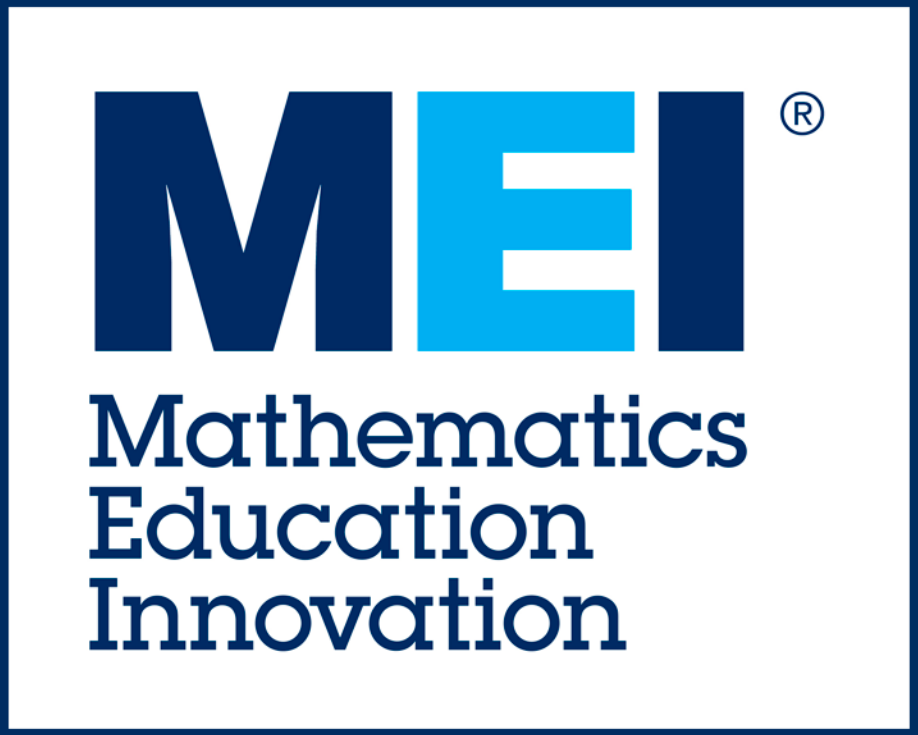

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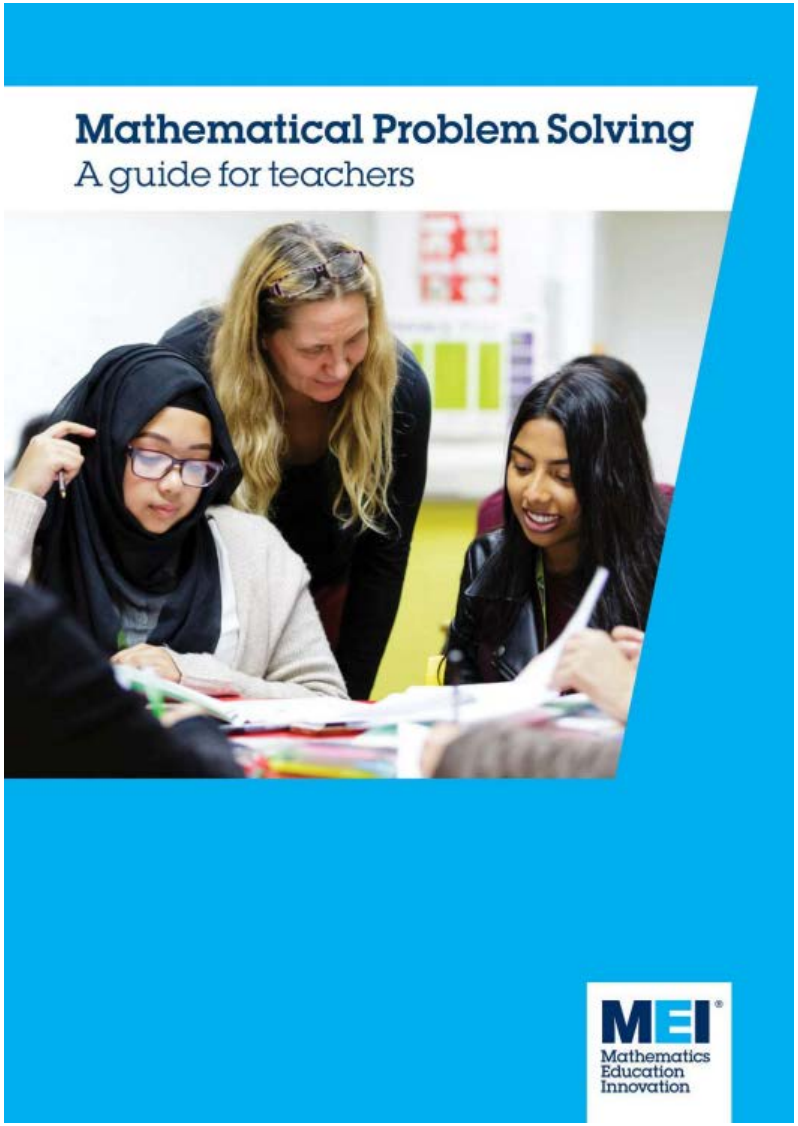
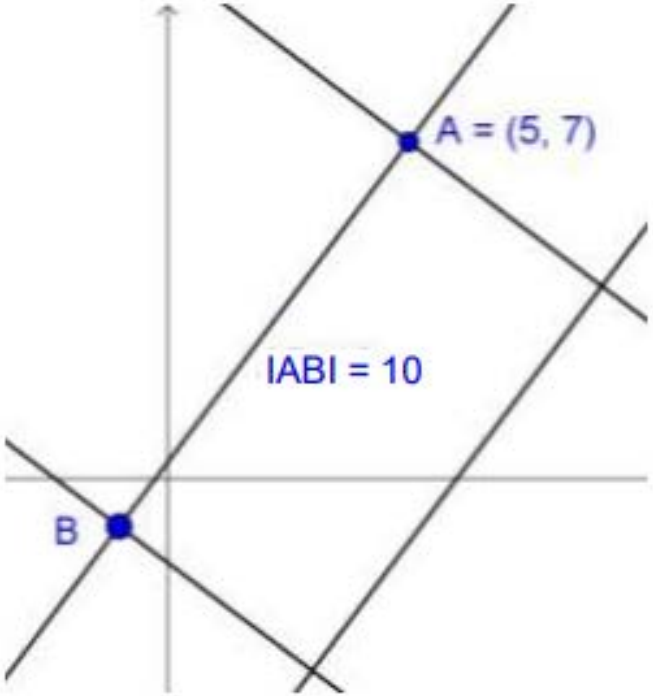


Example problems for A level Mathematics

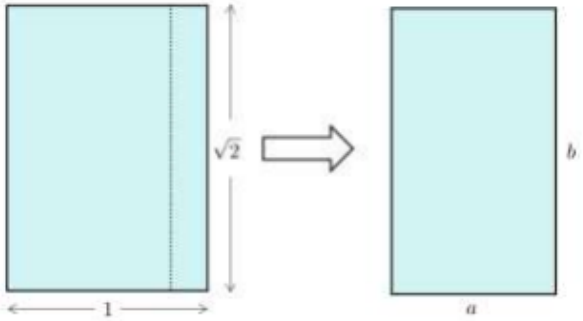
A level: Example 1



Find the equations of the four straight lines in this diagram.

A level: Example 3

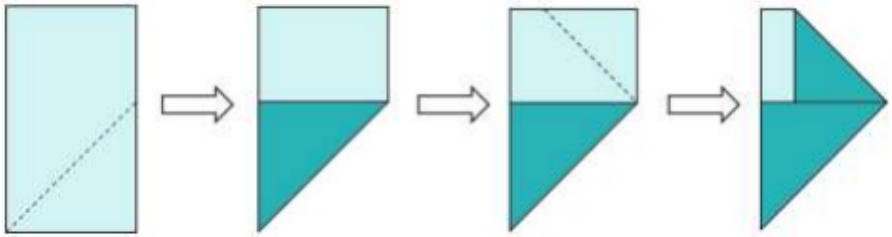
A piece of paper measures 1 unit by $\sqrt{2}$ units. A strip of paper is removed so that the dimensions of the paper are a and b as shown in the diagram below:



The ratio

$$\frac{b}{a} = \sqrt{3}$$

The piece of paper is now folded like this:



Find the perimeter and area of the final shape.

A level: Example 5

Student instruction sheet

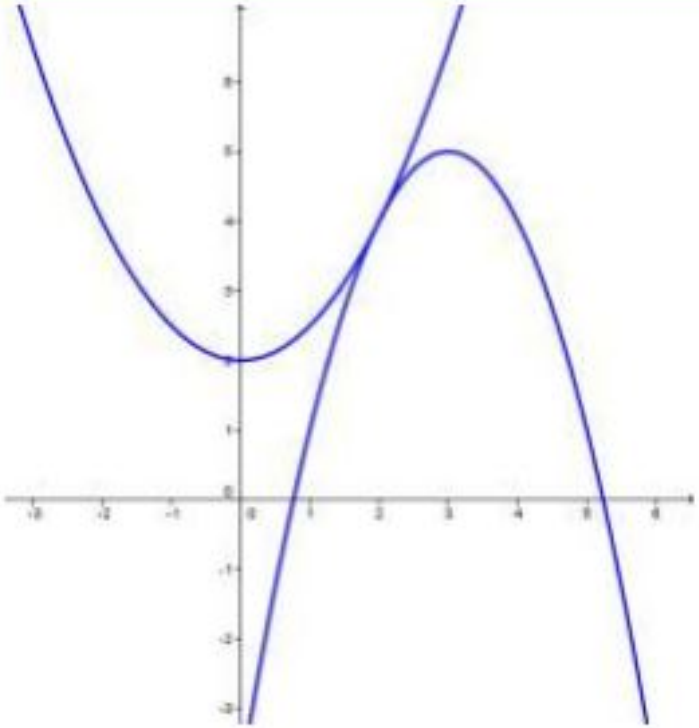
You are going to find a design that has been created using circles.

Some information about the design is given on the cards.

- Shuffle the cards and deal them all out
- Take it in turns to select one piece of information that you think is important and read it to the rest of the group
- You can write something down on the group's answer sheet but you must not show anyone any of your cards (even after you have read them out)
- You can remind the group of any information you have already read out at any stage
- You will need to go round the group more than once to get enough information to sketch the design
- As a group, sketch the design labelling each circle with its equation

What is the fewest number of cards needed to solve the problem?

A level: Example 9

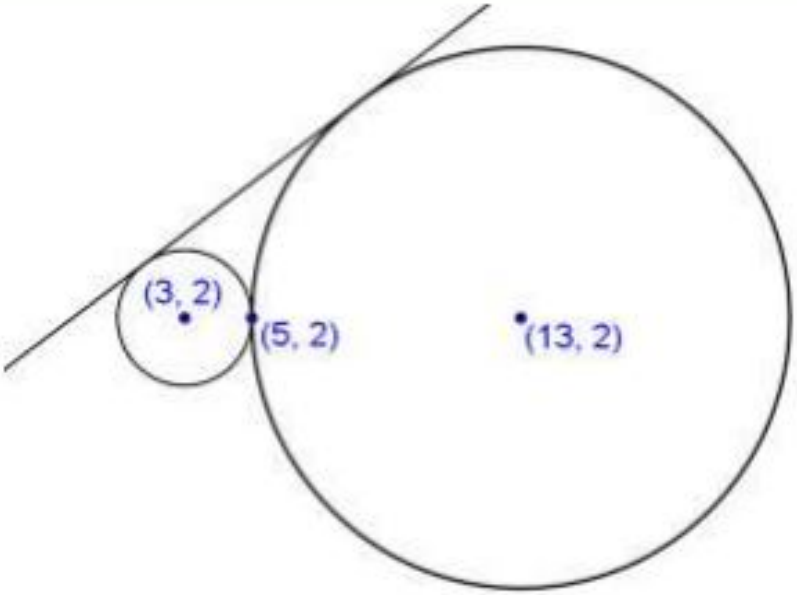


These two quadratic curves have a common tangent at $x = 2$.

Given that one curve has a vertex at $(0,2)$ and the other has a vertex at $(3,5)$, find the equation of each curve and the equation of the common tangent.

A level: Example 11

Example 11



The diagram shows two circles and a straight line that is a tangent to both circles.

Find the equation of the line.

A level: Example 15

Without using a calculator, show that

$$\sqrt{3} - \sqrt{2} = \sqrt{5 - 2\sqrt{6}}$$

Find better ways to write

(i) $\sqrt{12 - 2\sqrt{35}}$

(ii) $\sqrt{13 + 2\sqrt{42}}$

(iii) $\sqrt{21 + 6\sqrt{10}}$

A level: Example 16

Write down the first five terms of

$$\sum_{r=1}^{10} r^2$$

Write down the first five terms of

$$\sum_{r=1}^{10} (r-1)^2$$

Use your answers to help you find the value of

$$\sum_{r=1}^{10} r^2 - \sum_{r=1}^{10} (r-1)^2$$

Find an expression in terms of n for the value of

$$\sum_{r=1}^{n} r^2 - \sum_{r=1}^{n} (r-1)^2$$

Find an expression in terms of m and n (where $n > m$) for the value of

$$\sum_{r=m}^{n} r^2 - \sum_{r=m}^{n} (r-1)^2$$

A level: Example 18

Find the values of a such that the turning point (i.e. the vertex) of the parabola $y = x^2 + 2ax + 1$ is closest to the origin.

What is the locus of the turning point as a varies?

A level: Example 19

A geometric progression has first term a and common ratio r, and the terms are all different and $a \neq 0$. The first, second and fourth terms of the geometric progression form three consecutive terms of an arithmetic progression. Given that the geometric progression converges and has a sum to infinity of $3 + \sqrt{5}$, find the exact values of a and r.

A level: Example 20

In this question you must show detailed reasoning.

Fig. 1 shows the circle with equation $(x-3)^2+(y-4)^2=25$. The point C is the centre of the circle.

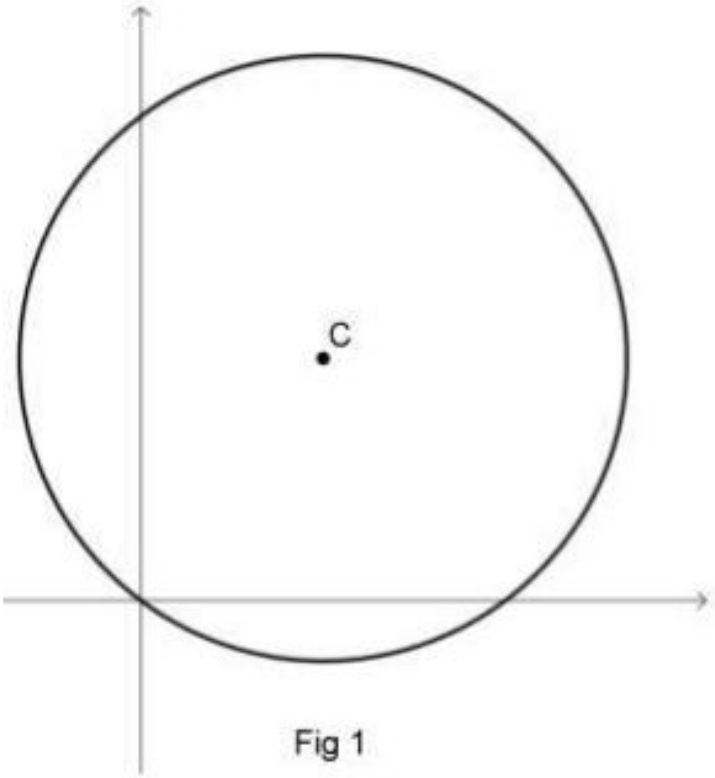


Fig 1

Find the area of the part of the circle that is below the x-axis.

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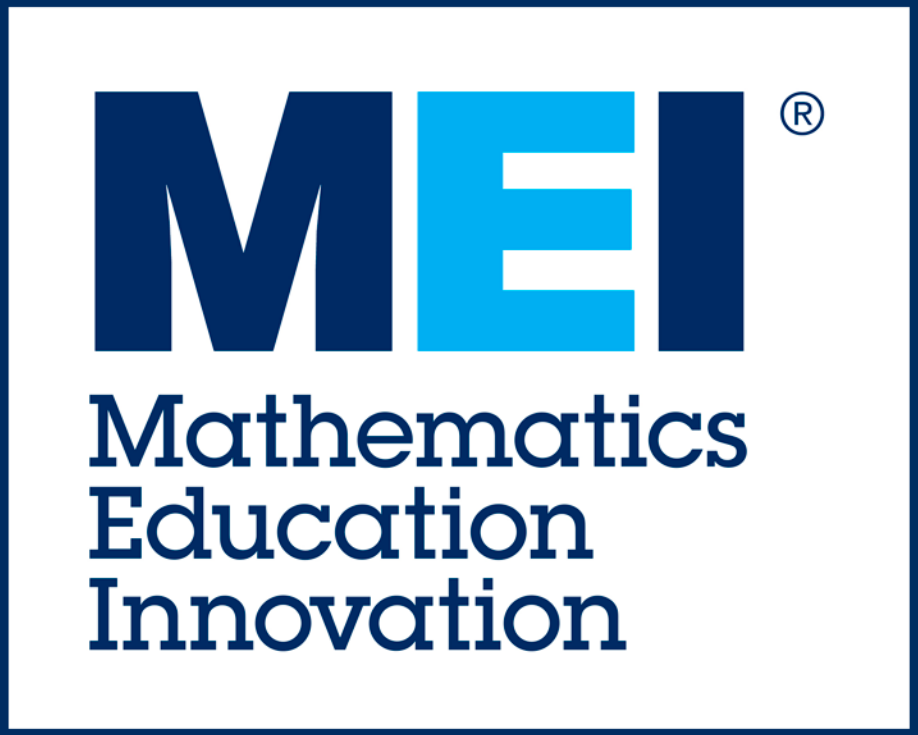

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