AQA Qualifications

GCSE

METHODS IN MATHEMATICS

Linked Pair Pilot Specification (9365)

Assessment Guidance

Our specification is published on our website (www.aqa.org.uk). We will let centres know in writing about any changes to the specification. We will also publish changes on our website. The definitive version of our specification will always be the one on our website, this may differ from printed versions.

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The GCSE Mathematics Department
AQA
Devas Street
Manchester
M16 6EX

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Contents

Methods in mathematics

M1.N.9 and 9h Understand and use the relationship between ratio, fractions and decimal representations, including recurring and terminating decimals

Assessment Guidance

Candidates should be able to:

- convert from a rational number to a terminating or recurring decimal
- convert from a terminating or recurring decimal to a rational number

Notes

This will be assessed in Section B (non-calculator)

Examples

Foundation Tier

1 Write 0.3 and 0.6 as fractions

2 Write the recurring decimal 0.429 429 429 using recurring decimal notation.

3 Write as recurring decimals

(a) $\frac{1}{6}$

(b) $\frac{4}{11}$

4 Which one of $\frac{5}{6}$, $\frac{7}{8}$, and $\frac{9}{10}$ is a recurring decimal?

Show clearly how you made your decision.

Foundation and Higher

5 (a) Show that $\frac{5}{9}$ is equivalent to 0.555

(b) Use the answer to part a. to write the decimal 0.4555 as a fraction.

6 (a) The nth term of a sequence is given by

$$\frac{2n - 1}{n + 1}$$

The first two terms are $\frac{1}{2} = 0.5$ and $\frac{3}{3} = 1$

Show that the 6th term is the first term of the sequence that is not a terminating decimal.

Higher Tier

7 Express the recurring decimal $0.0\dot{7}\dot{2}$ as a fraction.

Give your answer in its simplest form.
You **must** show your working.

8 Show that the recurring decimal $0.6\dot{7} = \frac{61}{90}$

M1.A.6h Set up, and solve simultaneous equations in two unknowns where one of the equations might include squared terms in one or both unknowns

Assessment Guidance

Candidates should be able to:

- solve quadratic equations by factorisation
- solve simultaneous equations where one of them is linear and one is non-linear

Notes

The linear equation will be of the form $y = ax + b$ or $cx + dy = e$ where a, b, c, d and e are positive or negative integers and at least one of c or d will be 1.

The non-linear equation will be of the form $y = ax^2 + bx + c$ or $x^2 + y^2 = r$, where a and r are positive integers and b and c are positive or negative integers.

Example

1 Solve the simultaneous equations $2x + y = 5$ and $x^2 + y^2 = 10$

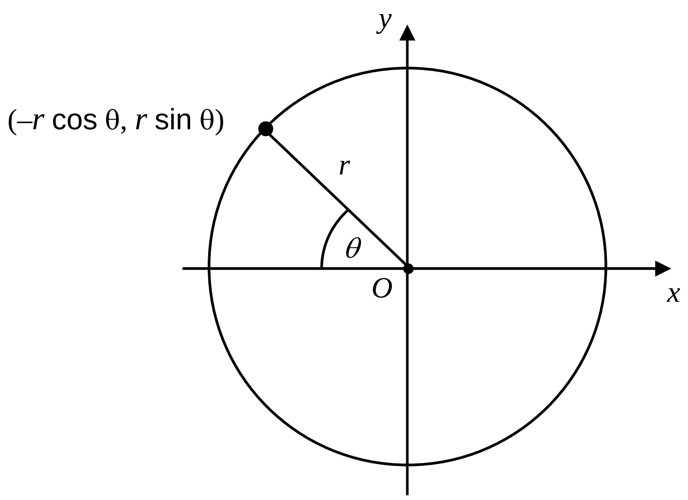
2 Solve the simultaneous equations $y = 3x - 1$ and $y = 2x^2 - 2x + 1$

M1.A.14h Understand and use the Cartesian equation of a circle centred at the origin and link to the trigonometric functions

Assessment Guidance

Candidates should be able to:

- know that $x^2 + y^2 = r^2$ is the equation of a circle centred at the origin with a radius of r
- know that the coordinate of any point on this circle will be of the form $(\pm r \cos \theta, \pm r \sin \theta)$, where θ is the angle between the line joining the point to the origin and the x axis



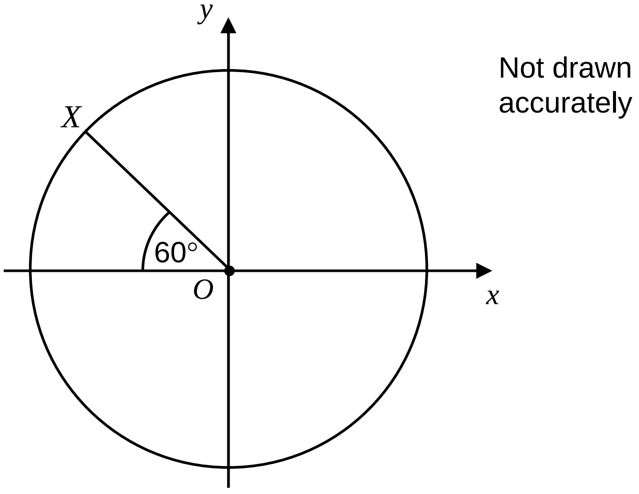
Notes

Candidates could use the convention of measuring the angle anti-clockwise from the positive x axis. Hence if this angle is called α, the coordinates will be $(r \cos \alpha, r \sin \alpha)$.

Example

The circle $x^2 + y^2 = 16$ is shown.

The point X is such that the angle between OX and the x-axis is 60°.



Work out the coordinates of the point X.

M1.P.6 Understand and use set notation to describe events and compound events

M1.P.7 Use Venn diagrams to represent the number of possibilities and hence find probabilities

Assessment Guidance

Candidates should be able to:

- understand that P(A) means the probability of event A
- understand that P(A') means the probability of **not** event A
- understand that $P(A \cup B)$ means the probability of event A or B
- understand that $P(A \cap B)$ means the probability of event A and B.
- understand a Venn diagram consisting of a universal set and at most two sets, which may or may not intersect.
- shade areas on a Venn diagram involving at most two sets which may or may not intersect.

Notes

The diagrams will be restricted to the universal set ξ and two sets.

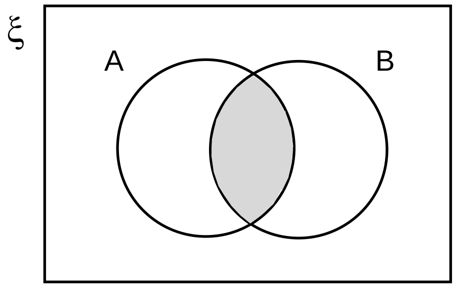
The symbol ξ should be known

Questions involving $P(A \cup B)$ and $P(A \cap B)$ will always be linked with a Venn diagram.

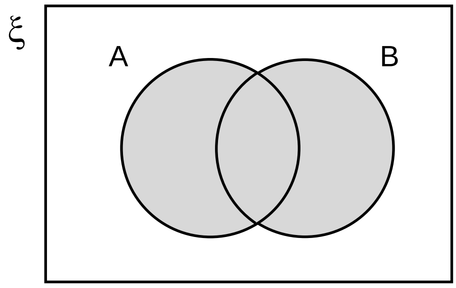
The addition law for probability will not be specifically required, but students should be able to understand and use probabilities, such as P(A) and P(A'), from the Venn diagram.

The two sets may be referred to as two capital letters, for example A and B.

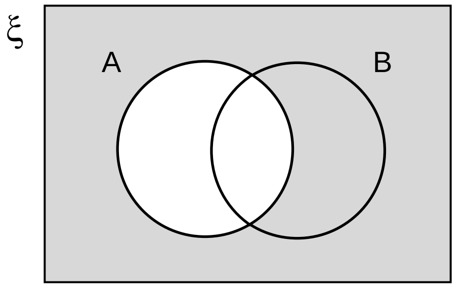
Candidates should know the following notations and the subsequent shaded area on the Venn diagram.



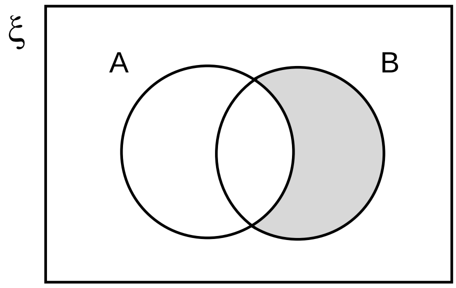
A ∩ B to mean the intersection of A and B.



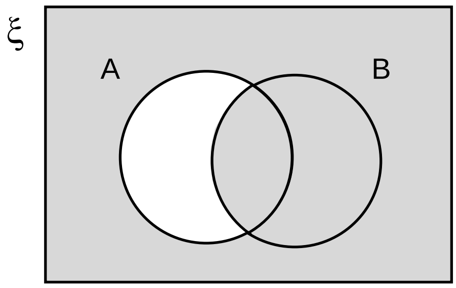
A ∪ B to mean the union of A and B.



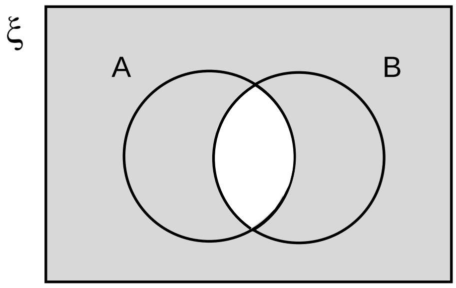
A’ to mean everything not in A



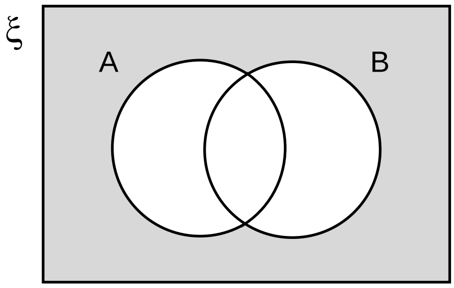
A’ ∩ B to mean everything not in A that is in B.



A’ ∪ B to mean the union of A’ and B.



(A ∩ B)’ = A’ ∪ B’ to mean everything not in the intersection.



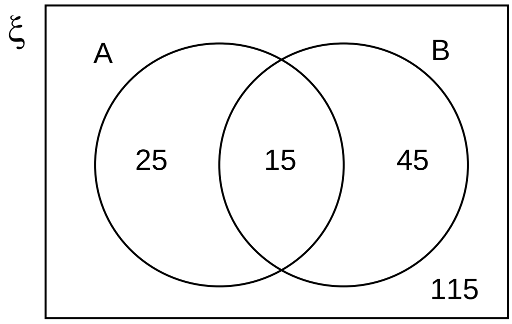
(A ∪ B)’ = A’ ∩ B’ to mean everything not in the union.

Examples

1 You are given that P(A) = 0.7

Work out P(A')

2 The Venn diagram shows the number of left handed students in a year group (set A) and the number of vegetarians in the same year group (set B)



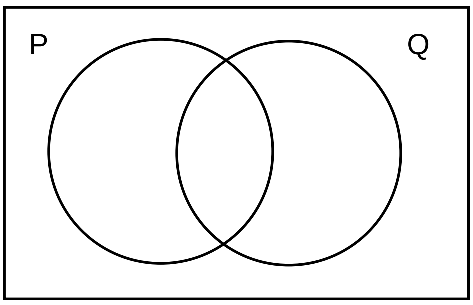
(a) How many students are in the year group altogether?

(b) Work out $P(A \cap B)$

(c) A student from the year group is chosen at random.

What is the probability that the student is a right-handed vegetarian?

3 On the Venn diagram shaded the area that represents $P' \cap Q$



M2.N.11 Understand and use Venn diagrams to solve problems

Assessment Guidance

Candidates should be able to:

- understand a Venn diagram consisting of a universal set and at most two sets, which may or may not intersect.
- solve problems given a Venn diagram.
- solve problems, where a Venn diagram approach is a suitable strategy to use but a diagram is not given in the question.

Notes

The symbol ξ should be known

Examples

1 A garage has 50 cars for sale.

16 of the cars have air conditioning and ABS brakes.
32 have air conditioning.
18 have ABS brakes.

Work out how many of the cars **do not** have air conditioning or ABS brakes.

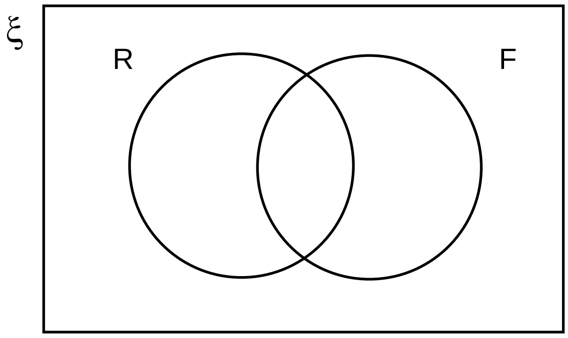
2 A running club has 120 members.

89 of the members take part in road races.
54 of the members take part in fell races.
17 members do not run in road or fell races.

Use this information to fill in the Venn diagram.

R represents those runners who run in Road races.

F represents those runners who run in Fell races.



M2.A.6h Form quadratic expressions to describe the nth term of a sequence

Assessment Guidance

Candidates should be able to:

- work out the nth term of a sequence that has an nth term of the form $an^2 + bn + c$ where a is a positive rational number and b and c are positive or negative rational numbers.

Notes

There are many methods for working out the nth term of a quadratic sequence.

Two common methods are:

Finding the second difference to get the coefficient of n^2 which is half of the second difference, then either:

Subtracting the square term once the second difference defines the coefficient and working out the nth term of the resulting linear sequence;

Working the differences 'backwards' to the term for $n = 0$ to give c and the term in $n = 1$ to get $a + b + c$.

Another method is to solve three simultaneous equations in a, b and c. This is not recommended.

Examples

1 Work out the nth term of the sequence

3 7 13 21 31 …..

2 Work out the nth term of the sequence

1 4 8 13 19 …..

3 Two sequences are

2 7 14 23 34 …..

and 9 13 19 27 37 …..

Show algebraically that the 8th term of each sequence has the same numerical value.

M2.G.6 Solve problems in the context of tiling patterns and tessellation

Assessment Guidance

Candidates should be able to:

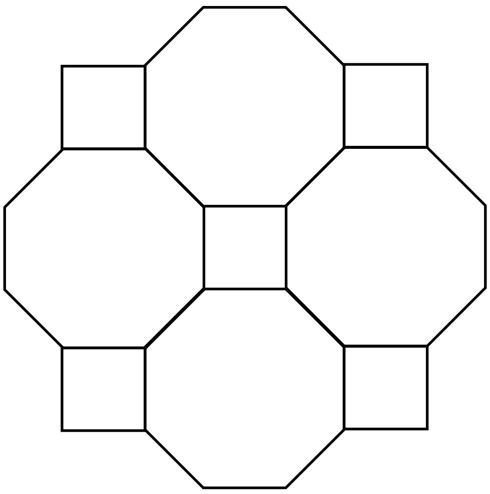
- understand that a tessellation of shapes covers the plane with no gaps
- understand that shapes that fit together at a point in a tessellation have an angle sum of 360°

Notes

Candidates will need to know how to work out the interior angles of regular polygons.

Example

1 A tessellation is made from regular octagons and squares.



By reference to the angles of the octagon and square, explain why these two shapes will tessellate.

2 Regular pentagons do not tessellate.

Explain why not.

M2.G.7h Understand, prove and use circle theorems and the intersecting chords theorem

Assessment Guidance

Candidates should be able to:

- understand that the tangent at any point on a circle is perpendicular to the radius at that point
- understand and use the fact that tangents from an external point are equal in length
- explain why the perpendicular from the centre to a chord bisects the chord
- understand that inscribed regular polygons can be constructed by equal division of a circle
- prove and use the fact that the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference
- prove and use the fact that the angle subtended at the circumference by a semicircle is a right angle
- prove and use the fact that angles in the same segment are equal
- prove and use the fact that opposite angles of a cyclic quadrilateral sum to 180 degrees
- prove and use the alternate segment theorem
- prove and use the intersecting chords theorem.

Notes

Proofs of these theorems will not be tested in the examination.

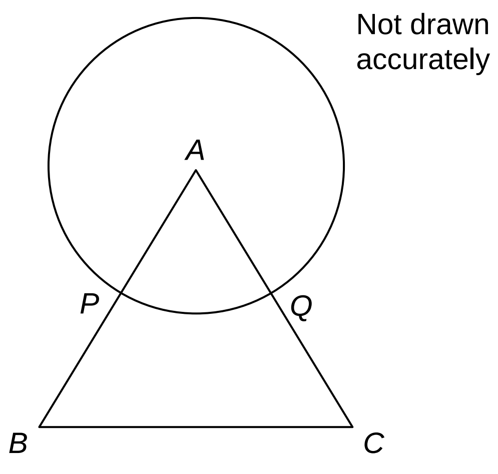
When asked to give reasons for angles any clear indication that the correct theorem is being referred to is acceptable. For example, angles on the same chord (are equal), angle at centre is equal to twice angle at circumference, angle on diameter is 90°, opposite angles in cyclic quadrilateral add up to 180°, alternate segment, intersecting chords.

Questions assessing quality of written communication may be set that require clear and logical steps to be shown, with reasons given.

At the higher grades questions may be set that involve complicated diagrams and require a proof.

Examples

1 In the diagram, *A* is the centre of the circle.
ABC is an isosceles triangle in which *AB* = *AC*
AB cuts the circle at *P* and *AC* cuts the circle at *Q*.

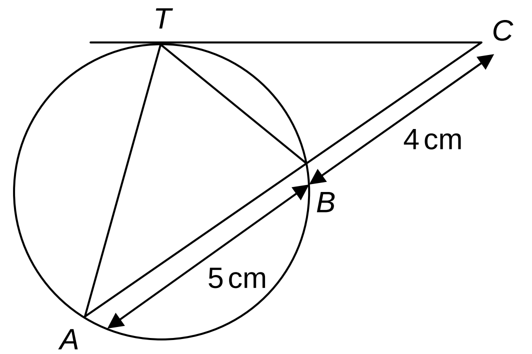


(a) Explain why *AP* = *AQ*

(b) Show that, or explain why *PB* = *QC*.

2 CT is a tangent to the circle at T.

AB = 5 cm and BC = 4 cm.



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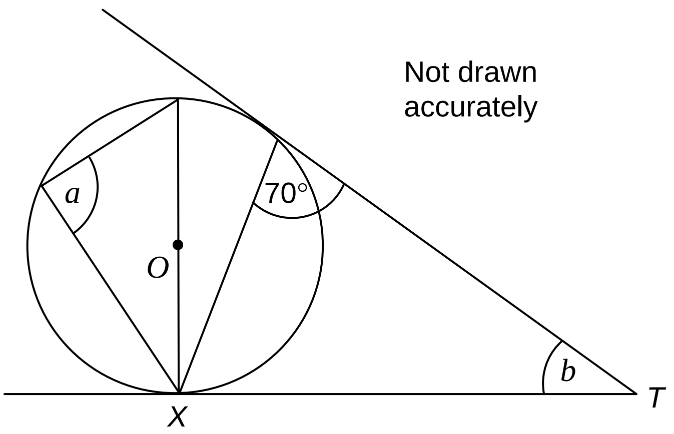
(a) Prove that triangles BTC and TAC are similar.

(b) Hence find the length of CT.

3 O is the centre of the circle.



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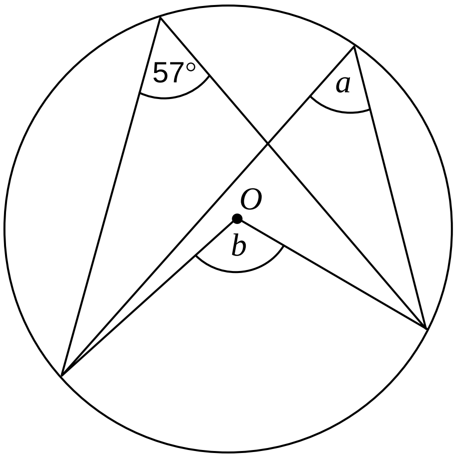
Find the sizes of angles a and b.

4 O is the centre of the circle.



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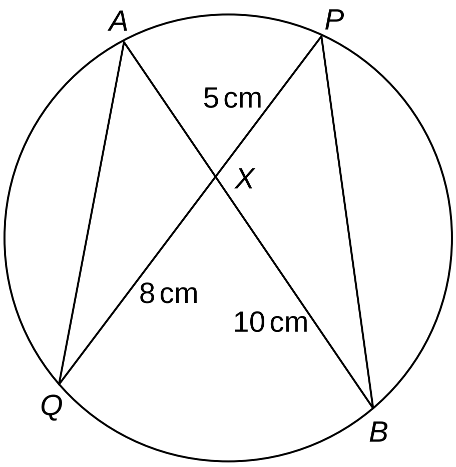
Find the sizes of angles a and b.

5 *AB* and *QP* are two chords in a circle that intersect at *X*.
XP = 5 cm, *QX* = 8 cm and *XB* = 10 cm.



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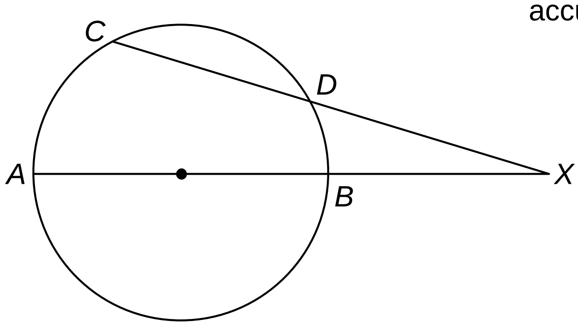
Work out the length *AX*.

6 *AB* is the diameter and *CD* a chord of a circle.
AB and *CD* are extended to meet at *X*.
AX is 20 cm, *CD* is 7 cm and *DX* is 8 cm.

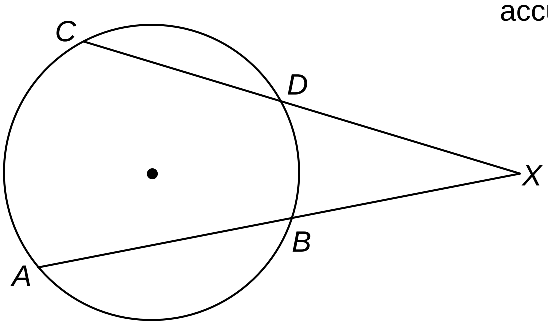
Not drawn accurately



Calculate *AB*, the diameter of the circle.

7 *CD* and *AB* are chords of a circle that intersect at *X*.
CD = 8 cm, *DX* = 6 cm, *AB* = 5 cm.

Not drawn accurately



Calculate the distance *BX*.

M2.G.8h Understand and use the midpoint and the intercept theorems

Assessment Guidance

Candidates should be able to:

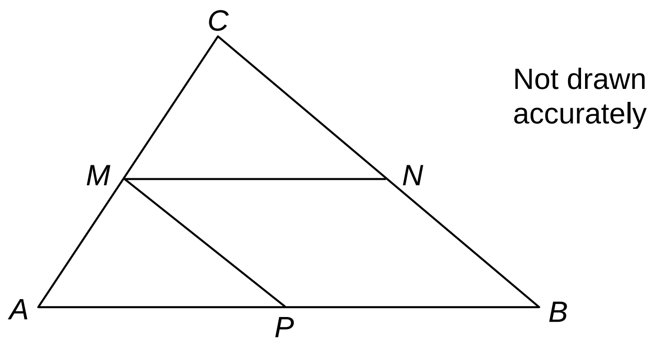
- understand and use the midpoint theorem which states that the line joining the midpoints of any two sides of a triangle is parallel to the third side of the triangle and equal to half its length.
- understand and use the corollary of the midpoint theorem which states that the line drawn through the midpoint of one side of a triangle and parallel to another side bisects the third side.
- understand and use the intercept theorem which states that if three or more parallel straight lines make intercepts on one transversal, they will make intercepts on any other transversal so that the ratios of lengths on the transversals are equal.
- understand and use the corollary of the intercept theorem, sometimes known as the ratio theorem, which states that a line *MN* drawn parallel to the side *AB* of the triangle *ABC* divides the sides *AC* and *BC* such that $AM : MC = BC : NC$

Notes

Proofs of these theorems will not be asked for.

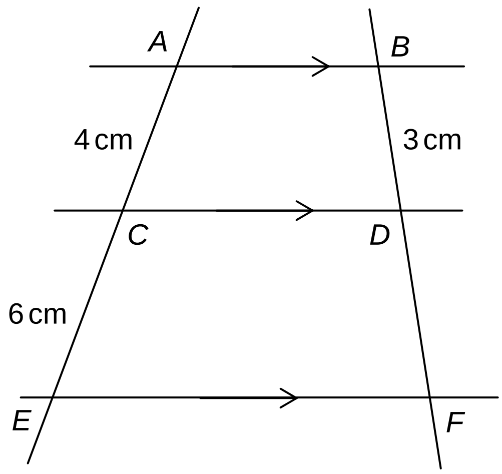
Examples

1 *M*, *N* and *P* are the midpoints of the sides *AC*, *CB* and *AB* of the triangle *ABC* respectively.



Explain clearly why the area of the quadrilateral *MNBP* is one half of the area of the triangle *ABC*.

2 *AB*, *CD* and *EF* are parallel lines.
AC = 4 cm, *CE* = 6 cm and *BD* = 3 cm.



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Calculate the length *DF*.

M2.G.9h Understand and construct geometrical proofs using formal arguments, including proving the congruence, or non-congruence of two triangles in all possible cases

Assessment Guidance

Candidates should be able to:

- know the four conditions for congruency, SSS, SAS, ASA and RHS.
- know that when constructing a geometric proof reasons should be given for all angles, lengths or other values calculated.

Notes

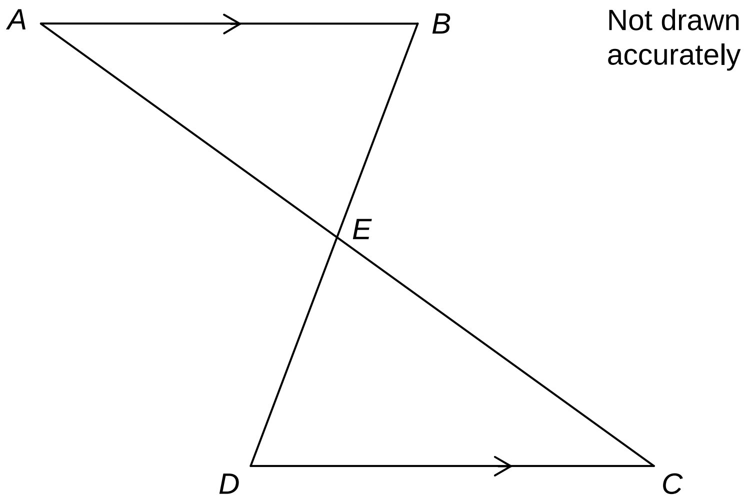
Candidates should know that AAA and SSA are not valid conditions for congruency.

A conclusion using one of the above conditions should always be given. The use of abbreviations is acceptable.

Examples

1 *ABE* and *DEC* are triangles such that *BED* is a straight line.

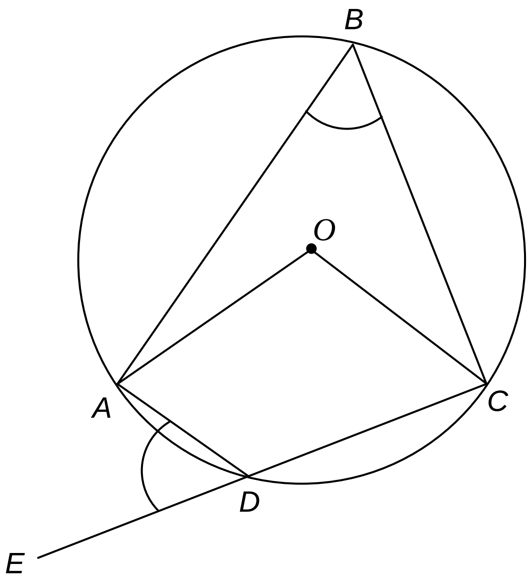
AB is parallel and equal in length to *DC*.



Prove that triangles *ABE* and *DEC* are congruent.

2 *ABCD* are points on the circumference of a circle centre *O*.

The line *CD* is extended to *E*.



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Prove that $\angle ABC = \angle ADE$

GCSE Methods in Mathematics (Pilot)

Qualification Accreditation Number: 500/7942/6

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