(b)	$f'(9)=10$	B1
	Gradient of normal is $-\frac{1}{f'(9)}$	M1
	$(y-20)="-\frac{1}{10}"(x-9)$ or $y="-\frac{1}{10}"x+c \Rightarrow 20="-\frac{1}{10}"\times 9+c \Rightarrow c=...$	**d**M1
	$x+10y-209=0$	A1
		(4)
		9 marks

(b) Notes

B1: For $f'(9)=10$ which may be implied by the gradient of normal = $-\frac{1}{10}$

M1: For gradient of normal = $-\frac{1}{\text{their } f'(9)}$ where $f'(9)$ is an attempt to substitute $x = 9$ into the given $f'(x)$

dM1: Correct method for the equation of the normal using $x = 9$, $y = 20$ and a changed $f'(9)$ with the values correctly placed.
If they use $y = mx + c$ they must proceed as far as finding a value for c.
Dependent upon the previous method mark.

A1: cso $x+10y-209=0$ or any integer multiple of this equation in the required form.

Question Number	Scheme	Marks
8	$kx^2 + 8x + 2(k+7) = 0$	
	$b^2 - 4ac = 8^2 - 4k \times 2(k+7)$	M1
	$8^2 - 4k \times 2(k+7) = 64 - 8k^2 - 56k$	A1
	Attempts to solve $b^2 - 4ac...0 \Rightarrow k^2 + 7k - 8 ...0 \Rightarrow k =$	**d**M1
	Critical values of 1 and -8	A1
	$k > 1$ or $k < -8$	**dd**M1 A1
		(6)
		6 marks

Notes

M1: Attempts $b^2 - 4ac$ with $a = k, b = 8$ and $c = 2(k+7)$

Condone slips with the $2(k+7)$ e.g. uses $2k+7$ or $k+7$ and condone missing brackets e.g. $b^2 - 4ac = 8^2 - 4k \times 2k + 14$

May be seen embedded in an attempt to use the quadratic formula.

May also be seen in an attempt at an equation or inequality e.g. $b^2 - 4ac...0$ or $b^2 < 4ac$ or e.g. $b^2 > 4ac$

A1: Correct 3 term quadratic expression seen e.g. $64 - 56k - 8k^2$ which may be seen as an inequality or an equation e.g. $64 < 56k + 8k^2$ or $64 = 56k + 8k^2$ or $8 - 7k - k^2$. Allow 8^2 for 64.

Any brackets must be removed.

dM1: Attempts to find the critical values from a 3 term quadratic equation or inequality resulting from $b^2 - 4ac...0$ or equivalent where … can be any inequality or equality via **non calculator** methods.

Depends on the first method mark.

Do not allow for quoting the quadratic formula quoted followed by values e.g.

$$8k^2 + 56k - 64 = 0 \Rightarrow k = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = 1, -8 \text{ is M0}$$

But allow e.g. $8k^2 + 56k - 64 = 0 \Rightarrow k = \frac{-56 \pm \sqrt{56^2 - 4 \times 8 \times (-64)}}{2 \times 8} = 1, -8$ is M1

Do not allow obvious use of a calculator where the factors do not correspond with their 3TQ

e.g. $8k^2 + 56k - 64 = 0 \Rightarrow (k-1)(k+8) = 0 \Rightarrow k = 1, -8$ is M0

but allow e.g. $8k^2 + 56k - 64 = 0 \Rightarrow 8(k-1)(k+8) = 0 \Rightarrow k = 1, -8$ is M1

A1: Correct critical values. May be implied by e.g. $k^2 + 7k - 8 > 0 \Rightarrow (k-1)(k+8) > 0 \Rightarrow k > 1, k < -8$

ddM1: Chooses the outside region for their critical values. Condone e.g. $1 < k < -8$ for this mark.

Condone the boundaries being included in the inequality and condone the use of x rather than k.

The evidence for choosing the outside region must be taken from what they write down and not from e.g. a sketch.

It is dependent upon both previous Method marks.

A1: CSO $k > 1$ or $k < -8$ o.e. Must be in terms of k.

The following are acceptable:

$k > 1, k < -8$	$k > 1$ and $k < -8$	$k > 1$ or $k < -8$	$k > 1 \cup k < -8$
$(0, -8), (1, \infty)$	$\{k : k > 1, k < -8\}$	$k > 1 \quad k < -8$	