

Q3.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	$81x^{20}y^{24}$	B2	cao	
		(B1)	for two of $81, x^{20}, y^{24}$	
(b)	$x^3+3x^2-10x-24$	M1	for method to find the product of any two linear expressions (3 out of 4 terms correct or 4 correct terms ignoring signs), eg $x^2 + 2x - 3x - 6$ or $x^2 + 2x + 4x + 8$ or $x^2 + 4x - 3x - 12$	Note that, for example $-x - 6$ in expansion of $(x + 2)(x - 3)$ is regarded as 3 correct terms.
		M1	for a complete method to find all terms, at least half of which are correct (ft their first product), eg $x^3 + 4x^2 + 2x^2 - 3x^2 + 8x - 6x - 12x - 24$	First product must be quadratic with at least 3 terms but need not be simplified or may be simplified incorrectly
		A1	cao	

Q4.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	$2x^3 + x^2 - 7x - 6$	M1	for a method to find the product of two linear expressions eg 3 correct terms out of 4 terms or 4 terms ignoring signs	Note that (eg) $-x - 6$ in expansion of $(x - 2)(2x + 3)$ is to be regarded as 3 correct terms.
		M1	for a complete method to obtain all terms, half of which are correct (ft their first product) eg $2x^3 - x^2 - 6x + 2x^2 - x - 6$	First product must be quadratic but need not be simplified or may be simplified incorrectly
		A1	cao	
(b)	-5	M1	for beginning to combine indices eg 4^{+n} or y^{3+2}	
		A1	cao	
(c)	1.27 and -0.472	M1	for substitution into the formula	Condone one sign error in the substitution Accept -4^2 or $(-4)^2$
		M1	for simplifying to the form $\frac{-b \pm \sqrt{N}}{k}$ eg $\frac{4 \pm \sqrt{76}}{10}$ or 1.27 to 1.28 or -0.48 to -0.47	
		A1	for 1.27 to 1.28 and -0.48 to -0.47	

Q5.

Question	Working	Answer	Mark	Notes
(a)		300	B1 B1	for correct use of indices rules, e.g. sight of 3 from $\sqrt[4]{27 \times 3}$ or sight of 10^2 for 300, 3×10^2 oe
(b)		$\frac{25}{9}$	M1 A1	shows understanding of notation by working out one step, e.g. reciprocal or cube root (to both numbers). oe

Q6.

Question	Working	Answer	Notes
(i)		200	B1 cao
(ii)		5.6	B1 For 5.6(2...)

Q7.

Paper 1MA1: 2H			
Question	Working	Answer	Notes
(a)		0.4	B1 For 0.4 oe
(b)		0.586	B1 for 3.48207..... or 17.34 or 0.200811... B1 for 0.585 to 0.586

Q8.

Paper 1MA1: 1H			
Question	Working	Answer	Notes
		25	B1 cao

Q9.

Question	Working	Answer	Mark	Notes
(a)		3^7	M1 A1	for a first step using a rule of indices, e.g. $3^5 \times 3^4 = 3^{5+4} (= 3^9)$ or $3^5 \div 3^2 = 3^{5-2} (= 3^3)$ or $3^4 \div 3^2 = 3^{4-2} (= 3^2)$ cao
(b)		1	B1	cao
(c)		$\frac{1}{9}$	B1	for $\frac{1}{9}$ (or 0.11...)

Q10.

Question	Answer	Mark	Mark scheme	Additional guidance
	9	M1 A1	for a correct first step, using the laws of indices to simplify eg. 3^3 or $3^{7+(-2)}$ or 3^{7-3} or 3^{-2-3} OR for using exact values, eg. $2187 \times \frac{1}{9} (= 243)$ or $2187 \div 27 (= 81)$ or $\frac{1}{27 \times 9} (= \frac{1}{243})$ cao	

Q11.

Question	Answer	Mark	Mark scheme	Additional guidance
	16	M1	for working with square root or with reciprocal in $\left(5\frac{4}{9}\right)^{\frac{1}{2}}$ eg $\left(\frac{9}{49}\right)^{\frac{1}{2}}$ or $\frac{1}{\sqrt{\frac{49}{9}}}$ or $\frac{1}{\left(\frac{49}{9}\right)^{\frac{1}{2}}}$ or $\left(\frac{7}{3}\right)^{-1}$ or $\frac{3}{7}$	
		M1	for a full method to simplify the numerator eg $\frac{3}{7} \times \frac{14}{3} (= 2)$	
		M1	for showing $\div 2^{-3}$ as $\times 8$, eg $\frac{3}{7} \times \frac{14}{3} \times 8$ or for $2^1 \div 2^{-3} (= 2^4)$ or for correctly reducing the expression to a single calculation, eg $\frac{336}{21}$ or $\frac{112}{7}$ or $2 \div \frac{1}{8}$	May be seen at any time during the calculation
		A1	cao	Award 0 marks for a correct answer with no supportive working

Q12.

Question	Answer	Mark	Mark scheme	Additional guidance
	2^6	M1	for the start of a method of simplification, eg $2^{-5+8} (= 2^3)$ or $2^{-5 \times 2} (= 2^{-10})$ or $2^{8 \times 2} (= 2^{16})$	
		A1	cao SC B1 for answer of 64 or 8^2 or 4^3 if M0 scored.	

Q13.

Question	Answer	Mark	Mark scheme	Additional guidance
	$\frac{16}{81}$	M1	for showing the cube root of 8 = 2 and the cube root of 27 = 3 or an intention to find the cube root and raise to power 4 eg $\sqrt[3]{\left(\frac{8}{27}\right)^4}$ or $\left(\sqrt[3]{\frac{8}{27}}\right)^4$ or $\left(\frac{2}{3}\right)^4$	
		A1	cao	

Q14.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	4^{-2}	B1	for 4^{-2}	Accept $n = -2$
(b)	5	M1	for $8^{\frac{5}{3}} = (\sqrt[3]{8})^5$ or 2^5 or $\sqrt[3]{8^5}$ or $\sqrt[3]{32768}$ or $9^{\frac{3}{2}} = (\sqrt{9})^3$ or 3^3 or $\sqrt{9^3}$ or $\sqrt{729}$	
		M1	for correctly evaluating $8^{\frac{5}{3}}$ or $9^{\frac{3}{2}}$, eg 32 or 27 seen	
		A1	cao	

Q15.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)(i)	1	B1	cao	
(ii)	$\frac{1}{25}$	B1	oe	
(b)	2^6	M1	for a correct first step using a rule of indices, eg $2^{2+4} (= 2^6)$ or $2^{2+3} (= 2^5)$ or $2^{4+3} (= 2^7)$ or for $2 \times 2 \times 2 \times 2 \times 2 \times 2$ or 64	
		A1	for 2^6	Accept $n = 6$

Q16.

Question	Answer	Mark	Mark scheme	Additional guidance
	17	M1	for $27^{\frac{2}{3}} = (\sqrt[3]{27})^2$ or 3^2 or $\sqrt[3]{27^2}$ or $\sqrt[3]{729}$ or $\left(\frac{1}{2}\right)^{-3} = \frac{1}{\left(\frac{1}{2}\right)^3}$ or 2^3	
		M1	for a full method eg " $3^{12} + 2^{13}$ " or for correctly evaluating $27^{\frac{2}{3}}$ or $\left(\frac{1}{2}\right)^{-3}$ eg 9 or 8 seen	
		A1	cao	

Q17.

Question	Answer	Mark	Mark scheme	Additional guidance
	$5\frac{5}{6}$	P1	for $2^x = 2^{n-\frac{1}{3}}$ or $2^y = 2^{\frac{5}{2}}$ or $x = n - \frac{1}{3}$ oe or $y = \frac{5}{2}$ oe or for $(2^{x+y}) = \frac{2^n}{\sqrt[3]{2}} \times (\sqrt{2})^5$	
		P1	for $2^{x+y} = 2^{n-\frac{1}{3}+\frac{5}{2}}$ or $x+y = n - \frac{1}{3} + \frac{5}{2}$ oe or $\frac{11}{2} = n - \frac{1}{3}$ oe	
		A1	oe eg $\frac{35}{6}$	

Q18.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	10	M1	for $25^{\frac{1}{2}} = 5$ or $8^{\frac{1}{3}} = 2$	Accept $25^{\frac{1}{2}} = -5$ for M1 only
		A1	cao	
(b)	$\frac{1}{8}$	M1	for $\left(\frac{1}{\sqrt[5]{32}}\right)^3$ or $\left(\frac{1}{2}\right)^3$ or $\sqrt[5]{\frac{1}{32^3}}$ or $\sqrt[5]{\frac{1}{32768}}$	
		A1	for $\frac{1}{8}$ oe SCB1 for answer of 8 if M0 scored	

Q19.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	$14x^5y^6$	B2 (B1)	cao for correct simplification of two terms ax^5y^6 or $14x^b y^6$ or $14x^5 y^c$ where $a \neq 14$, $b \neq 5, c \neq 6$	Where a, x^b, y^c can be made up of two products Condone inclusion of multiplication signs for B1
(b)	m^{-6}	B1	for m^{-6} or $\frac{1}{m^6}$	

Q20.

Question	Answer	Mark	Mark scheme	Additional guidance
	$\frac{3}{4}$ oe	P1 P1 A1	for a first step to converting to a common base with one correct conversion, eg. $9^{-\frac{1}{2}} = 3^{-1}$ or $\frac{1}{3}$ or $27^{\frac{1}{4}} = 3^{\frac{3}{4}}$ oe (dep) for $3^{-1} = 3^{\frac{3}{4}} \div 3^{x+1}$ oe cao	$9^{-\frac{1}{2}} = 3^{-1}$ (or $\frac{1}{3}$) oe or $27^{\frac{1}{4}} = 3^{\frac{3}{4}}$ oe seen alone gets the P1

Q21.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	$\frac{8}{27}$	M1	for showing the 4th root of 16 as 2 and the 4th root of 81 as 3 or $\frac{8}{n}$ ($n \neq 27$) or $\frac{n}{27}$ ($n \neq 8$) or an intention to find the 4th root and cube, eg. $\sqrt[4]{\left(\frac{16}{81}\right)^3}$ or $\left(\sqrt[4]{\frac{16}{81}}\right)^3$ oe	
		A1	cao	
(b)	0	M1	for writing $\frac{1}{9} = 3^{-2}$, $9\sqrt{3} = 3^{2.5}$, $\frac{1}{\sqrt{3}} = 3^{-0.5}$ as powers of 3, with at least 2 correct or for working out $\frac{1}{9} \times 9\sqrt{3} \times \frac{1}{\sqrt{3}} = 1$	
		A1	cao	

Q22.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	x^{15}	B1	cao	
(b)	$40 - 10x$	M1	for method to expand one bracket or collect like terms, eg $4 \times x + 4 \times 3$ ($= 4x + 12$) or $7 \times 4 - 7 \times 2x$ ($= 28 - 14x$) or $4 \times x - 7 \times 2x$ ($= 4x - 14x$) and $4 \times 3 + 7 \times 4$ ($= 12 + 28$)	
		A1	oe	
(c)	$3x^2(5x + y)$	M1	for $3(5x^3 + x^2y)$ or $x(15x^2 + 3xy)$ or $3x(5x^2 + xy)$ or $x^2(15x + 3y)$ or $3x^2(ax + by)$	Where $a \geq 1$ and $b \geq 1$
		A1	cao	

Q23.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	m^6	B1	cao	
(b)	x^{13}	B1	cao	
(c)	$4p^3 + 12p^2$	B2 (B1)	for $4p^3 + 12p^2$ for expanding the bracket to get $p^3 + 3p^2$ or $4p^3$ or $12p^2$	

Q24.

Question	Answer	Mark	Mark scheme	Additional guidance
	$3x^7y^2$	M1 M1 A1	<p>for full evaluation of numerator or denominator with at least 2 of 3 terms correct in a product, eg $36x^{10}y^6$ or $12x^3y^4$</p> <p>or full evaluation of $\frac{6x^5y^3}{3x^2y^7}$ or $\frac{6x^5y^3}{4xy^{-3}}$ with at least 2 of 3 terms correct in a product, eg $2x^3y^{-4}$ or $1.5x^4y^6$</p> <p>for correct evaluation of numerator and denominator, eg $36x^{10}y^6$ and $12x^3y^4$</p> <p>or for full evaluation of numerator and denominator with no more than one error and a final answer of the form ax^by^c with two of a, b and c correct</p> <p>or for correct evaluation of $\frac{6x^5y^3}{3x^2y^7}$ and $\frac{6x^5y^3}{4xy^{-3}}$ eg $2x^3y^{-4}$ and $1.5x^4y^6$</p> <p>or for full evaluation of $\frac{6x^5y^3}{3x^2y^7}$ and $\frac{6x^5y^3}{4xy^{-3}}$ with no more than one error and a final answer of the form ax^by^c with two of a, b and c correct</p>	Accept $a = 3$, $b = 7$, $c = 2$

Q25.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	n^3	B1	cao	
(b)	cd^3	M1	for partial simplification, eg c or d^3	May be seen as simplification in original fraction Accept c^1d^3
		A1	for cd^3	
(c)	$x > \frac{14}{5}$	M1	for $5x > 14$ or $5x = 14$ or critical value, $\frac{14}{5}$ oe	Must see carried out correctly, ie at least $5x > 7 \times 2$ not just intention seen. Allow other signs for this mark.
		A1	$x > \frac{14}{5}$ or $x > 2\frac{4}{5}$ or $x > 2.8$	

Q26.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	10^{60}	M1	for a correct first step using one of the rules of indices, eg. $10^{150} \times 10^{90} = 10^{240}$ or $10^{360} \div 10^{150} = 10^{210}$ or $10^{360} \div 10^{90} = 10^{270}$ or $\sqrt{10^{360}} = 10^{180}$ or $\sqrt{10^{150}} = 10^{75}$ or $\sqrt{10^{90}} = 10^{45}$	
		M1	for correct use of rules of indices leading as far as $\sqrt{10^{120}}$ or $\frac{10^{180}}{10^{120}}$	
		A1	cao	
(b)	reason	C1	for correct reasoning Acceptable examples eg should do 50×2 (not 50^2) because $(12^{50})^2 = 12^{100}$ because when you have a power inside and outside the bracket you times them because $(a^b)^c = a^{bc}$ (not a^{b^c}) Not acceptable examples because you need to multiply everything in the brackets by 2 because he should have squared 12 as well you add the powers instead of timesing	

Q27.

Question	Answer	Mark	Mark scheme	Additional guidance
	49, 2	P1 A1	for setting up $6 \div n = 3$ oe or $7^n = a$ oe or one correct answer cao	Accept the figures written as a complete statement eg $(49x^6)^{\frac{1}{2}}$

Q28.

Question	Working	Answer	Mark	Notes
		1.45	P1 P1 A1 OR P1 A2	for converting to a common base with at least one correct conversion, eg. $(16 =) 2^4$ or $(8 =) 2^3$ (dep) for correct use of index laws to derive an equation, eg. $4 \times \frac{1}{5} + x = 3 \times \frac{3}{4}$ oe for 1.45 oe (accept $2^{1.45}$) OR for a process to find the value of 2^x , eg. $8^{\frac{8}{4}} \div 16^{\frac{1}{3}} = 2.73\dots$ for 1.45 oe (accept $2^{1.45}$)

Q29.

Question	Working	Answer	Mark	Notes
		625	2	M1 for 3^{4n} or 5^4 or $(3^{-n})^{-4}$ or 0.2^{-4} A1 625

Q30.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	1	B1	cao	
(b)	3	B1	cao	
(c)	$\frac{1}{16}$	B1	oe	
(d)	3	B1	cao	

Q31.

Question	Working	Answer	Mark	Notes
(a)		10	B1	accept ± 10
(b)		25	M1	for $(\sqrt[3]{125})^2$ or $\sqrt[3]{125} = 5$ or $125^2 = 15625$ or $\sqrt[3]{125^2}$
			A1	cao

Q32.

Question	Working	Answer	Mark	Notes
(a)		6	B1	cao
(b)		5	B1	cao
(c)		Shown	M1	for writing 100^a or 1000^b as a power of 10 ($=10^{2a}$ or 10^{3b}) or 10^{2a+3b} or $100 = 10^2$ and $1000 = 10^3$
			C1	for complete chain of reasoning leading to conclusion

Q33.

Question	Working	Answer	Mark	Notes
		$\frac{1}{16}$	1	cao

Q34.

Question	Working	Answer	Mark	Notes
(a)		$\frac{1}{9}$	M1	for showing a method using either reciprocal or square root e.g. $\frac{1}{n}$ or 9 seen
			A1	cao Accept $\pm\frac{1}{9}$ or 0.1 recurring
(b)		$\frac{16}{25}$	M1	for showing cube root of 64 as 4 and the cube root of 125 as 5
			A1	or $\frac{16}{n}$ ($n \neq 25$) or $\frac{n}{25}$ ($n \neq 16$) or an intention to find the cube root and square. cao Accept 0.64

Q35.

Question	Answer	Mark	Mark scheme	Additional guidance
(a)	6	B1	cao	Accept ± 6
(b)	1	B1	cao	
(c)	$\frac{1}{9}$	M1	for evidence of working with a cube root eg $\sqrt[3]{27}$ or $\sqrt[3]{729}$ OR evidence of working with a reciprocal eg $\frac{1}{27^{2/3}}$ or $\left(\frac{1}{27}\right)^{\frac{2}{3}}$	
		A1	cao	