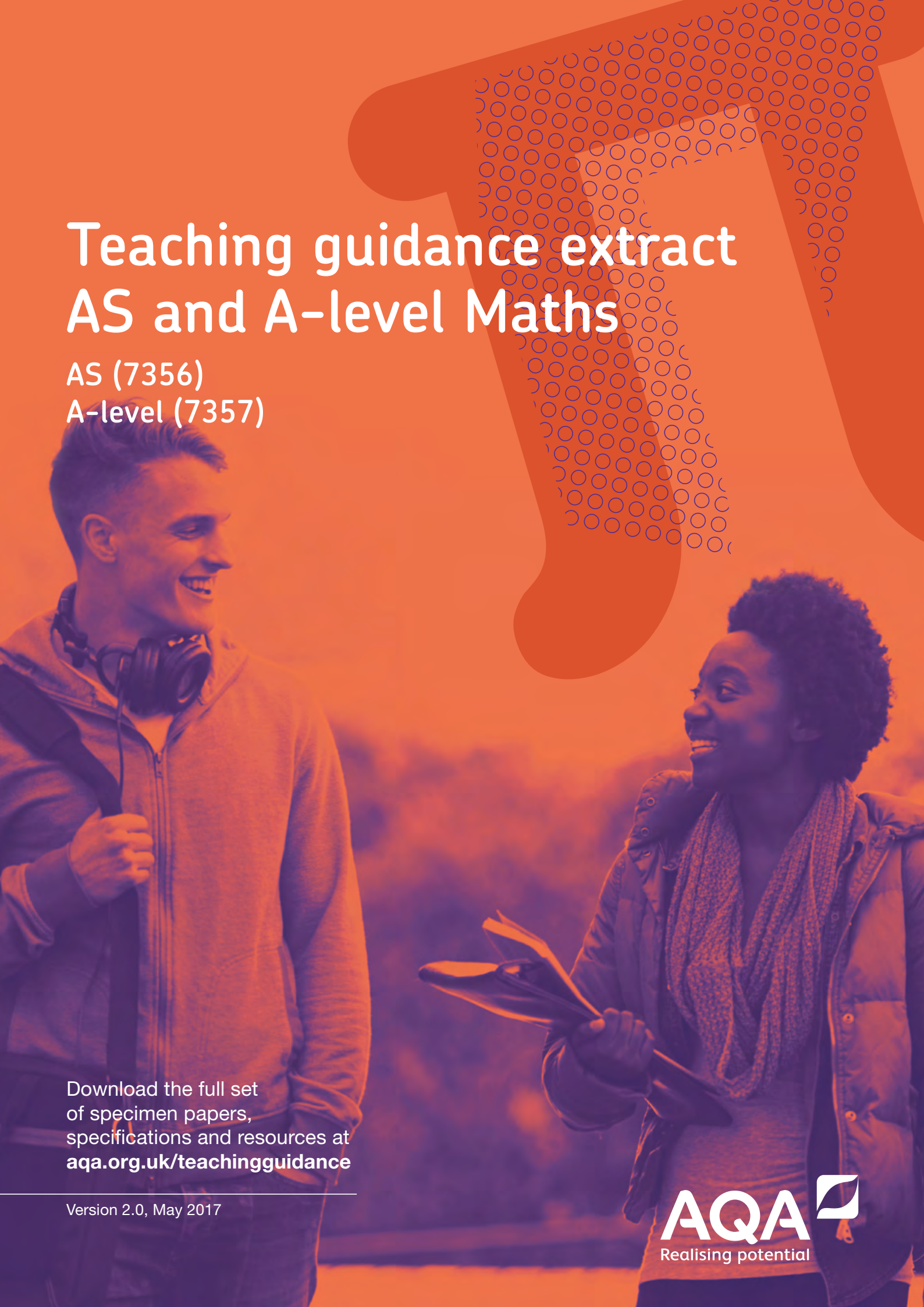
Teaching guidance extract AS and A-level Maths

AS (7356)
A-level (7357)



Download the full set of specimen papers, specifications and resources at **aqa.org.uk/teachingguidance**

Version 2.0, May 2017

AQA
Realising potential

Contents

This is an extract from the *A-level Maths Teaching guidance* document.

The *Teaching guidance* is a new resource for AS and A-level Maths. It is designed to help you plan by clarifying how we have interpreted the specification content and provides example questions to show how content may be assessed.

It has been written to accompany the specification and is an essential tool for planning your teaching.

The full version of the *AS and A-level Maths Teaching guidance* will be available to download from our All About Maths website: allaboutmaths.aqa.org.uk

Subject content

The content for A-level Maths is 100% prescribed by the Department for Education (DfE).
This is common across all exam boards. This document is designed to illustrate the detail within the content defined by the DfE.

- Content required for AS Maths is shown in **bold** text.
- Content required for A-level Maths only is shown in standard text.

Disclaimer

The Teaching guidance notes further explain how we have interpreted the content of the specification. The Teaching guidance notes do not always cover the whole content statement.

This document is not, in any way, intended to restrict what can be assessed in the question papers based on the specification.

Questions will be set in a variety of formats including both familiar and unfamiliar contexts.

Examples given in this Teaching guidance extract illustrate the type of questions which may be asked on a question paper, although, the examples given are not exhaustive of how content might be assessed.

The wording and format used in this guidance do not always represent how questions would appear in a question paper. The guidance contains examples from past AQA question papers and includes new written examples. New examples that are evident in this guidance have not been through the same rigorous checking process used in our live examination question papers.

The Teaching guidance may be updated periodically to improve the clarity or correct any errors. The specification should always be used as the single document that covers the subject content. The definitive version of our specification will always be the one on our website, this may differ from printed versions.

Teaching guidance explained

The *AS and A-level Maths Teaching guidance* has been written to accompany the specification and help you to plan your teaching.

The specification content, as defined by the DfE, is set out in the section headers

Content in bold type is assessed at AS and A-level

Content in standard type is assessed at A-level only

The teaching guidance notes clarify how we have interpreted the specification content and explain what students should be able to do to meet the requirements of the topic

B6

Manipulate polynomials algebraically, including expanding brackets and collecting like terms, factorisation and simple algebraic division; use of the factor theorem.

Simplify rational expressions including by factorising and cancelling, and algebraic division (by linear expressions only).

Assessed at AS and A-level

Teaching guidance

Students should be able to:

- manipulate polynomials, which may be embedded in questions focused on other topics
- understand factorisation and division applied to a quadratic or a cubic polynomial divided by a linear term of the form $(x + a)$ where a is an integer.

Notes: any correct method will be accepted, eg by inspection, by equating coefficients or by formal division.

The greatest level of difficulty is exemplified by $x^3 - 5x^2 + 7x - 3$, ie a cubic always with a factor $(x + a)$ or, where a is a small whole number but including the cases of three distinct linear factors, repeated linear factors or a quadratic factor which cannot be factorised in the real numbers.

The example questions demonstrate how content may be assessed

Examples

1 Find $\int (2x+1)(x^2-x+2)\,dx$

2 The polynomial $p(x)$ is given by $p(x) = x^3 + 7x^2 + 7x - 15$

(a) Use the Factor Theorem to show that $x + 3$ is a factor of $p(x)$

(b) Express $p(x)$ as the product of three linear factors.

3 The polynomial $p(x)$ is given by $p(x) = x^3 + x - 10$

(a) Use the Factor Theorem to show that $x - 2$ is a factor of $p(x)$

(b) Express $p(x)$ in the form $(x - 2)(x^2 + ax + b)$ where a and b are constants.

The guidance and questions are split into two sections: content that is assessed at AS and A-level and content that is assessed at A-level only

Only assessed at A-level

Teaching guidance

Students should be able to:

- understand Factor Theorem where the divisor is of the form $(ax + b)$
- simplify rational expressions
- carry out algebraic division where the divisor is of the form $(ax + b)$.

Additional notes provide further guidance when necessary

Note: any correct method will be accepted, eg by inspection, by equating coefficients or by formal division.

Examples

1 Express $\dfrac{3x^3 + 8x^2 - 3x - 5}{3x - 1}$ in the form $ax^2 + bx + \dfrac{c}{3x-1}$

where a, b and c are integers.

2 The polynomial $f(x)$ is defined by $f(x) = 4x^3 - 7x - 3$

(a) Find $f(-1)$

(b) Use the Factor Theorem to show that $2x + 1$ is a factor of $f(x)$

(c) Simplify the algebraic fraction $\dfrac{4x^3 - 7x - 3}{2x^2 + 3x + 1}$

Pure maths extract

E9

Use trigonometric functions to solve problems in context, including problems involving vectors, kinematics and forces.

Only assessed at A-level

Teaching guidance

Students should be able to:

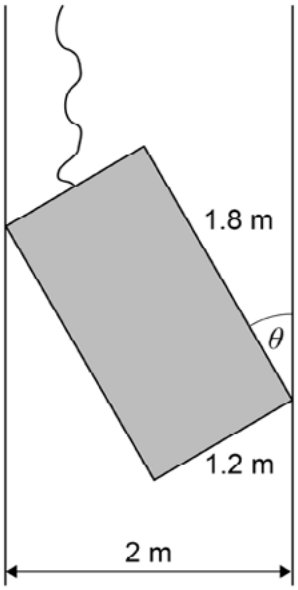
- solve problems using any of the techniques from sections E1 to E8 on their own or in combination.
- select for themselves the appropriate technique for solving a problem.

Examples

1 A crane is lowering a heavy crate down a mine shaft when the crate scrapes the side of the mine shaft, twists and becomes stuck.

The mine shaft has a width of 2 metres and the crate is 1.8 metres tall by 1.2 metres wide.

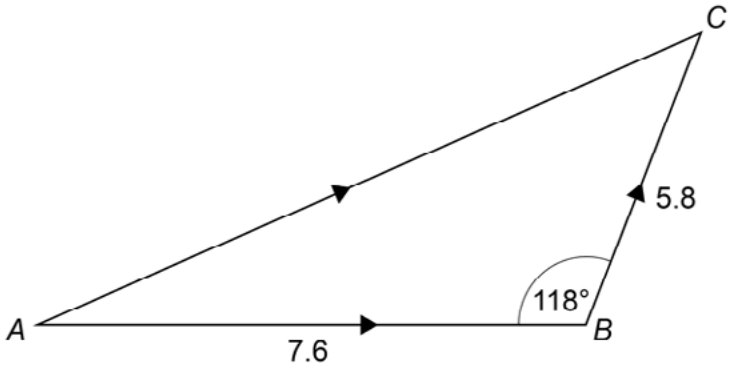
The angle between the wall of the mine shaft and the side of the crate is θ, as shown in the diagram.



(a) Show that $9\sin\theta + 6\cos\theta = 10$

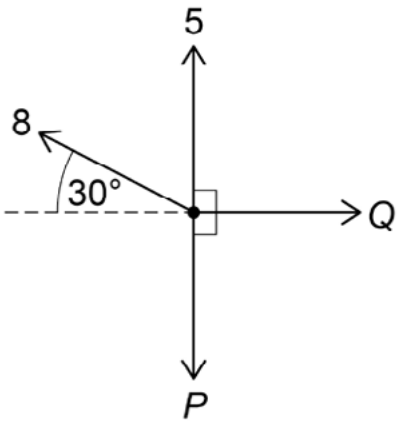
(b) Hence find the value of θ

2 Two vectors $\overrightarrow{AB}$ and $\overrightarrow{BC}$ have magnitude 7.6 units and 5.8 units respectively and the obtuse angle between the vectors is 118°, as shown in the diagram:



Find the magnitude of the vector $\overrightarrow{AC}$.

3 A particle is in equilibrium under the action of four horizontal forces of magnitudes 5 newtons, 8 newtons, P newtons and Q newtons, as shown in the diagram:



(a) Show that $P = 9$.

(b) Find the value of Q.

Note: A-level students should be encouraged to apply their mathematical thinking to problem solving and modelling from the first day of teaching.

Mechanics extract

R5 Understand and use addition of forces; resultant forces; dynamics for motion in a plane.

Only assessed at A-level

Teaching guidance

Students should be able to:

- find resultants by use of a vector diagram or resolving into perpendicular components.

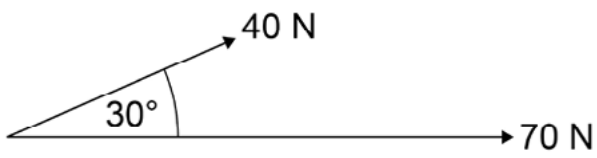
  Note: unless specifically stated in the question, any appropriate method for finding the resultant is acceptable.

- use $F = ma$ in the form $F = m\frac{\mathrm{d}v}{\mathrm{d}t}$ to set up and solve a differential equation.

  Note: mass will be constant.

Examples

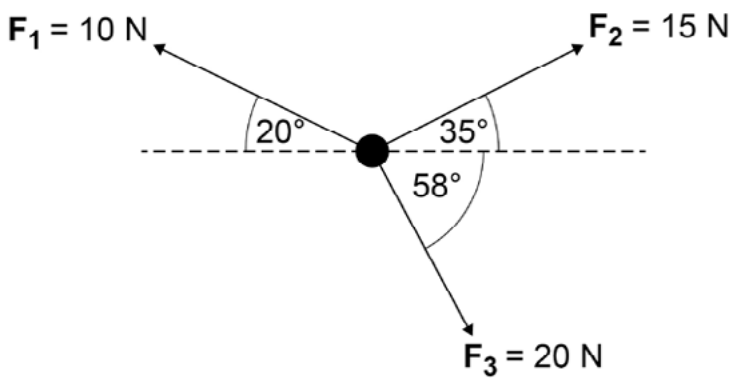
1 Two forces, acting at a point, have magnitudes of 40 newtons and 70 newtons. The angle between the two forces is 30°, as shown in the diagram.



(a) Find the magnitude of the resultant of these two forces.

(b) Find the angle between the resultant force and the 70 newton force.

2 Three forces $\mathbf{F}_1$, $\mathbf{F}_2$ and $\mathbf{F}_3$ act on a particle of mass 1.5 kg, as shown in the diagram.



Find the magnitude and direction of the acceleration of the particle.

3 **In this question use $g = 9.8$ m s^{-2}, giving your final answers to an appropriate degree of accuracy.**

Vicky has mass 65 kg and is skydiving. She steps out of a helicopter and falls vertically. She then waits a short period of time before opening her parachute. The parachute opens at time $t = 0$ when her speed is 19.6 m s^{-1}. She then experiences an air resistance force of magnitude $260v$ newtons, where v m s^{-1} is her speed at time t seconds.

(a) When $t > 0$:

(i) Show that the resultant downward force acting on Vicky is $65(9.8 - 4v)$ newtons.

(ii) Show that $\frac{dv}{dt} = 4(v - 2.45)$

(b) By showing that

$$\int \frac{1}{v - 2.45}\,dv = -\int 4\,dt$$

find v in terms of t.

Statistics extract

L3

Interpret measures of central tendency and variation, extending to standard deviation.

Be able to calculate standard deviation, including from summary statistics.

Assessed at AS and A-level

Teaching guidance

Students should be able to:

- find the mean, median, mode, range, quartiles and interquartile range from data given in graphical or tabular form.
- interpret values of the mean, median and mode.
- calculate standard deviation (or variance) using a calculator or from summary statistics of the form $\sum x$, $\sum x^2$ or $\sum (x-\bar{x})^2$

  Note: it is advisable for students to know whether to divide by n or $(n-1)$ when calculating either the variance of a population or an estimate for the population from a sample data. However, either divisor will be accepted **unless** a question specifically requests an unbiased estimate of a population variance.

Examples

1 The runs scored by a cricketer in 11 innings during the 2006 season were as follows.

47 63 0 28 40 51 a 77 0 13 35

The exact value of a was unknown but it was greater than 100.

(a) Calculate the median and the interquartile range of these 11 values.

(b) Give a reason why, for these 11 values:

(i) the mode is **not** an appropriate measure of average

(ii) the range is **not** an appropriate measure of spread.

2 The weight of fat in a digestive biscuit is known to be normally distributed.

Pat conducted an experiment in which she measured the weight of fat, x grams, in each of a random sample of 10 digestive biscuits, with the following results:

$$\sum x = 31.9 \text{ and } \sum (x - \bar{x})^2 = 1.849$$

Use this information to calculate estimates of the mean and standard deviation of digestive biscuits.

3 The time, in seconds, taken by 20 people to solve a simple numerical puzzle were

17	19	22	26	28	31	34	36	38	39
41	42	43	47	50	51	53	55	57	58

(a) Calculate the mean and the standard deviation of these times.

(b) In fact, 23 people solved the puzzle. However, three of them failed to solve it within the allotted time of 60 seconds.

Calculate the median and the interquartile range of the times taken by all 23 people.

(c) For the times taken by all 23 people, explain why:

(i) the mode is **not** an appropriate numerical measure.

(ii) the range is **not** an appropriate numerical measure.

Note: a question in such a context may ask students to find values of possible measures of central tendency and spread for a given set of data, and to critically assess which of these best represent the data.

Why teach with AQA?

1. Student friendly mark schemes that reward mathematical understanding

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3. Helping students prepare for higher education (HE)

We've been working with HE representatives for leading UK universities since 2012, to make sure our qualifications create a smooth transition for students, if that's their chosen route.

Need help? Any questions? Get in touch

Get in touch with us if you have any questions about the new specifications.

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