

## LC 2013 (SET D): PAPER 2

### QUESTION 4 (25 MARKS)

#### Question 4 (a)

$$c_1 : (h, k) = (-3, -2), r = 2$$

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

$$(x + 3)^2 + (y + 2)^2 = 4$$

$$c_2 : x^2 + y^2 - 2x - 2y - 7 = 0$$

$$(-g, -f) = \left( -\frac{-2}{2}, -\frac{-2}{2} \right) = (1, 1)$$

$$r = \sqrt{1^2 + 1^2 - (-7)} = \sqrt{9} = 3$$

#### FORMULAE AND TABLES BOOK

#### Co-ordinate geometry: Circle [page 19]

Given centre  $(h, k)$  and radius  $r$

$$(x - h)^2 + (y - k)^2 = r^2$$

Given equation

$$x^2 + y^2 + 2gx + 2fy + c = 0$$

Centre  $(-g, -f)$

Radius  $\sqrt{g^2 + f^2 - c}$

Circle	Centre	Radius	Equation
$c_1$	$(-3, -2)$	2	$(x + 3)^2 + (y + 2)^2 = 4$
$c_2$	$(1, 1)$	3	$x^2 + y^2 - 2x - 2y - 7 = 0$

#### MARKING SCHEME NOTES

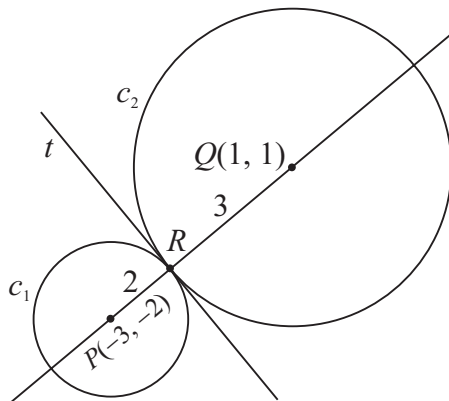
#### Question 4 (a) [Scale 10C (0, 3, 8, 10)]

- 3:**
- Any one correct
  - Any reasonable step
- 8:**
- Any two correct
  - Correct approach but error in work

#### Question 4 (b) (i)

Call the point of contact  $R$ .

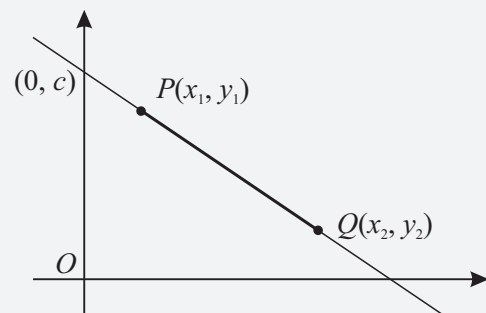
$R$  divides the line of centres,  $PQ$ , in the ratio 2: 3.



#### FORMULAE AND TABLES BOOK

#### Co-ordinate geometry: Line [page 18]

Point dividing  $[PQ]$  in the ratio  $a:b$



$$\left( \frac{bx_1 + ax_2}{b + a}, \frac{by_1 + ay_2}{b + a} \right)$$

$$a = 2, b = 3$$

$$(x_1, y_1) = (-3, -2), (x_2, y_2) = (1, 1)$$

$$R = \left( \frac{3(-3) + 2(1)}{2 + 3}, \frac{3(-2) + 2(1)}{2 + 3} \right) = \left( \frac{-9 + 2}{5}, \frac{-6 + 2}{5} \right) = \left( -\frac{7}{5}, -\frac{4}{5} \right)$$

**MARKING SCHEME NOTES**

**Question 4 (b) (i) [Scale 10D (0, 3, 7, 9, 10)]**

- 3: • Some reference to ratio  
 •  $c_1 \cap c_2$  and stops  
 • Any reasonable step
- 7: • Some correct substitution into correct ratio formula  
 • Substitution resulting in a quadratic equation in one variable
- 9: • Error in ratio formula but finishes  
 • Finds one of the ordinates only

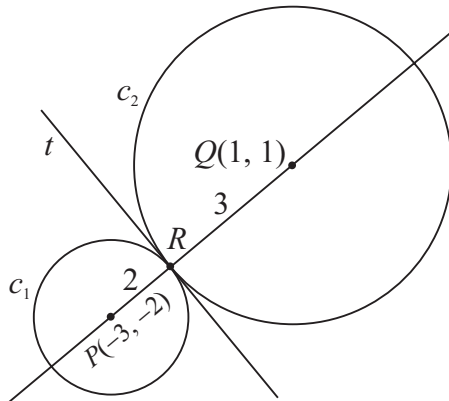
**Question 4 (b) (ii)**

Find the slope of the line  $pq$ :

$$P(-3, -2) = (x_1, y_1), Q(1, 1) = (x_2, y_2)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1 - (-2)}{1 - (-3)} = \frac{3}{4}$$

$$m^\perp = -\frac{4}{3} \leftarrow \text{Tangent } t \text{ is perpendicular to the line } PQ.$$



Equation of  $t$ :

$$(x_1, y_1) = \left(-\frac{7}{5}, -\frac{4}{5}\right), m = -\frac{4}{3}$$

$$y - \left(-\frac{4}{5}\right) = -\frac{4}{3}\left(x - \left(-\frac{7}{5}\right)\right)$$

$$y + \frac{4}{5} = -\frac{4}{3}\left(x + \frac{7}{5}\right)$$

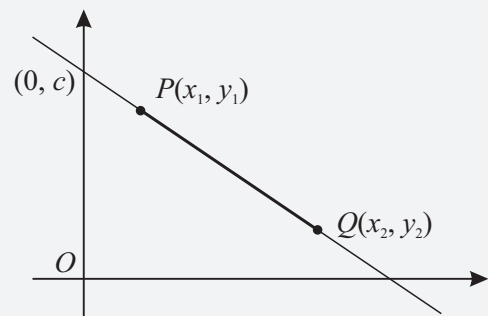
$$y + \frac{4}{5} = -\frac{4}{3}x - \frac{28}{15} \leftarrow \text{Multiply across by 15.}$$

$$15y + 12 = -20x - 28$$

$$20x + 15y + 40 = 0$$

$$4x + 3y + 8 = 0$$

**FORMULAE AND TABLES BOOK**  
**Co-ordinate geometry: Line**



Slope of  $PQ$  [page 18]

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Equation of  $PQ$  [page 18]

$$y - y_1 = m(x - x_1)$$

$$y = mx + c$$

**MARKING SCHEME NOTES**

**Question 4 (b) (ii) [Scale 5C (0, 3, 4, 5)]**

- 3: • Slope of line of centres  
 • Any reasonable step
- 4: • Uses point of contact with slope of diameter for equation  
 •  $c_1 - c_2 = 0$  but not in linear format