

# circles points of intersection

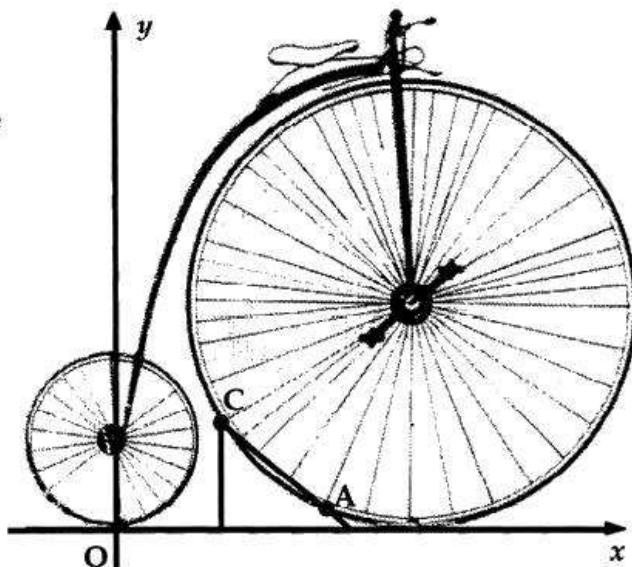
- [SQA] 1. A penny-farthing bicycle on display in a museum is supported by a stand at points A and C. A and C lie on the front wheel.

With coordinate axes as shown and 1 unit = 5cm, the equation of the rear wheel (the small wheel) is

$$x^2 + y^2 - 6y = 0 \text{ and}$$

the equation of the front wheel is

$$x^2 + y^2 - 28x - 20y + 196 = 0.$$

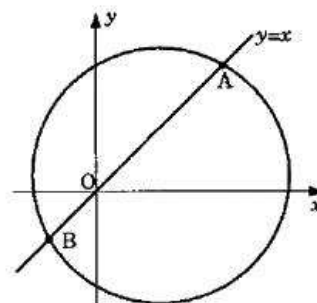


- (a) (i) Find the distance between the centres of the two wheels.  
 (ii) Hence calculate the clearance, i.e. the smallest gap, between the front and rear wheels. Give your answer to the nearest millimetre. (8)
- (b) B(7,3) is half-way between A and C, and P is the centre of the front wheel.  
 (i) Find the gradient of PB.  
 (ii) Hence find the equation of AC and the coordinates of A and C. (8)

- [SQA] 2. The straight line  $y = x$  cuts the circle

$$x^2 + y^2 - 6x - 2y - 24 = 0 \text{ at A and B.}$$

- (a) Find the coordinates of A and B.  
 (b) Find the equation of the circle which has AB as diameter.



3  
3

[SQA]

3. Circle P has equation  $x^2 + y^2 - 8x - 10y + 9 = 0$ . Circle Q has centre  $(-2, -1)$  and radius  $2\sqrt{2}$ .

(a) (i) Show that the radius of circle P is  $4\sqrt{2}$ .

(ii) Hence show that circles P and Q touch. 4

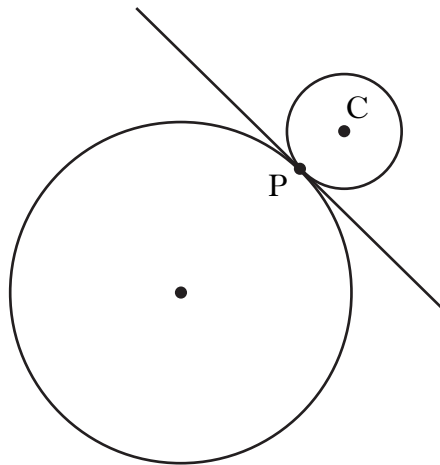
(b) Find the equation of the tangent to the circle Q at the point  $(-4, 1)$ . 3

(c) The tangent in (b) intersects circle P in two points. Find the  $x$ -coordinates of the points of intersection, expressing your answers in the form  $a \pm b\sqrt{3}$ . 3

4. (a) (i) Show that the line with equation  $y = 3 - x$  is a tangent to the circle with equation  $x^2 + y^2 + 14x + 4y - 19 = 0$ .

(ii) Find the coordinates of the points of contact, P. 5

(b) Relative to a suitable set of coordinate axes, the diagram below shows the circle from (a) and a second smaller circle with centre C.



The line  $y = 3 - x$  is a common tangent at the point P.

The radius of the larger circle is three times the radius of the smaller circle.

Find the equation of the smaller circle. 6

[SQA]

5. Diagram 1 shows a circle with equation  $x^2 + y^2 + 10x - 2y - 14 = 0$  and a straight line,  $l_1$ , with equation  $y = 2x + 1$ .

The line intersects the circle at A and B.

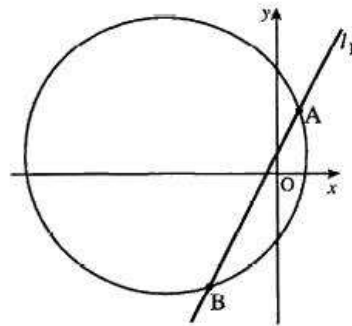


Diagram 1

- (a) Find the coordinates of the points A and B.

(5)

- (b) Diagram 2 shows a second line,  $l_2$ , which passes through the centre of the circle, C, and is at right angles to line  $l_1$ .

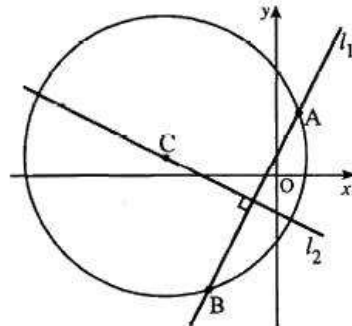


Diagram 2

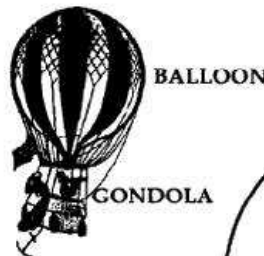
- (i) Write down the coordinates of C.  
(ii) Find the equation of the line  $l_2$ .

(1)

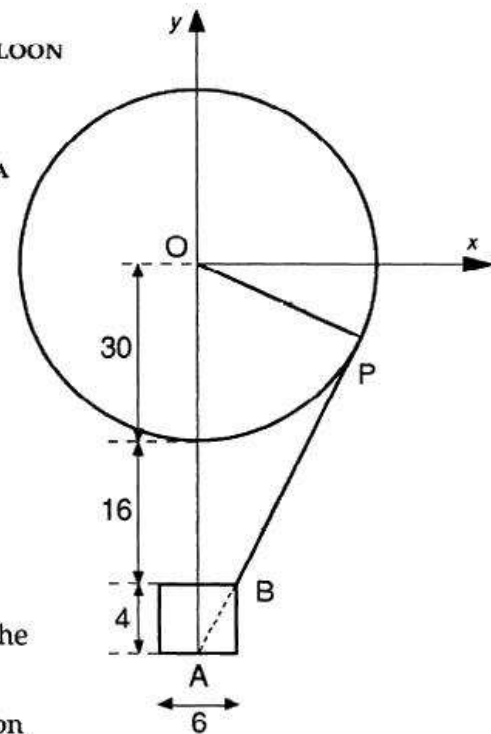
(3)

[SQA]

6. A spherical hot-air balloon has radius 30 feet. Cables join the balloon to the gondola which is cylindrical with diameter 6 feet and height 4 feet. The top of the gondola is 16 feet below the bottom of the balloon.



Co-ordinate axes are chosen as shown in the diagram. One of the cables is represented by PB and PBA is a straight line.



- (a) Find the equation of the cable PB.  
(b) State the equation of the circle representing the balloon.  
(c) Prove that this cable is a tangent to the balloon and find the co-ordinates of the point P.

(3)

(1)

(5)

[END OF QUESTIONS]