Chapter 14

Exercise 14A

1 a $(x-4)^2 + (y-6)^2 = 25$
b $(x-7)^2 + (y+2)^2 = 16$
c $(x+3)^2 + (y-6)^2 = 4$
d $(x+3)^2 + (y+5)^2 = 36$
e $x^2 + (y+3)^2 = 49$
f $(x+4)^2 + y^2 = 9$
g $x^2 + y^2 = 5$
h $(x+7)^2 + (y+1)^2 = 13$

2 a (2, 3); 6
b (–4, 1); 3
c (7, –5); 10
d (0, 9); 4
e (–3, 0); $2\sqrt{21}$
f (1, –1); 1
g (0, 0); $\sqrt{17}$
h (–4, 5); $\sqrt{7}$

3 $(x-5)^2 + (y-5)^2 = 25$

4 $x^2 + (y-7)^2 = 25$

5 $(x+2)^2 + (y-1)^2 = 25$

6 $(x+5)^2 + (y+1)^2 = 20$

7 $(x+2)^2 + (y+6)^2 = 25$

8 $a = 6$
$(x-4)^2 + (y-6)^2 = 34$

9 $d_{min} = 13$

Exercise 14B

1 Equations a, b, e, f represent circles, because the radius squared is a positive number.

In equation c the radius is zero, while in equation d the radius squared is a negative number, hence in these cases the circles cannot exist.

2 a (–2, 1); 2
b (3, –2); 3
c (–3, 2); 4
d (3, 5); $\sqrt{17}$
e (0, 3); $\sqrt{11}$
f $\left(\frac{-1}{2}, \frac{1}{4}\right)$, $\frac{13}{16}$

3 (–2, 4); 5
S lies inside the circle, U and V lie outside the circle, T is on the circle.

4 $k_1 = 1$, $k_2 = 7$

5 $m_1 = -7$, $m_2 = 3$

6 $c = -135$

7 $x^2 + y^2 + 14x - 4y - 271 = 0$

8 $\overline{ST} = 2$

9 $\overline{UV} = 2$

10 a $k > -5$
b $k < 4$
c $k < -2$ and $k > 2$
d $k < -4$ and $k > 4$

11 $x = 2$, $y = 3$

12 $x^2 + y^2 - 8x - 26y + 169 = 0$

13 $x^2 + y^2 - 10x - 10y + 45 = 0$

14 $x^2 + y^2 - 2x - 4y - 20 = 0$

Exercise 14C

1 $2y - 7x + 57 = 0$

2 $2y + 9x = 72$

3 $3y + 4x + 25 = 0$

4 P(4, 6), Q(4, –2)

5 (7, 12)

6 The line is a tangent.

7 The line is a chord.

8 The line does not touch the circle.

9 (–1, 10); (11, 4)
$y = 2x - 18$, $y = 2x + 12$

10 $k = -\sqrt{10}$, $\sqrt{10}$

11 $k = -1, 3$

12 $x^2 + y^2 + 8x - 8y + 7 = 0$

13 $x^2 + y^2 - 4x + 8y - 5 = 0$

14 (1, 0)

Exercise 14D

1 **a** The circles do not touch: $d > r_1 + r_2$.

b, c The circles intersect: $d < r_1 + r_2$.

d, e The circles do not touch and one is contained in the other: $d < r_1 - r_2$.

2 $p = -1175$

(21, 20)