

Rewriting Bases PPQs

1.

(a) Write $\frac{1}{32}$ as a power of 2

.....
(2)

2. (a) Write $\frac{1}{16}$ as a power of 2

.....
(2)

(b) Write 2 as a power of 8

.....
(2)

3. (a) Express $8^{\frac{1}{2}}$ as a power of 2

.....
(2)

(b) Express $\sqrt{3}$ as a power of 9

.....
(2)

(c) Express $\frac{1}{4\sqrt{2}}$ as a power of 2

.....
(3)

(Total 7 marks)

4. (a) Find the value of $(9^{\frac{1}{2}})^4$

.....
(1)

- (b) Express 5^{20} as a power of 25

.....
(2)

- (c) Express $\sqrt{8}$ as a power of 2

.....
(2)

(Total 5 marks)

5. $g = 2^3 \times 3 \times 7^2$ $h = 2 \times 3 \times 7^3$

- (a) Express gh as a product of powers of its prime factors.
Simplify your answer.

.....
(2)

$$\frac{g}{h} = 2^a \times 3^b \times 7^c$$

- (b) Find the value of a , the value of b and the value of c .

$a =$

$b =$

$c =$

(2)

$$\frac{1}{\sqrt[3]{9^4}} = 3^n$$

- (d) Work out the exact value of n .

.....
(3)

(Total for Question 16 is 9 marks)

6. (a) Simplify $(16y^8)^{\frac{3}{4}}$

.....
(2)

(b) Given that $2^p \times 8^q = 2^n$
express n in terms of p and q .

$n =$
(2)

(Total for Question 21 is 4 marks)

7.

Given that $(2^{\frac{1}{2}})^n = \frac{2^x}{8^y}$

express n in terms of x and y .

.....
(Total for Question 24 is 3 marks)

8. (b) $\frac{8^2 \times 8^3}{8^4} = 2^n$

Find the value of n .

$n = \dots\dots\dots$
(2)

(Total for Question 10 is 5 marks)

9. Solve $3 \times 4^{2k+8} = 24$
Show your working clearly.

$k = \dots\dots\dots$

(Total for Question 21 is 4 marks)

10.

(a) Simplify fully $\left(\frac{125e^{12}}{27f^3}\right)^{\frac{2}{3}}$

.....
(3)

(b) Given that $2^{\frac{1}{2}} \times 2^{\frac{n}{3}} = \frac{8^x}{4^n}$

express x in terms of n .

.....
(4)

(Total for Question 20 is 7 marks)

11 $128 = 4^{2x} \times 2^x$

Work out the value of x .

$x =$

(Total for Question 14 is 3 marks)

12.

$$\frac{8}{2^7} = 2^n$$

(a) Find the value of n .

$$n = \dots\dots\dots$$

(2)

$$(13^{-6})^4 \times 13^5 = 13^k$$

(b) Find the value of k .

$$k = \dots\dots\dots$$

(2)

(Total for Question 10 is 4 marks)

13. $\frac{5^{n^2}}{5^6} \times \frac{5^{n^2-5n}}{5^3} = 125$ where $n > 0$

Work out the value of n .
Show clear algebraic working.

$$n = \dots\dots\dots$$

(Total for Question 22 is 5 marks)

14.

Given that $\frac{12 \times (\sqrt{8})^{2y+2}}{6 \times 4^{2y+1}}$ can be written in the form 2^p ,

find an expression for p in terms of y .

$p = \dots\dots\dots$

(Total for Question 20 is 3 marks)

Answers

1.

22	(a)			2^{-5}	2	B2	B1 for $\frac{1}{2^5}$ or $\left(\frac{1}{2}\right)^5$ or 2^5
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2.

20.	a	2^4 or -4 seen		2^{-4}	2	M1 A1	
	b	2^3 or $1/3$ seen		$8^{1/3}$	2	M1 A1	accept $8^{0.3rec}$

3.

13.	(a)	2^3 seen		$2^{3/2}$ or $2^{1.5}$ or $2^{1\frac{1}{2}}$	2	M1 A1	
	(b)	$9^{1/2}$ seen		$9^{1/4}$ or $9^{0.25}$	2	M1 A1	
	(c)	$\frac{1}{2^2 \times 2^{1/2}}$ $\frac{1}{\sqrt{32}}$ $\frac{\sqrt{2}}{8}$ $\frac{1}{2^{5/2}}$ $\frac{1}{\sqrt{2^5}}$ $\frac{2^{0.5}}{2^3}$		$2^{-5/2}$ or etc	3	M1 A1	or $2^{-2} \times 2^{-1/2}$: M2

Total 7marks

4.

18.	(a)		81	1	B1	
	(b)	$25 = 5^2$ or $5 = 25^{0.5}$ or 0.5×20 oe	25^{10}	2	M1 A1	not 5×5
	(c)	2^3 or $8^{1/3}$ or $8^{0.3}$ or $(/2)^3$ or (2^3) or $2^{1/2} \times 2^{1/2} \times 2^{1/2}$ or 3×0.5	$2^{1.5}$ oe	2	M1 A1	must involve power(s) not $2/2$ not $/2 \times /2 \times /2$

Total 5 marks

5.

16	(a)	$2^{3+1} \times 3^{1+1} \times 7^{2+3}$		$2^4 \times 3^2 \times 7^5$	2	M1	or for a product of powers of 2, 3 and 7 with two powers correct, or for an attempt to find prime factors of 2420208 (allow one arithmetical error) or for $2^4, 3^2, 7^5$
	(b)	$2^{3-1} \times 3^{1-1} \times 7^{2-3}$		2, 0, -1	2	M1 A1	or for any two correct. Accept $2^2 \times 3^0 \times 7^{-1}$
	(c)	Eg $7^2 - (2\sqrt{5})^2$ or $7^2 - 14\sqrt{5} + 14\sqrt{5} - (2\sqrt{5})^2$		Show that	2	M1 A1	For a correct unsimplified exact expansion 7^2 may be simplified to 49 and $(2\sqrt{5})^2$ as far as 20 Correct solution (simplified correctly) dep on M1
	(d)	$\frac{1}{9^{2/3}}$ or $9^{-2/3}$ or $\frac{1}{\sqrt[3]{(3^2)^4}}$ or $\frac{1}{\sqrt[3]{3^8}}$ oe		$(3^2)^{-2/3}$ or $3^{-4/3}$ or $\frac{1}{3^{4/3}}$	3	M1	Or for $9^4 = 3^8$
				$-\frac{8}{3}$		A1	oe Eg $-2\frac{2}{3}$ or $-2.\dot{6}$ but not a decimal approximation.

Total 9 marks

6.

21.	(a)			$8y^6$	2	B2 B1 for 8 B1 for y^6
	(b)	$2^p \times (2^3)^q = 2^p \times 2^{3q} = 2^{p+3q}$		$p + 3q$	2	B2 B1 for 2^{3q} seen

Total 4 marks

7.

24	$2^{\frac{1}{2}n} = \frac{2^x}{(2^3)^y}$			M1	for writing 8 as 2^3 or $2^{\frac{1}{2}n}$ on lhs
	$2^{\frac{1}{2}n} = 2^{x-3y}$			M1	for 2^{x-3y} or $\frac{1}{2}n = x - 3y$
		$n = 2x - 6y$	3	A1	or for $n = 2(x - 3y)$ or $n = (x - 3y) \div 0.5$

Total 3 marks

8.

10	(a)			$2^2 \times 5$		B1 for $2^2 \times 5$ oe or 20
	(i)			$2^3 \times 3 \times 5^2$	3	B2 for $2^3 \times 3 \times 5^2$ oe or 600 (B1 for any product using powers of 2 and 3 and 5 or at least 300, 600... and 40, 80, 120 ...)
	(ii)					
	(b)	$8 (= 2^3)$ or 2^3				M1 for one correct use of index laws eg. $8^5 \div 8^4$
				3	2	A1

Total 5 marks

9.

21.	$(2^2)^{2k+8} = 2^3$ or $4^{\frac{3}{2}} = 8$ or $2^{4k+16} = 2^3$ or $4^{\frac{3}{2}} = 4^{2k+8}$			4	M2 M1 for $4^{2k+8} = 8$ or $3 \times 4^{\frac{3}{2}} = 24$
	$4k + 16 = 3$ or $2k + 8 = 1.5$ oe				M1 A correct equation in k or a fully correct method to find k
				$-\frac{13}{4}$	A1oe Dep on at least M2

Total 4 marks

10.

20	(a)	eg $\left(\frac{27f^3}{125e^{12}}\right)^{\frac{2}{3}}$ or $\frac{1}{\left(\frac{125e^{12}}{27f^3}\right)^{\frac{2}{3}}}$ or $\left(\frac{15625e^{24}}{729f^6}\right)^{\frac{1}{3}}$ or $\left(\frac{5e^4}{3f}\right)^{-2}$ eg $\left(\frac{3f}{5e^4}\right)^2$ or $\frac{1}{\left(\frac{15625e^{24}}{729f^6}\right)^{\frac{1}{3}}}$ or $\left(\frac{25e^8}{9f^2}\right)^{-1}$ or $\frac{1}{\left(\frac{5e^4}{3f}\right)^2}$ or $\left(\frac{729f^6}{15625e^{24}}\right)^{\frac{1}{3}}$		$\frac{9f^2}{25e^8}$	3	M1 For dealing with either negative index or cube root or square or an expression including $\frac{9}{25} \text{ or } \left(\frac{25}{9}\right)^{-1} \text{ or } \frac{f^2}{e^8} \text{ or } \frac{e^{-8}}{f^{-2}}$ (oe)
	(b)	$8^x = (2^3)^x \text{ or } 2^{3x}$ $4^n = (2^2)^n \text{ or } 2^{2n}$ $2^{\frac{1}{2}} \times 2^{\frac{n}{3}} = 2^{\frac{1}{2} + \frac{n}{3}}$ eg $\frac{3+2n}{6} = 3x - 2n$ or $\frac{1}{2} + \frac{n}{3} + 2n = 3x$ oe Eg $x = \frac{1}{6} + \frac{n}{9} + \frac{2n}{3}$, $x = \frac{1}{6} + \frac{7n}{9}$ oe		$x = \frac{14n+3}{18}$	4	M2 For all of: 8^x written as a power of 2 4^n written as a power of 2 LHS written as a single 2 with a power M1 for 2 of these 3 M1 A correct equation using only the powers A1 oe

11.

14	$2^7 = 4^{2x} \times 2^x$ or $128 = (2^2)^{2x} \times 2^x$	1.4	3	M1 Replacing 128 by 2^7 or 4 by 2^2
	$7 = 2(2x) + x$			M1
				A1 oe
Total 3 marks				

12.

10	(a) $\frac{2^3}{2^7}$ or $2^3 \times 2^{-7}$ or $\frac{1}{2^4}$ or $\frac{1}{16}$ and $16 = 2^4$		2	M1
		-4		A1 Accept 2^{-4}
	(b) $13^{-24} \times 13^5$		2	M1 for 13^{-24} or for $k = -6 \times 4 + 5$
		-19		A1 Accept 13^{-19}
Total 4 marks				

13.

22	$\frac{5^{n^2+n^2-5n}}{5^{6+3}} (=125)$ or $5^{n^2-6} \times 5^{n^2-5n-3} (=125)$ or $5^{n^2+n^2-5n-9} (=125)$ or $5^{n^2+n^2-5n} = 125 \times 5^9$	4	5	M1 For simplifying the LHS to a product or quotient of two single powers of 5 or for an equation with 125 and at most a single power of 5 on each side.
	$5^{n^2+n^2-5n} = 5^{12}$ or $5^{n^2+n^2-5n-9} = 5^3$ or $5^{n^2+n^2-5n-9-3} = 5^0$			M1 For simplifying both sides to a single power of 5
	e.g. $2n^2 - 5n - 12 (=0)$ or $2n^2 - 5n = 12$			A1 A correct quadratic equation in n , simplified to three terms in any position.
	$(2n+3)(n-4) (=0)$ or $n = \frac{5 \pm \sqrt{(-5)^2 - 4 \times 2 \times -12}}{2 \times 2} = \left(\frac{5 \pm \sqrt{25+96}}{4} \right)$			M1 A correct factorisation or correct substitution into the quadratic formula or correctly completing the square.
				A1 dep on correct quadratic equation Award A0 if negative root is not excluded.
Total 5 marks				

14.

20	e.g. $\frac{2 \times (2^{\frac{3}{2}})^{2y+2}}{(2^2)^{2y+1}}$ or $\frac{12 \times (\sqrt{2^3})^{2y+2}}{6 \times (2^2)^{2y+1}}$ or $2 \times \left(2^{\frac{3}{2}}\right)^{2y+2} = (2^2)^{2y+1} \times 2^p$	2 - y	3	M1 for writing 8 and 4 correctly in terms of 2 in a correct fraction or equation
	$\frac{2^{3y+4}}{2^{4y+2}}$ or $\frac{2 \times 2^{3y+3}}{2^{4y+2}}$ or $\frac{12 \times 2^{3y+3}}{6 \times 2^{4y+2}}$ $2^{3y+4} = 2^{4y+2} \times 2^p$ or $2 \times 2^{3y+3} = 2^{4y+2} \times 2^p$			M1 (dep) for use of $(2^a)^b = 2^{ab}$ twice or $(2\sqrt{2})^{2n} = 2^{3n}$ in a correct expression or equation
				A1