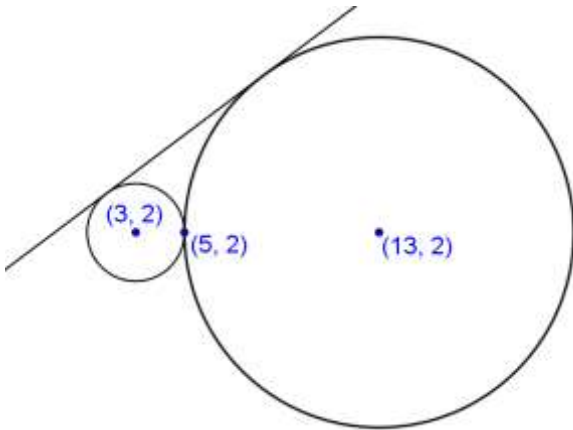


# Mathematical Problem Solving

## AS/A Level example

### Solution to example 11

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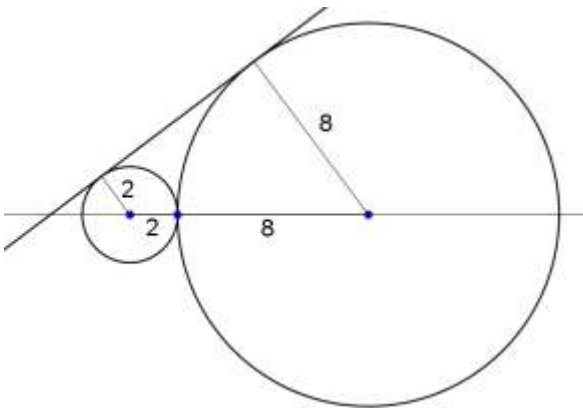
The diagram shows two circles and a straight line that is a tangent to both circles.

Find the equation of the line.

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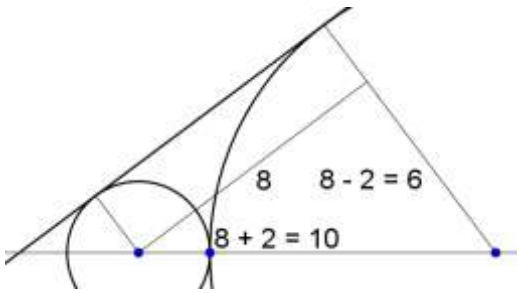
The radius of the small circle is 2 units and the radius of the large circle is 8 units.

Drawing a diagram and putting these values on it.



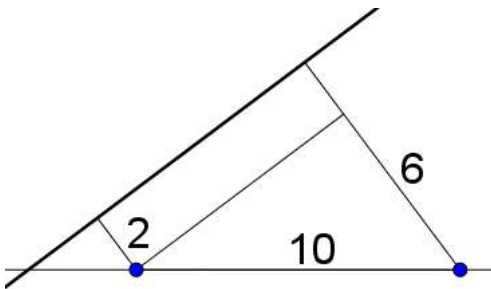
Two of the marked radii are parallel as the angle they make with the tangent is  $90^\circ$ .

Drawing a line through the centre of the circle parallel to the marked tangent gives



This is a 3, 4, 5 triangle doubled to be 6, 8, 10.

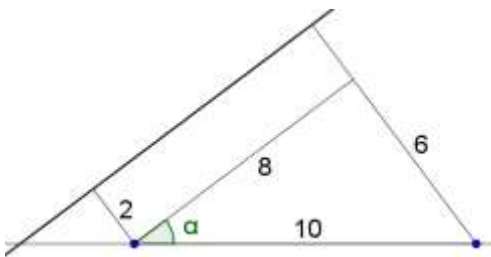
The small triangle on the left is similar to this



With all lengths  $\frac{1}{3}$  of the larger triangle.

So the tangent passes through a point that is a horizontal distance of  $\frac{10}{3}$  away from the point  $(3, 2)$  i.e. the point  $(-\frac{1}{3}, 2)$ .

The gradient of the line can be found using one of the right angled triangles



$\tan \alpha = \frac{6}{8} = \frac{3}{4}$  so the gradient of the line is  $\frac{3}{4}$

The equation of the line is  $y - 2 = \frac{3}{4}(x + \frac{1}{3})$

$$4y - 8 = 3x + 1$$

$$3x - 4y + 9 = 0$$