

Touching Circles

1. Two circles have equations $(x - 14)^2 + (y - 16)^2 = 100$ and $x^2 + y^2 + 12x - 2y - 188 = 0$.

Show that these circles touch externally at a single point.

2. Two circles have equations

$$x^2 + y^2 + 4x + 16y - 60 = 0 \quad \text{and} \quad x^2 + y^2 - 8x + 4y + 12 = 0$$

Show that these circles touch at a single point.

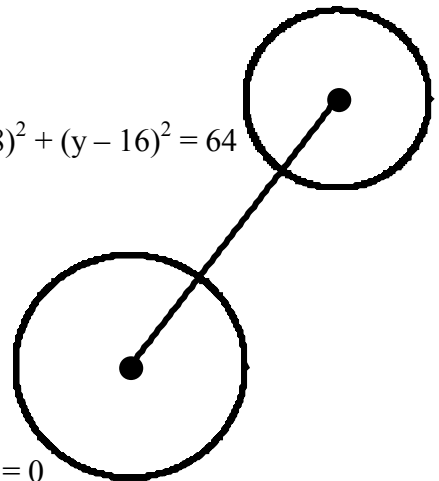
3. Two circles have equations

$$x^2 + y^2 + 20x + 16y + 64 = 0 \quad \text{and} \quad (x - 8)^2 + (y - 16)^2 = 64$$

$$(x - 8)^2 + (y - 16)^2 = 64.$$

Find the smallest distance between these circles.

$$x^2 + y^2 + 20x + 16y + 64 = 0$$



4. Two circles have equations

$$(x - 10)^2 + (y - 14)^2 = 25 \quad \text{and} \quad x^2 + y^2 - 10x - 4y - 35 = 0$$

Show that these circles touch externally at a single point.

5. Two circles have equations

$$(x + 8)^2 + (y - 2)^2 = 45 \quad \text{and} \quad x^2 + y^2 - 8x - 16y + 35 = 0.$$

(a) Show that these circles touch at a single point.

(b) Find the coordinates of the point of contact of the two circles.

6. Two circles have equations

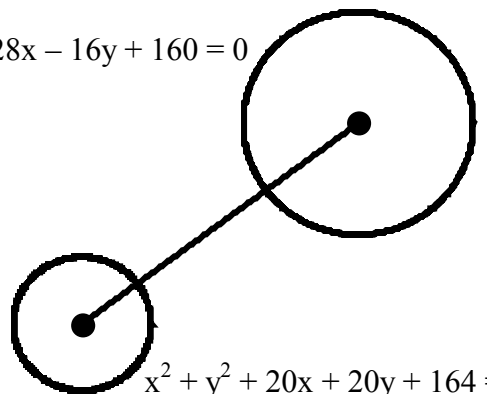
$$x^2 + y^2 + 20x + 20y + 164 = 0$$

and

$$x^2 + y^2 - 28x - 16y + 160 = 0.$$

Find the smallest distance between these circles.

$$x^2 + y^2 - 28x - 16y + 160 = 0$$

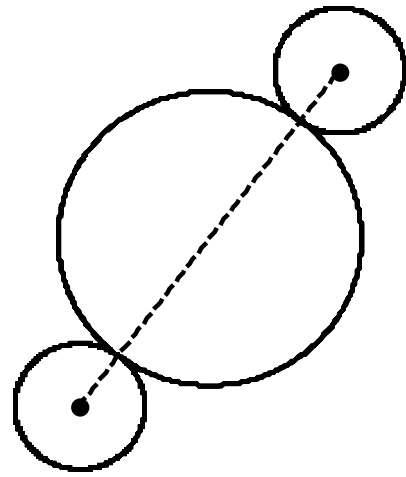


$$x^2 + y^2 + 20x + 20y + 164 = 0$$

7. The diagram shows three circles which touch externally.
The centres of the circles are collinear and the equations of the two smaller circles are

$$(x + 2)^2 + y^2 = 9 \quad \text{and} \quad x^2 + y^2 - 20x - 32y + 347 = 0.$$

Find the equation of the larger circle.



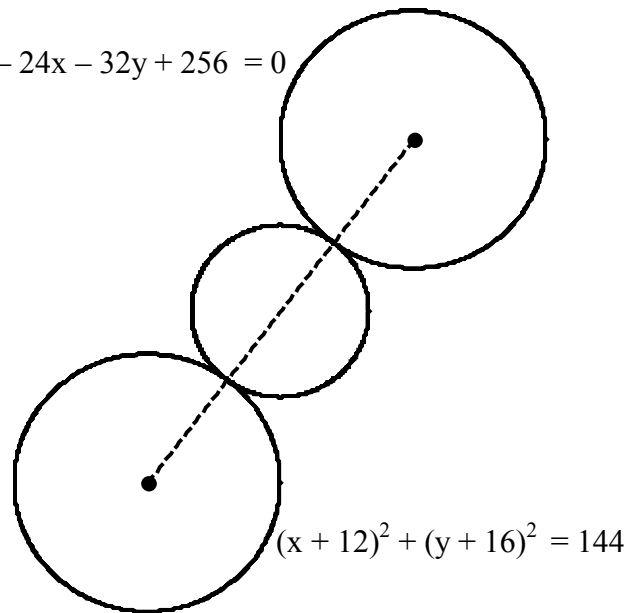
$$x^2 + y^2 - 24x - 32y + 256 = 0$$

8. The diagram shows three circles which touch externally.
The centres of the circles are collinear and the equations of the two larger circles are

$$(x + 12)^2 + (y + 16)^2 = 144 \quad \text{and}$$

$$x^2 + y^2 - 24x - 32y + 256 = 0.$$

Find the equation of the smaller circle.



$$(x + 12)^2 + (y + 16)^2 = 144$$