HIGHER

8.9 Perpendicular Lines and the equation of a tangent: 30-minute Pack

EDEXCEL 1MA1 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Circle C has equation $(x - 1)^2 + (y - 2)^2 = 25$ and point P is (4, 6) on C.

(a) Find the equation of the tangent at P. **(2)**

.....

(b) Find the equation of the line through P that is perpendicular to this tangent. **(2)**

.....

(Total for Question 1 is 4 marks)

2 A circle has equation $x^2 + y^2 = 50$ and a point T lies on the circle. Show that the tangents from the external point (10, 0) touch the circle at points with x-coordinate 5, and find the coordinates of these points of contact.

(Total for Question 2 is 4 marks)

© Revision Library | revisionlibrary.co.uk

3 The circle $x^2 + y^2 = 100$ has a point A with x-coordinate 8 and y positive.

(a) Find the equation of the tangent at A. **(2)**

.....

(b) Find the coordinates of the intersection point of the tangent and the line $y = 2x - 5$. **(2)**

.....

(Total for Question 3 is 4 marks)

---

4 For the circle $x^2 + y^2 = 25$ find the point or points where the tangent has gradient 2.

(Total for Question 4 is 3 marks)

---

5 The circle $x^2 + y^2 = 169$ is given and the line L has equation $3x - 4y + 10 = 0$.

(a) Find the points on the circle where the tangent is perpendicular to the line L. **(4)**

.....

(b) Find the equations of the tangents at those points. **(4)**

.....

(Total for Question 5 is 8 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · 8.9 Perpendicular Lines and the equation of a tangent: 30-minute Pack

Question 1

(a) radius slope = (6 - 2)/(4 - 1) = 4/3 so tangent slope = -3/4 oe **M1**

(a) y = -3/4 x + 9 cao **A1**

(a) Answer: y = -3/4 x + 9

(b) perpendicular slope = 4/3 and form y - 6 = 4/3 (x - 4) oe **M1**

(b) y = 4/3 x + 2/3 cao **A1**

(b) Answer: y = 4/3 x + 2/3

Question 2

write tangent at (x0,y0) as x x0 + y y0 = 50 and substitute (10,0): 10 x0 = 50 oe **M1**

so x0 = 5 and use circle to find $y0^2 = 50 - 25 = 25$ oe **M1**

find y0 = ±5 oe **M1**

points (5,5) and (5,-5) cao **A1**

Answer: (5, 5) and (5, -5)

Question 3

(a) find y: $y^2 = 100 - 64$ so y = 6 and slope -x/y = -8/6 = -4/3 oe **M1**

(a) y = -4/3 x + 50/3 cao **A1**

(a) Answer: y = -4/3 x + 50/3

(b) solve -4/3 x + 50/3 = 2x - 5 oe **M1**

(b) intersection (13/2, 8) cao **A1**

(b) Answer: (13/2, 8)

Question 4

set tangent gradient -x/y = 2 so x = -2y oe **M1**

substitute: $(-2y)^2 + y^2 = 25$ so $5y^2 = 25$ so $y^2 = 5$ oe **M1**

points $(-2\sqrt{5}, \sqrt{5})$ and $(2\sqrt{5}, -\sqrt{5})$ cao **A1**

Answer: $(-2\sqrt{5}, \sqrt{5})$ and $(2\sqrt{5}, -\sqrt{5})$

Question 5

(a) find gradient of L: 3x - 4y + 10 = 0 gives y = 3/4 x + 5/2 so gradient 3/4; perpendicular gradient -4/3 oe **M1**

(a) set tangent gradient -x0/y0 = -4/3 so x0/y0 = 4/3 so x0 = 4k, y0 = 3k oe **M1**

(a) substitute into circle: $(4k)^2 + (3k)^2 = 169$ so $25k^2 = 169$ so k = ±13/5 oe **M1**

(a) points (52/5, 39/5) and (-52/5, -39/5) cao **A1**

(a) Answer: (52/5, 39/5) and (-52/5, -39/5)

(b) tangent gradient is -4/3 so form y = -4/3 x + c and substitute (52/5,39/5) to find c: 39/5 = -4/3 * 52/5 + c oe **M1**

(b) compute c: multiply by 15 => 117 = -208 + 15c so 15c = 325 so c = 65/3 oe **M1**

(b) other tangent through (-52/5,-39/5) gives c = -65/3 by symmetry oe **M1**

(b) equations y = -4/3 x + 65/3 and y = -4/3 x - 65/3 cao **A1**

(b) Answer: y = -4/3 x + 65/3 and y = -4/3 x - 65/3

© Revision Library | revisionlibrary.co.uk