

Circles

What you should know

The equation of a circle, centre the origin and radius r is $x^2 + y^2 = r^2$.

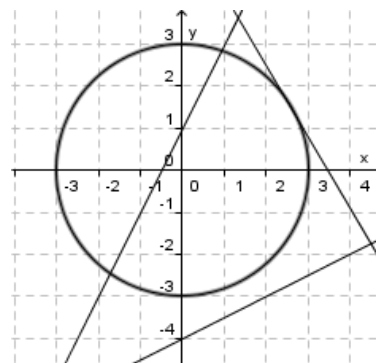
The tangent to a circle is perpendicular to the radius at the point of contact.

In a right-angled triangle, $\tan \theta = \frac{\text{opposite}}{\text{adjacent}}$.

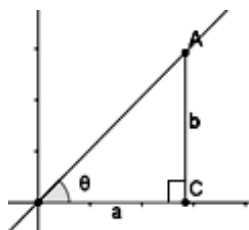
New idea

Any straight-line graph will cross a circle 0 or 1 or 2 times. If the straight line crosses the circle exactly once, it is a tangent to the circle.

A straight line with gradient m makes an angle θ with the x -axis where $m = \tan \theta$.

**Task: Finding a tangent to a circle**

- Look at the diagram.



What is the gradient of the line joining point A to the origin? What is $\tan \theta$?

- Use a graphical calculator or a graph-drawing package on a computer to draw the circle $x^2 + y^2 = 9$ and lines with gradient 2. Can you find the equation of a line that touches the circle?
- For gradient 2, there are two possible tangents. One crosses the y -axis at c . Where does the other one cross the y -axis?

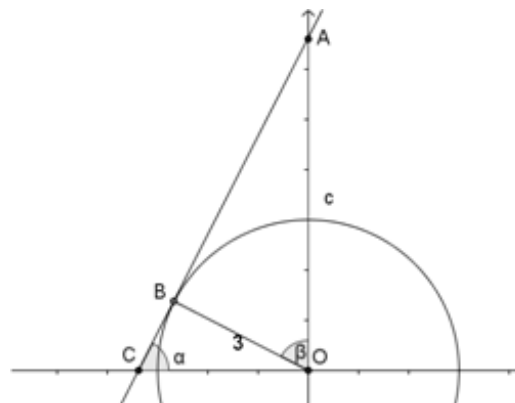
Take it further

Now that you know c , can you find the equations of lines that do not cross the circle? What if the gradient of the tangent is a value different from 2?

Where this goes next

At A level the intersections of lines and curves are studied further in Core Mathematics.

- Look at the diagram.



What is $\tan \alpha$?

Explain why angle α and angle β are equal.

How long is AB?

What is the value of c ?