5. The circle C has equation

$$x^2 + y^2 - 20x - 24y + 195 = 0$$

The centre of C is at the point M.

(a) Find

    (i) the coordinates of the point M,

    (ii) the radius of the circle C.

(5)

N is the point with coordinates (25, 32).

(b) Find the length of the line MN.

(2)

The tangent to C at a point P on the circle passes through point N.

(c) Find the length of the line NP.

(2)

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Question 5 continued

P 4 1 4 8 7 A 0 1 3 3 2

5.			
(a)			
(i)	The centre is at (10, 12)	B1: $x = 10$	B1 B1
		B1: $y = 12$	
(ii)	Uses $(x-10)^2 + (y-12)^2 = -195 + 100 + 144 \Rightarrow r = ...$		M1
	Completes the square for both x and y in an attempt to find r. $(x \pm "10")^2 \pm a$ and $(y \pm "12")^2 \pm b$ and $+195 = 0, (a, b \neq 0)$ Allow errors in obtaining their r^2 but must find square root		
	$r = \sqrt{10^2 + 12^2 - 195}$	A correct numerical expression for r including the square root and can implied by a correct value for r	A1
	$r = 7$	Not $r = \pm 7$ unless -7 is rejected	A1
			(5)
(a) Way 2	Compares the given equation with $x^2 + y^2 + 2gx + 2fy + c = 0$ to write down centre $(-g, -f)$ i.e. (10, 12)	B1: $x = 10$	B1B1
		B1: $y = 12$	
	Uses $r = \sqrt{(\pm "10")^2 + (\pm "12")^2 - c}$		M1
	$r = \sqrt{10^2 + 12^2 - 195}$	A correct numerical expression for r	A1
	$r = 7$		A1
			(5)
(b)	$MN = \sqrt{(25 - "10")^2 + (32 - "12")^2}$	Correct use of Pythagoras	M1
	$MN \left(= \sqrt{625}\right) = 25$		A1
			(2)
(c)	$NP = \sqrt{("25"^2 - "7"^2)}$	$NP = \sqrt{(MN^2 - r^2)}$	M1
	$NP \left(= \sqrt{576}\right) = 24$		A1
			(2)
(c) Way 2	$\cos(NMP) = \dfrac{7}{"25"} \Rightarrow NP = "25"\sin(NMP)$	Correct strategy for finding NP	M1
	$NP = 24$		A1
			(2)
			[9]