

# Topic X1: Indices, surds and quadratics (Post-TT B) [24] MARKSCHEME

1.

<b>4</b>	$k = x^3$ $k^2 + 26k - 27 = 0$ $k = -27, 1$  $x = -3, 1$	*M1 A1 A1 DM1 A1	Attempt a substitution to obtain a quadratic $k^2 + 26k - 27 = 0$ $-27, 1$ Attempt cube root $x = -3, 1$ (no extras) ( SR: $x = 1$ seen www <b>B1</b> $x = -3$ seen www <b>B1</b> )
		<b>5</b>	

2.

<b>(i)</b>	$3^{-2}$	<b>B1 1</b>	
<b>(ii)</b>	$3^{\frac{1}{3}}$	<b>B1 1</b>	
<b>(iii)</b>	$3^{10} \times 3^{30}$ $= 3^{40}$	<b>M1</b> <b>A1 2</b> <span style="border: 1px solid black; padding: 2px;">4</span>	

3.

$u^2 - 5u + 4 = 0$	M1*	Use the given substitution to obtain a quadratic or factorise into 2 brackets each containing $(3x - 2)^2$	No marks if evidence of "square rooting" e.g. " $(3x - 2)^2 - 5(3x - 2) + 2$ (or $4 = 0$ )"
$(u - 1)(u - 4) = 0$	DM1	Correct method to solve a quadratic	No marks if straight to quadratic formula to get $x = "1"$ $x = "4"$ and no further working
$u = 1$ or $u = 4$	A1	Correct values for $u$	SR 1) If M0 Spotted solutions www B1 each Justifies 4 solutions exactly B2
$3x - 2 = \pm 1$ or $3x - 2 = \pm 2$	M1	Attempt to square root and rearrange to obtain $x$ OR to expand, rearrange and solve quadratic (at least one)	SR 2) If first 3 marks awarded, spotted solutions 2 correct B1
$x = 1$ or $\frac{1}{3}$ or $\frac{4}{3}$ or 0	A1	2 correct values	Other 2 correct B1
	A1	All 4 correct values ( $\frac{0}{3} = A0$ )	Justifies 4 solutions exactly B1
	<span style="border: 1px solid black; padding: 2px;">6</span>		<u>Alternative scheme for candidates who multiply out:</u>
			Attempt to expand $(3x - 2)^4$ and $(3x - 2)^2$ M1
			$81x^4 - 216x^3 + 171x^2 - 36x = 0$ A1
			$x = 0$ a solution or $x$ a factor of the quartic A1
			Attempt to use factor theorem to factorise their cubic M1*
			Correct method to solve quadratic DM1
			All 4 solutions correct A1

4.

<b>(i)</b> $\frac{16x^2 \times 2x^3}{x}$	B1	32	
$= 32x^4$	B1	2 $x^4$	
<b>(ii)</b> $\frac{1}{6}x$	M1	6 or $\frac{1}{36^{\frac{1}{2}}}$ or $\frac{1}{\sqrt{36}}$ seen	$\frac{1}{\sqrt{36}}$ is M0
	A1	$\frac{1}{6}$ in final answer	$\frac{1}{\sqrt{36}}$
	B1	$\frac{3}{5}x$ (Allow $x^1$ ) in final answer	$\pm \frac{1}{6}$ is A0

5.

$3(x^2 - 6x) + 4$	B1	$p = 3$	If $p, q, r$ found correctly, then ISW slips in format.
$= 3[(x - 3)^2 - 9] + 4$	B1	$(x - 3)^2$ seen or $q = -3$	$3(x - 3)^2 + 23$ B1 B1 M0 A0
$= 3(x - 3)^2 - 23$	M1	$4 - 3q^2$ or $\frac{4}{3} - q^2$ (their $q$ )	$3(x - 3) - 23$ B1 B1 M1 A1 (BOD)
	A1	$r = -23$	$3(x - 3x)^2 - 23$ B1 B0 M1 A0
	<span style="border: 1px solid black; padding: 2px;">4</span>		$3(x^2 - 3)^2 - 23$ B1 B0 M1 A0
	<span style="border: 1px solid black; padding: 2px;">4</span>		$3(x + 3)^2 - 23$ B1 B0 M1 A1 (BOD)
			$3x(x - 3)^2 - 23$ B0 B1M1A1