

## 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

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

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

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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.

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

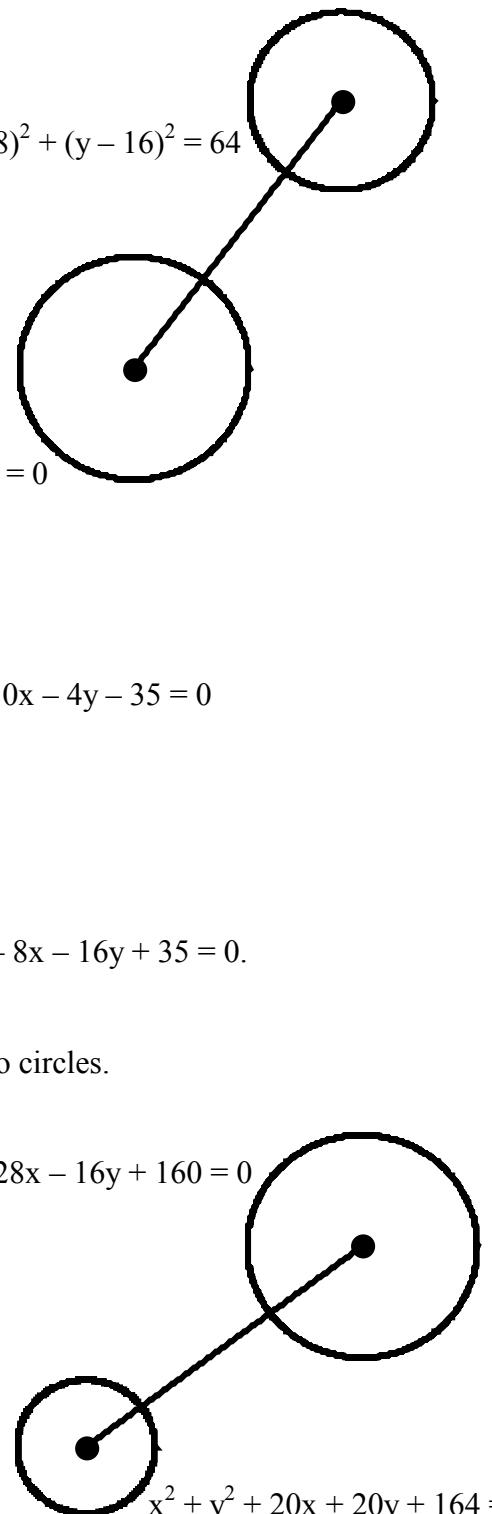
6. Two circles have equations

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

and

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

Find the smallest distance between these circles.

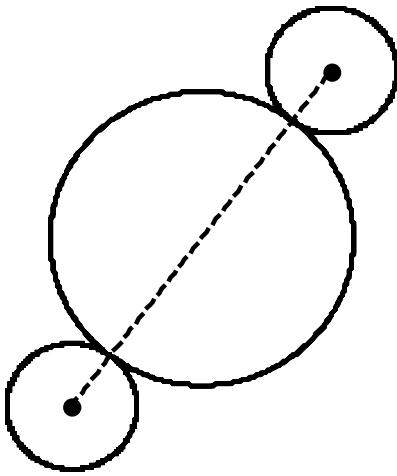


7. The diagram shows three circles which touch externally.

The centres of the circles are collinear and the equations of the two smaller circles are

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

Find the equation of the larger circle.



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

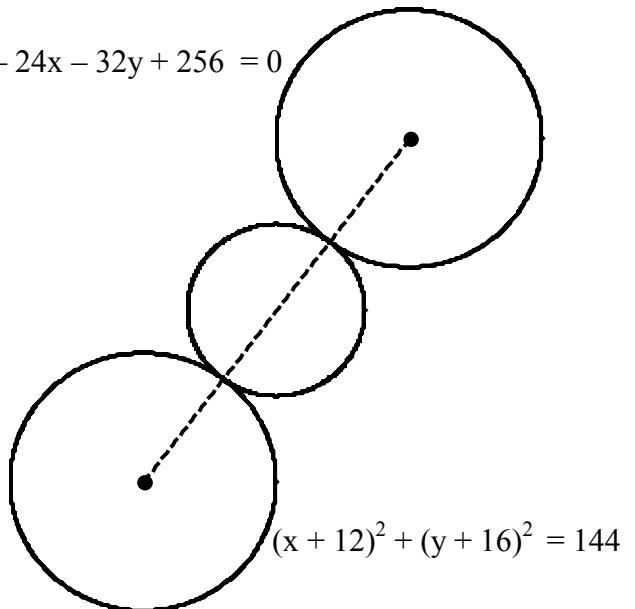
8. The diagram shows three circles which touch externally.

The centres of the circles are collinear and the equations of the two larger circles are

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

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

Find the equation of the smaller circle.



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