Question Number	Scheme	Marks
4	$kx^2+6kx+5=0$	
	$b^2-4ac=(6k)^2-4\times k\times 5$	M1
	$b^2-4ac=(6k)^2-4\times k\times 5...0\Rightarrow k...$	dM1
	$k<\frac{5}{9}$	A1
	$0<k<\frac{5}{9}$	A1
		(4 marks)

M1: Attempts to use b^2-4ac for the given quadratic with $b = 6k$, a = k and $c = 5$.

May be seen as part of the quadratic formula or may be implied by an attempt to solve e.g. $b^2=4ac$

Condone attempts where the "6" isn't squared e.g. $6k^2-4\times k\times 5$ but the k must be squared.

dM1: Dependent upon the previous M mark, it is for setting $b^2-4ac...0$ leading to a non-zero value for k from an "equation" of the form $\alpha k^2-\beta k...0$

Condone any of e.g. "=", "<", ">" etc. for "…" for this mark.

A1: For obtaining an upper limit for k of $\frac{5}{9}$ (not just the value) but condone $k\leqslant\frac{5}{9}$ which may be implied by e.g. $0<k<\frac{5}{9}$ or $0<k\leqslant\frac{5}{9}$. Allow exact equivalents for $\frac{5}{9}$ e.g. $\frac{10}{18}$ etc. Condone the use of x for this mark so allow e.g. $x\leqslant\frac{5}{9}$, $x<\frac{5}{9}$ Allow $0.\dot{5}$ for $\frac{5}{9}$

Allow the inequalities to be on separate lines e.g. $k<\frac{5}{9}$ $k>0$

Question Number	Scheme	Marks
5(a)	$9^x = p^2,\quad 3^{x+2} = 9p \quad \text{or} \quad 3^{x-1} = \frac{p}{3}$	B1
	$3\times 9^x + 3^{x+2} = 1 + 3^{x-1} \Rightarrow 3p^2 + 3^2 \times p = 1 + \frac{p}{3^1}$	M1
	$9p^2 + 26p - 3 = 0$ via $3p^2 + 9p = 1 + \frac{p}{3}$*	A1*
		(3)
(b)	$9p^2 + 26p - 3 = 0 \Rightarrow (9p-1)(p+3) = 0$	M1
	$3^x = \frac{1}{9}$	A1 M1 in EPEN
	$x = -2$	A1
		(3)
		(6 marks)

(a) Mark (a) and (b) together.

B1: Uses an index law and states or implies any of $9^x = p^2$, $3^{x+2} = 9p$ or $3^{x-1} = \frac{p}{3}$ or equivalent forms

e.g. $9^x = p \times p$, $3^{x+2} = 3^2 \times p$, $3^{x-1} = p \times 3^{-1}$

If awarding for the first term, then it must be from correct work so $3\times 9^x = 3\times 3^x \times 3^x = 3p^2$ is fine but $3\times 9^x = 3\times 3^2 \times 3^x = 3p^2$ or $3\times 9^x = 3\times 3\times 3^x = 3p^2$ is not, but do check the other terms.

M1: Look for $3\times 9^x + 3^{x+2} = 1 + 3^{x-1} \Rightarrow 3p^2 \pm kp = 1 \pm \frac{p}{3}$ oe **obtained from correct work**, with $k = 6$ or 9

So if e.g. $3p^2$ is obtained from $3\times 9^x = 3\times 3^2 \times 3^x = 3p^2$ or $3\times 9^x = 3\times 3\times 3^x = 3p^2$ then score M0.

A1*: Proceeds to the given answer of $9p^2 + 26p - 3 = 0$ with no errors or omissions.

An intermediate line of $3p^2 + 9p = 1 + \frac{p}{3}$ o.e. must be seen.

Note that the following is common in part (a) and scores no marks: $3\times 9^x + 3^{x+2} = 1 + 3^{x-1} \Rightarrow 3\times 3p + p^2 = 1 + p^{-1}$

(b)

M1: Valid **<u>non-calculator</u>** attempt at solving $9p^2 + 26p - 3 = 0$ – see General Guidance.

It must be clear they are solving the given quadratic not their incorrect one.

Answers just written down scores M0

A1(M1 in EPEN): For $3^x = \frac{1}{9}$ seen. It must be clear that it is a value for 3^x and not a value for p or x.

May be implied by e.g. $p = \frac{1}{9} \Rightarrow x = -2$. You can ignore e.g. $3^x = -3$ for this mark.

A1: $x = -2$ only