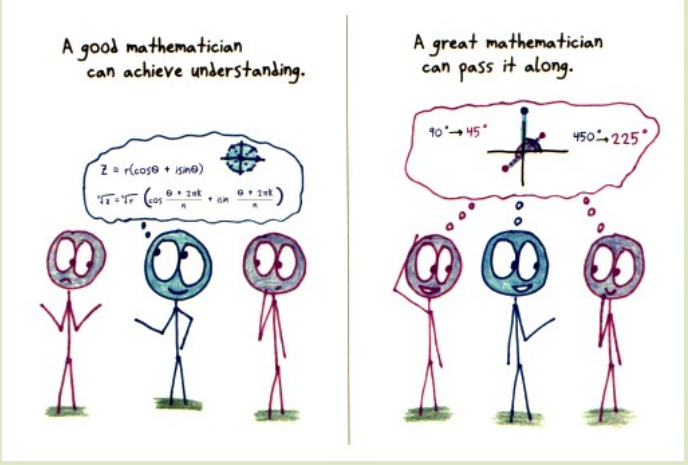
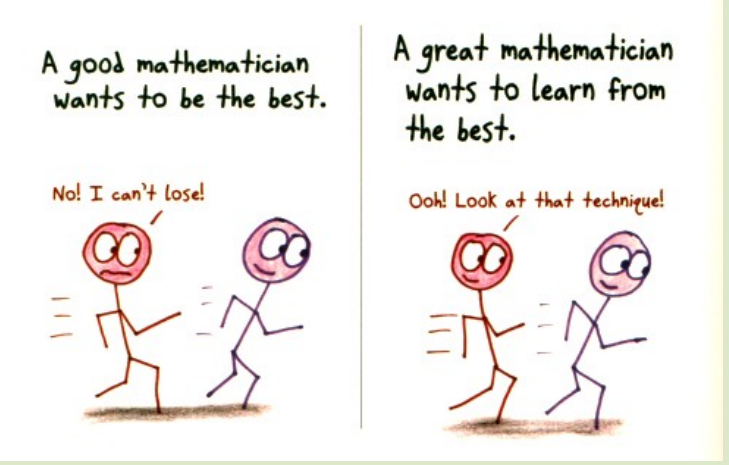
Introduction : Science Communication



"Popularizing Science"



"Open Science"

Introduction : Science Communication

Four Pillars of Open Science

Almost all scientists today will have bumped into the expression "open science". As an umbrella term used to cover any kind of change towards availability and accessibility of scientific knowledge, "open science" evokes many different concepts and covers many different fronts, from the right to have free access to scholarly publications (dubbed "open access"), over the demand for a wider public engagement (typically referred to as citizen science), to the development of free tools for collaboration and open peer-review (as implemented in science-oriented social media platforms).

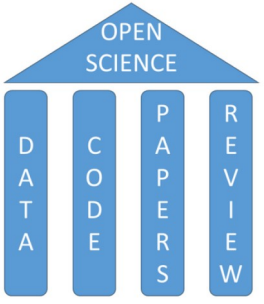
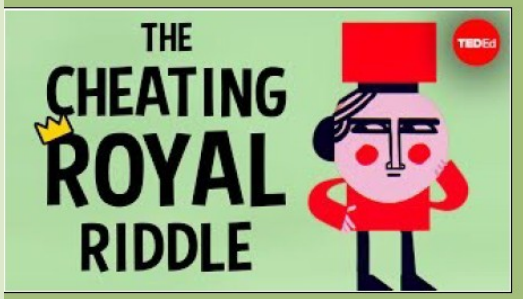


Figure 1: The four pillars of open science discussed in this article.
Image adapted from [17], distributed under a CC BY 4.0 International license (http://creativecommons.org/licenses/by/4.0/).

Science (Or) Fiction : The Science Behind Fiction



The Cheating Royal Riddle

1. Watch the "Cheating Royal Riddle" video from 00:00 to 01:57. What is the situation? What are your clues to solve the riddle?

2. Try and solve the riddle: according to you, who should be the heir to the throne? Be ready to justify.

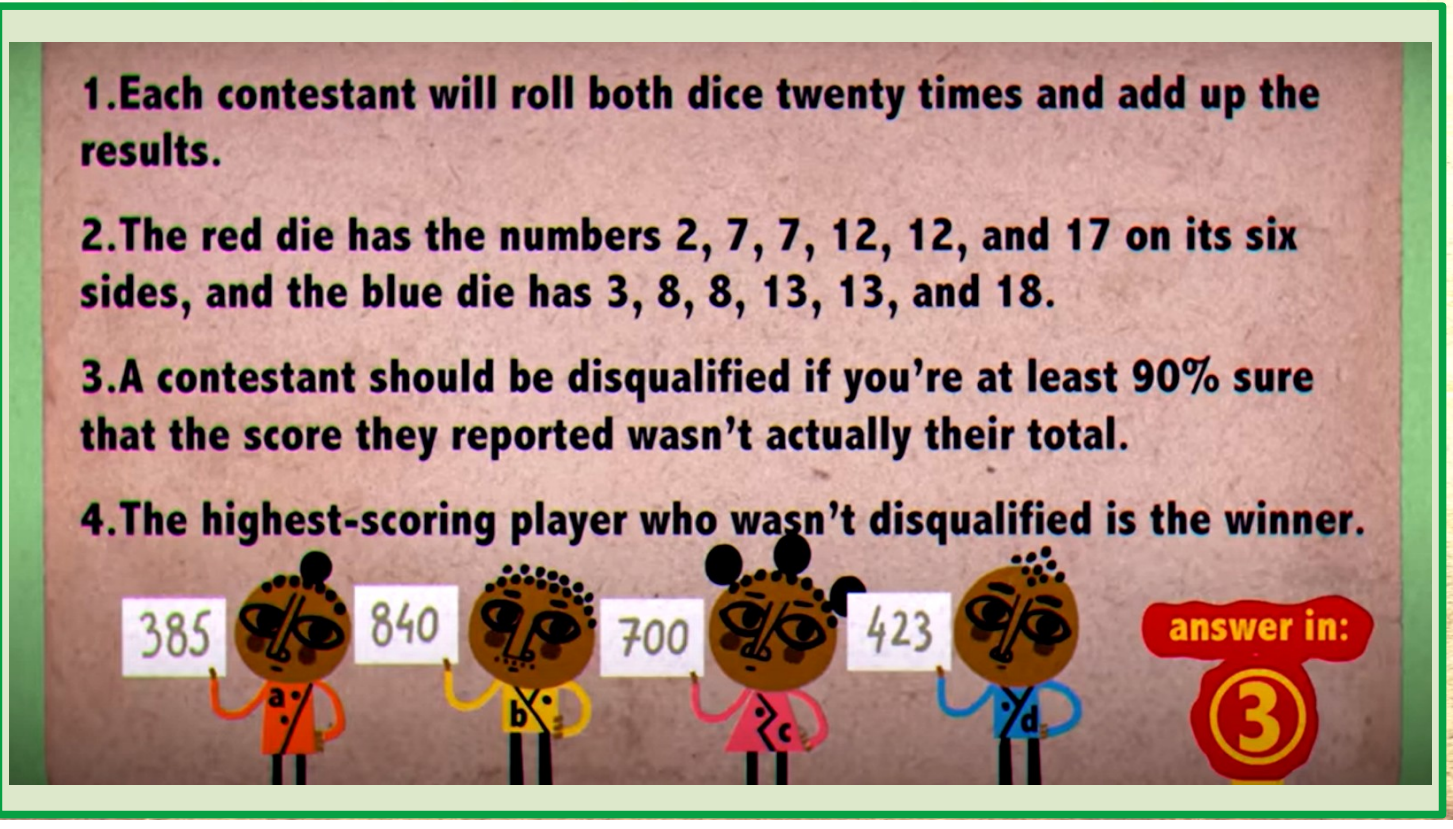
3. To check your answer, watch the video from 01:57 to 05:09. Can you explain in each case why most of the contestants are disqualified?

4. Vocabulary.
How would you say...?

a. Les deux mêmes dés à six faces: ……
b. Chaque face a autant de chances de sortir : ……
c. Ils jettent les deux dés vingt fois : ……
d. Ajouter quelque chose à : ……
e. Dix-sept plus dix-huit égale : ……
f. Le résultat le plus élevé qu'il est possible d'obtenir est : ……
g. La probabilité est d'un sur six puissance 40 : ……
h. 7,5 milliards au carré : ……
i. au hasard : ……

5. Phonetics.
Where would you stress: thirteen, seventeen, eighteen?
And: twenty, thirty, seventy, eighty?

Science (Or) Fiction : The Science Behind Fiction



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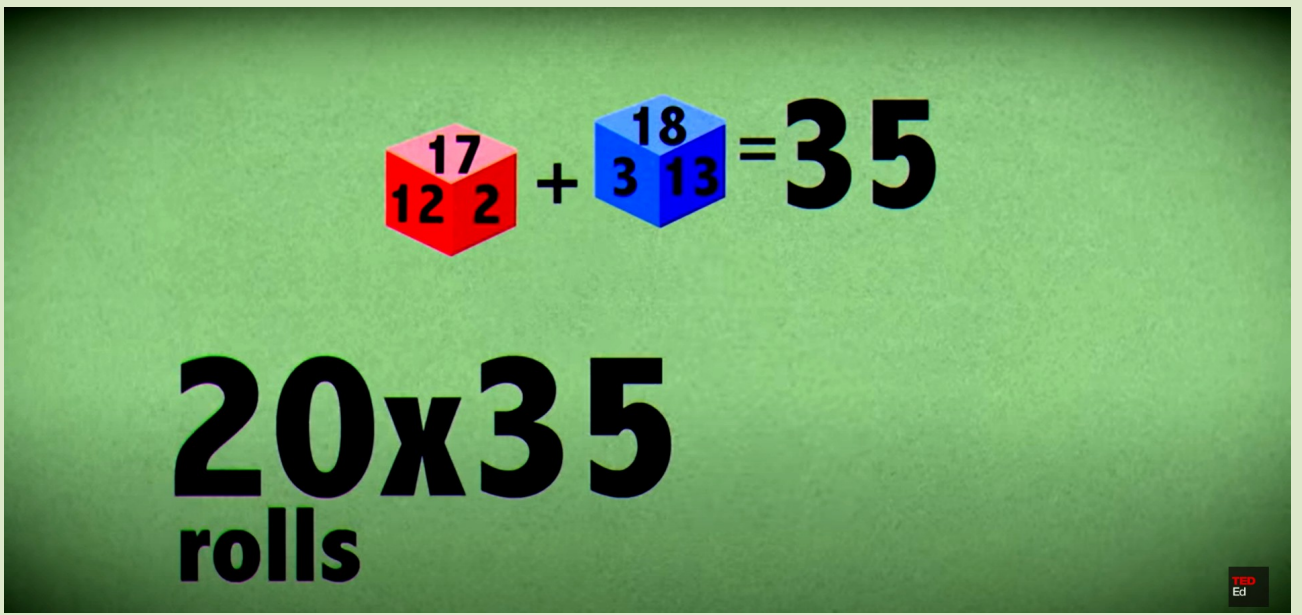

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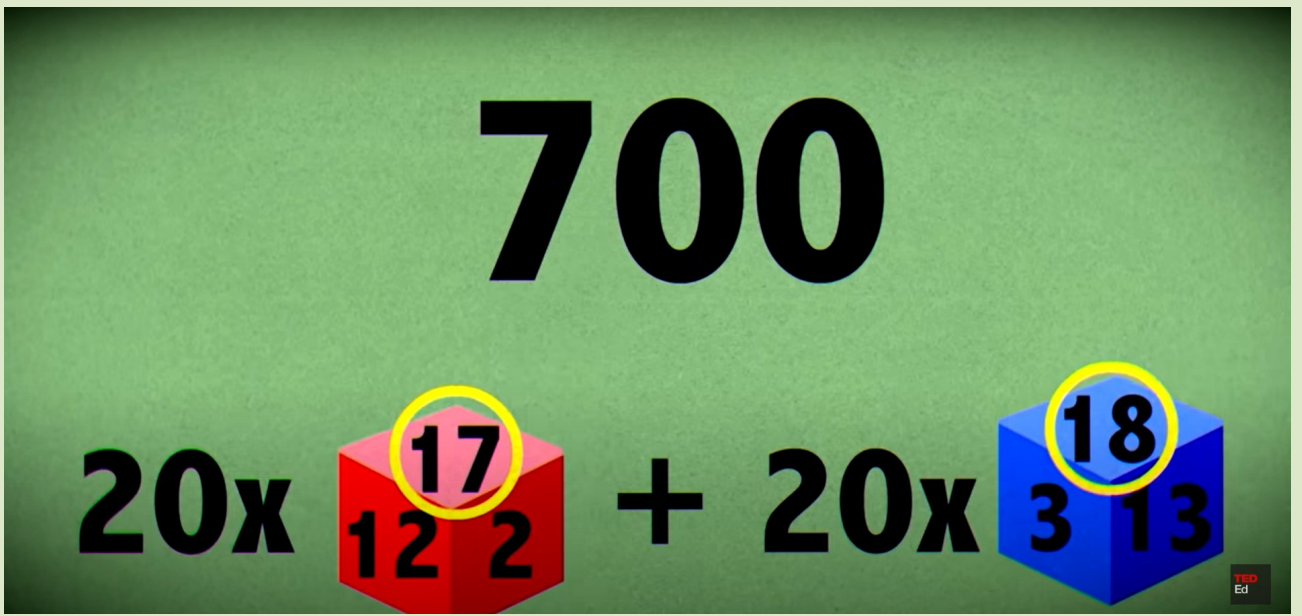

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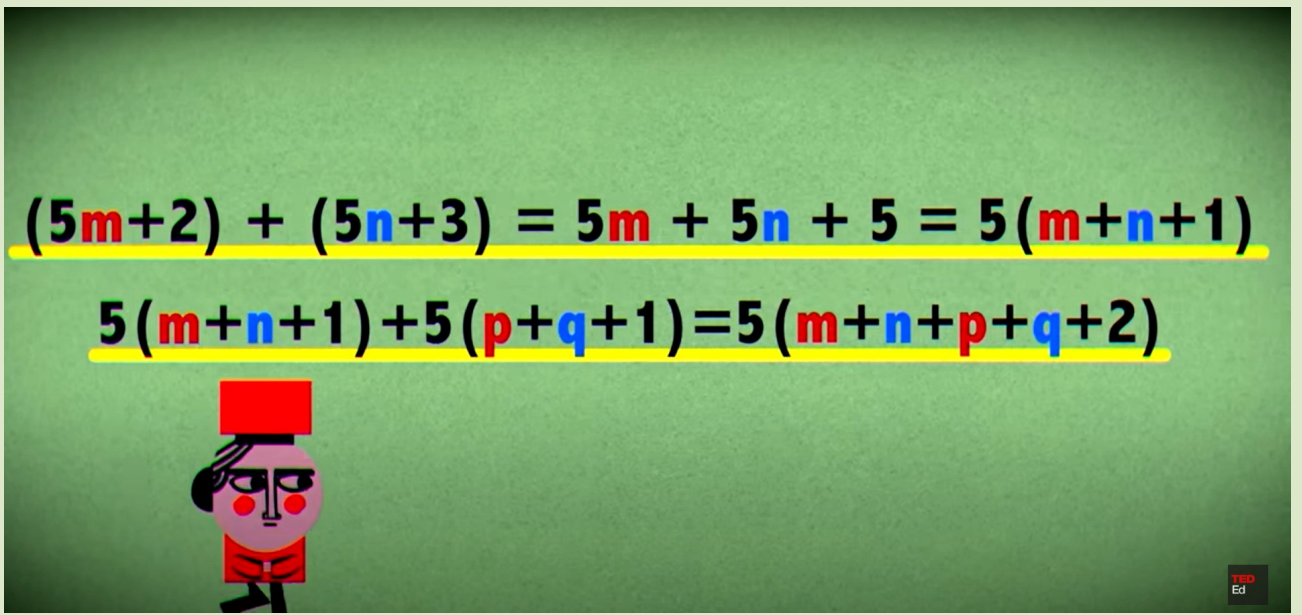

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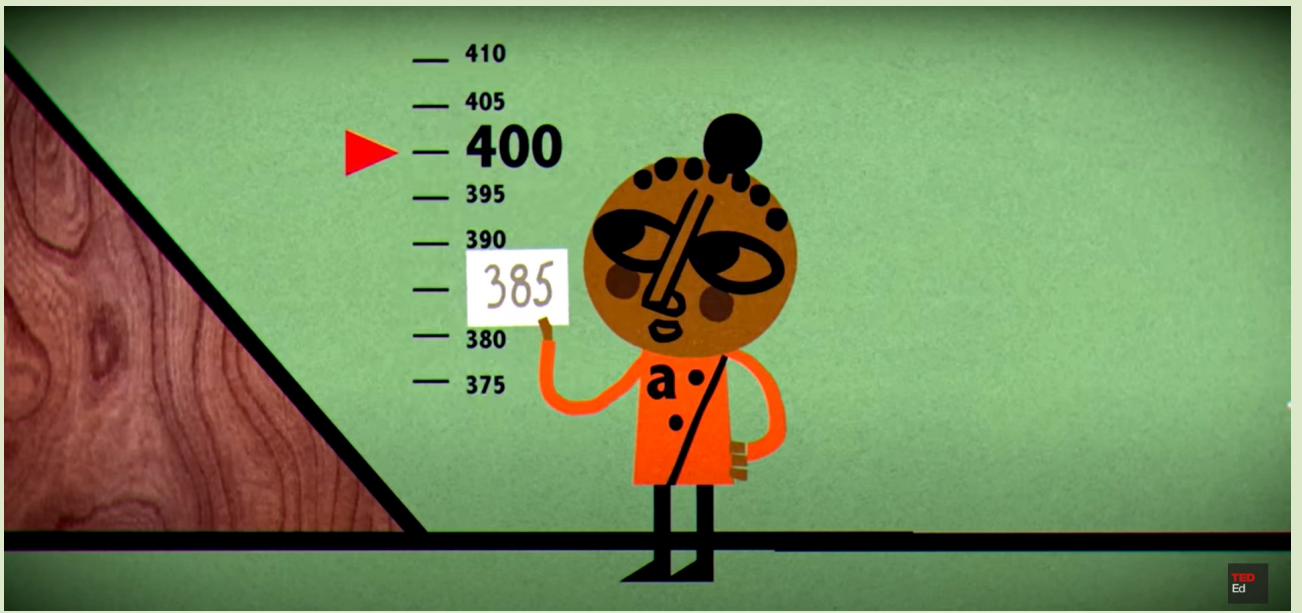

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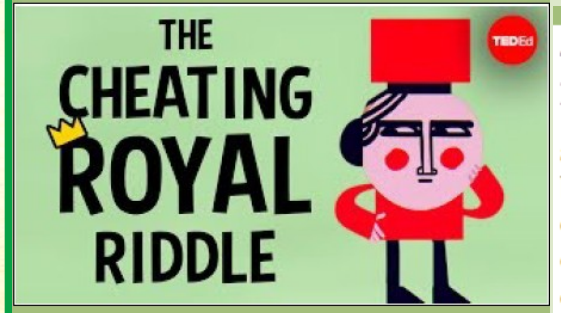

4. Vocabulary.

How would you say...?

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b. Chaque face a autant de chances de sortir : .....
c. Ils jettent les deux dés vingt fois : .....
d. Ajouter quelque chose à : .....
e. Dix-sept plus dix-huit égale : .....
f. Le résultat le plus élevé qu'il est possible d'obtenir est : .....
g. La probabilité est d'un sur six puissance 40 : .....
h. 7,5 milliards au carré : .....
i. au hasard : .....

5. Phonetics.

Where would you stress: thirteen, seventeen, eighteen?

And: twenty, thirty, seventy, eighty?

Science (Or) Fiction : The Science Behind Fiction

4. Vocabulary.

How would you say…?

a. Les deux mêmes dés à six faces: the same two six-sided dice
b. Chaque face a autant de chances de sortir : each side is equally likely to come up
c. Ils jettent les deux dés vingt fois : they roll both dice twenty times
d. Ajouter quelque chose à : to add something to
e. Dix-sept plus dix-huit égale : seventeen plus eighteen is/equals/is equal to (moins: minus)
f. Le résultat le plus élevé qu'il est possible d'obtenir est : the greatest possible result is
g. La probabilité est d'un sur six puissance 40 : the probability is one over six to the fortieth power
h. 7,5 milliards au carré : seven point five billion squared
i. au hasard : randomly, at random (par hasard: by chance)

5. Phonetics.

Where would you stress: thirteen, seventeen, eighteen?

And: twenty, thirty, seventy, eighty?

Science (Or) Fiction : The Science Behind Fiction

Journal of Physics Special Topics

A2_9

D.A. Marshall, T.O. Hands, I. Griffiths, G. Douglas

Department of Physics and Astronomy, University of Leicester. Leicester, LE1 7RH.

December 9, 2011

Abstract

Introduction

In the film *Batman Begins*, Batman can glide from tall buildings using his 'memory cloth' cape, which becomes rigid when a current is passed through it [1]. This method of gliding is similar to that used by base jumpers with wingsuits, where the wingsuit acts as an aerofoil to create a horizontal force propelling the base jumper forwards [2].

This paper analyses whether Batman could generate enough lift to glide successfully.

Theory

The forces acting on a skydiver travelling with a velocity v are shown in Fig. 1. The drag and lift forces acting on the skydiver in the x and y directions are therefore

$$D_x = D\cos\theta \quad (1)$$
$$D_y = D\sin\theta \quad (2)$$
$$L_x = L\cos(\pi/2-\theta) = L\sin\theta \quad (3)$$
$$L_y = L\sin(\pi/2-\theta) = L\cos\theta \quad (4)$$

where L and D are the magnitudes of the lift and drag forces respectively. The forces acting on the skydiver in the horizontal (x) and vertical (y) directions are then

$$F_x = L\sin\theta - D\cos\theta \quad (5)$$
$$F_y = mg - L\cos\theta - D\sin\theta. \quad (6)$$

Lift and drag are given by (see [3] and [4])

$$L = \frac{1}{2}C_L\rho A v^2 \quad (7)$$
$$D = \frac{1}{2}C_D\rho A v^2 \quad (8)$$

where C_L and C_D are the lift and drag coefficients, ρ is air density and A is the wing area. Assuming that the angle of the skydiver with respect to the direction they are travelling remains constant, as shown in Fig. 2, C_L and C_D will be constant.

Given that the horizontal and vertical velocities can be expressed as $v_x = v\sin\theta$ and $v_y = v\cos\theta$, the equations above can then be used to give the acceleration a

Fig. 1: Forces acting on a skydiver. The solid lines indicate forces while the dotted lines indicate the skydiver's direction of motion and the horizon. **L**, **D** and $m\mathbf{g}$ are the lift, drag and gravitational forces respectively, where m is the mass of the skydiver and $\mathbf{g} = 9.81\,\mathrm{ms}^{-2}$ is acceleration due to gravity. The skydiver is travelling at an angle θ to the horizon.

Fig. 2: Batman gliding at a constant angle with respect to his direction of travel.

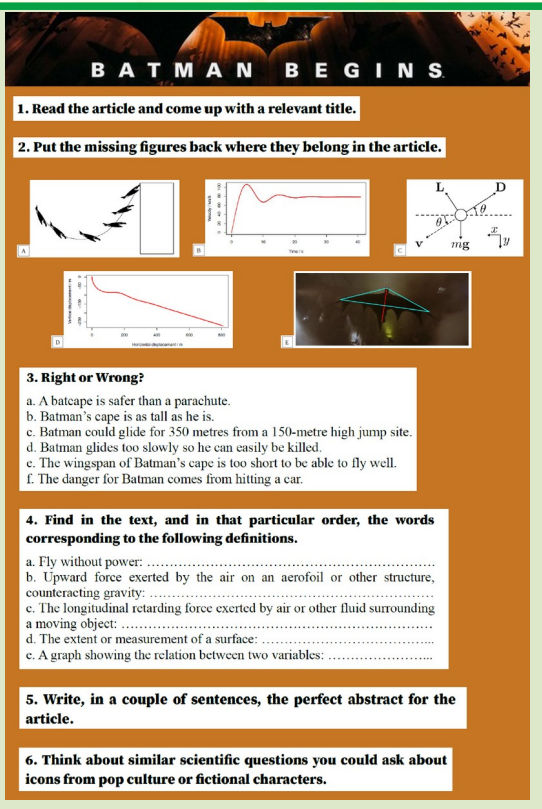
of the skydiver in the x and y directions

$$a_x = \frac{\rho A}{2m}v(C_L v_y - C_D v_x) \quad (9)$$
$$a_y = g - \frac{\rho A}{2m}v(C_L v_x + C_D v_y) \quad (10)$$

where $v = \sqrt{v_x^2 + v_y^2}$.

The glide of Batman

The path of Batman as he glides from the top of a building can be estimated by iteratively calculating the x and y components of the acceleration at each point, which are then added to the velocity components in the next



Science (Or) Fiction : The Science Behind Fiction

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The path of Batman as he glides from the top of a building can be estimated by iteratively calculating the x and y components of the acceleration at each point, which are then added to the velocity components in the next

7. Discuss with your partner.
Which super power would you want and why?

Super power	How useful?	What would you do with this power?
Ability to fly		
X-ray vision		
Read minds		
Turn into anything		
Superhuman strength		
Hypnosis		

8. Grammar exercise.
Let's pay attention to the expression of movement in English.

Ex.: "A current is passed through it." (> traverser)
"Batman can glide to a distance of about 350m." (> parcourir en vol plané)

Traduction du mouvement

La tendance de l'anglais à concrétiser et à clarifier ce que le français décrit de façon plus abstraite a pour conséquence un très large choix de verbes exprimant une façon de se déplacer. L'anglais dispose par ailleurs de particules adverbiales qui permettent de renforcer ou de préciser le mouvement décrit par le verbe. Il est donc essentiel en thème de :

– choisir le **verbe exact** qui convient ;
Il remua l'index *en ma direction. He wiggled his finger at me.*

– penser à **ajouter un verbe de mouvement / position** dans certaines phrases ;
Elle attendait à l'arrêt de bus. *She stood waiting at the bus stop.*
Il descendit la route en courant. *He came running down the road.*
Les femmes tricotaient au salon. *The women sat knitting in the sitting room.*

– penser à utiliser des **particules adverbiales**, qui sont essentielles en anglais pour décrire un mouvement.
Lorsqu'on traduit, il est alors nécessaire, dans la plupart des cas, d'effectuer un chassé-croisé c'est-à-dire une double transposition.

Il sortit du pub en titubant.
He staggered out of the pub.
She shuffled along, leaning on her walking stick.
Elle avançait d'un pas traînant, appuyée sur sa canne.

Adapté depuis In So Many Words *de Françoise Grellet*

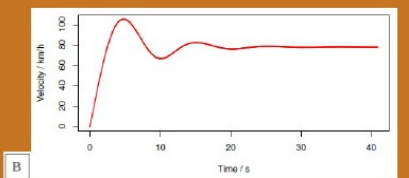
Translate the following sentences paying particular attention to the choice of the verb.

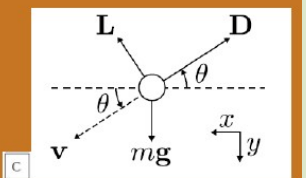
1. Il but d'un trait le café brûlant. .....
2. Elle jaillit de derrière l'armoire pour me faire peur. .....
3. Les danseurs tourbillonnaient (= *to whirl*). .....
4. Il se baissa et attrapa le journal. .....

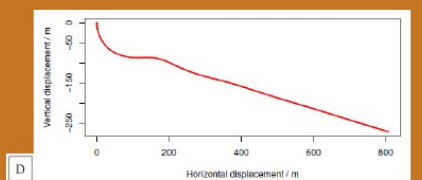
Science (Or) Fiction : The Science Behind Fiction

1. Read the article and come up with a relevant title.

2. Put the missing figures back where they belong in the article.







Science (Or) Fiction : The Science Behind Fiction

1. Read the article and come up with a relevant title.

A2_9 Trajectory of a falling Batman

2. Put the missing figures back where they belong in the article.

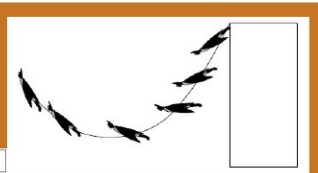


Figure 2

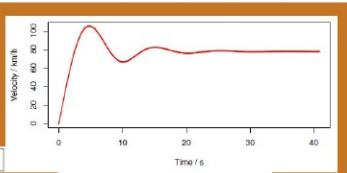


Figure 5

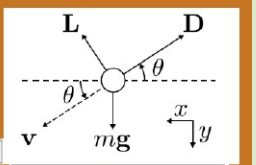


Figure 1

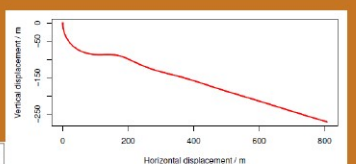


Figure 4

Figure 3

Science (Or) Fiction : The Science Behind Fiction

3. Right or Wrong?

a. A batcape is safer than a parachute.
b. Batman's cape is as tall as he is.
c. Batman could glide for 350 metres from a 150-metre high jump site.
d. Batman glides too slowly so he can easily be killed.
e. The wingspan of Batman's cape is too short to be able to fly well.
f. The danger for Batman comes from hitting a car.

4. Find in the text, and in that particular order, the words corresponding to the following definitions.

a. Fly without power: .....
b. Upward force exerted by the air on an aerofoil or other structure, counteracting gravity: .....
c. The longitudinal retarding force exerted by air or other fluid surrounding a moving object: .....
d. The extent or measurement of a surface: .....
e. A graph showing the relation between two variables: .....

5. Write, in a couple of sentences, the perfect abstract for the article.

Science (Or) Fiction : The Science Behind Fiction

3. Right or Wrong?

a. A batcape is safer than a parachute. Wrong
b. Batman's cape is as tall as he is. Wrong
c. Batman could glide for 350 metres from a 150-metre high jump site. Right
d. Batman glides too slowly so he can easily be killed. Wrong
e. The wingspan of Batman's cape is too short to be able to fly well. Right
f. The danger for Batman comes from hitting a car. Wrong

4. Find in the text, and in that particular order, the words corresponding to the following definitions.

a. Fly without power: to glide
b. Upward force exerted by the air on an aerofoil or other structure, counteracting gravity: lift
c. The longitudinal retarding force exerted by air or other fluid surrounding a moving object: drag
d. The extent or measurement of a surface: area
e. A graph showing the relation between two variables: plot

5. Write, in a couple of sentences, the perfect abstract for the article.

Abstract
The film *Batman Begins* shows the character of Batman gliding using a rigid form of his cape. This paper assesses the feasibility of such a glide and finds that while a reasonable distance could be travelled if gliding from a tall building, the speed at which Batman would be travelling would be too dangerous to stop without some method of slowing down.

Science (Or) Fiction : The Science Behind Fiction

8. Grammar exercise.

Let's pay attention to the expression of movement in English.

Ex.: "A current is passed through it." (> traverser)

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La tendance de l'anglais à concrétiser et à clarifier ce que le français décrit de façon plus abstraite a pour conséquence un très large choix de verbes exprimant une façon de se déplacer. L'anglais dispose par ailleurs de particules adverbiales qui permettent de renforcer ou de préciser le mouvement décrit par le verbe. Il est donc essentiel en thème de :

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Il remua l'index en ma direction. *He wiggled his finger at me.*

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– penser à utiliser des **particules adverbiales**, qui sont essentielles en anglais pour décrire un mouvement.

Lorsqu'on traduit, il est alors nécessaire, dans la plupart des cas, d'effectuer un chassé-croisé c'est-à-dire une double transposition.

Il sortit du pub en titubant.

He staggered out of the pub.

She shuffled along, leaning on her walking stick.

Elle avançait d'un pas traînant, appuyée sur sa canne.

Adapté depuis In So Many Words *de Françoise Grellet*

Translate the following sentences paying particular attention to the choice of the verb.

1. Il but d'un trait le café brûlant. .....
2. Elle jaillit de derrière l'armoire pour me faire peur. .....
3. Les danseurs tourbillonnaient (= *to whirl*). .....
4. Il se baissa et attrapa le journal. .....

Science (Or) Fiction : The Science Behind Fiction

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Adapté depuis In So Many Words *de Françoise Grellet*

Translate the following sentences paying particular attention to the choice of the verb.

1. Il but d'un trait le café brûlant. He gulped down the scalding coffee.
2. Elle jaillit de derrière l'armoire pour me faire peur. She jumped out from behind the wardrobe to frighten me.
3. Les danseurs tourbillonnaient (= *to whirl*). The dancers were whirling round.
4. Il se baissa et attrapa le journal. He bent down and picked up the newspaper.

Science (Or) Fiction : The Science Behind Fiction

Numbers in English

A. CARDINAL NUMBERS

640 = six hundred **and** forty

7, 060 = seven thousand **and** sixty

3,935 = three thousand, nine hundred **and** thirty-five

£3,000,000 = three million **pounds**

B. DATES

03/02/1980: **the** third **of** February, nineteen eighty (**British** format)

08/05/ 2010: the **fifth** of August, two thousand and ten / twenty ten (**American** format)

1903: nineteen **oh** three / nineteen hundred **and** three

C. FRACTIONS AND DECIMALS

½ kilo: **half a** kilo ≠ 1 ½ kilo: **one and a half** kilo

1/3: a third ; ¼ a quarter

1.25: one point two five

2.66: two point six six

5.753: five point seven five three

D. ARITHMETIC

+ = addition ex: 6 + 4 = 10 (six **plus**/and four **equals /is** ten)

- = substraction ex 6-4 = 2 (six **minus** four **equals /is** two)

X = multiplication ex: 6 X 4 = 24 (six **times / multiplied by** four **equals /is** twenty-four)

/ **=** division ex: 4/2 = 2 (four **divided by** two **equals /is** two)

E. SAYING '0'

- In a tel number ex 0238494452: **oh** two three eight four nine **double four** five two (GB) / **zero** two three eight four nine **four four** five two (US).
- In maths: 0.7 **nought point** seven (GB) or **point** seven (GB)
  6.08 six **point oh** eight (GB) / six **point zero** eight (US)
- In temperatures: - 10 degrees ten degrees **below zero** / **minus** ten degrees

F. TALKING NUMBERS

- 1,3,5,7 etc. are **odd** numbers
- 2, 4, 6, 8 etc. are **even** numbers
- I got 16/20 in my English test: 16/20 = sixteen **out of** twenty