Question	Scheme	Marks	AOs
1	$g(3)=3(3)^3-20(3)^2+3(k+17)+k=0$	M1	3.1a
	$4k-48=0 \Rightarrow k=...$	M1	1.1b
	$\{k=\}12$	A1	1.1b
		(3)	
			(3 marks)

Notes

Note: Ignore any use of $f(x)$ in place of $g(x)$ throughout.

M1: Attempts $g(3)=0$ to set up a linear equation in *k*. The = 0 may implied by their value of *k*.

Expect to see 3 substituted for *x* at least twice but condone minor slips copying the function.
May be scored for e.g. 81 – 180 + 3(*k* + 17) + *k* = 0
Missing brackets may be recovered.

Attempting $g(-3)=0$ scores M0 but note that the second M1 is available.

If algebraic division is attempted, they need to achieve a linear remainder in *k* only and set =0 Condone slips in their calculations.
As a minimum, expect to see $3x^2+\lambda x,\ \lambda \neq 0$ as their quotient **leading to a linear remainder in *k* only set = 0** (the = 0 may be implied by their value for *k*).
For reference, the correct division is

$$\begin{array}{r|l} & 3x^2 - 11x + \ k - 16 \\ x-3 & 3x^3 - 20x^2 + (k+17)x + k \\ & \underline{3x^3 - 9x^2} \\ & \quad -11x^2 + (k+17)x + k \\ & \quad \underline{-11x^2 + 33x} \\ & \qquad (k-16)x + k \\ & \qquad \underline{(k-16)x - 3k + 48} \\ & \qquad\qquad 4k - 48 = 0 \end{array}$$

You may also see variations on the table below.
Here, the M1 is scored when the sum of both coefficients of *x* are equated to (*k* + 17)

	$3x^2$	$-11x$	$-\frac{k}{3}$
x	$3x^3$	$-11x^2$	$-\frac{k}{3}x$
-3	$-9x^2$	$33x$	k

$33-\frac{k}{3}=k+17$ scores M1

M1: Scored for attempting to solve a linear equation in *k* having attempted g (±3) = 0
Do not be concerned about the process, e.g. $-81+180-3(k+17)+k=0 \rightarrow k=...$ scores M1.
Via division they must have a linear remainder in *k* set = 0
The = 0 may be implied by their value for *k* in all approaches.

A1: Obtains $\{k=\}12$ only. Do not accept e.g. $\frac{48}{4}$ Allow slips in working to be recovered.
Condone e.g. $x=12$ provided it has come from a linear equation in *k*.
Note that e.g. $3(3)^3-20(3)^2+3(k+17)+k\{=0\} \rightarrow k=12$ and
$81-180+3k+51+k\{=0\} \rightarrow k=12$ are sufficient to imply M1M1A1.