1.

$t^n = \frac{1}{t^3}$

(a) Write down the value of n.

$n =$ .....

(1)

2.

(a) Simplify $\left(4h^{\frac{2}{3}}\right)^3$

.....

(2)

$$\frac{a\sqrt{a}}{\sqrt[3]{a^2}} = a^k$$

(b) Work out the value of k.

$k =$ .....

(3)

(Total for Question 13 is 5 marks)

3.

$$p^m = \frac{1}{p \times \sqrt[3]{p^2}}$$

(b) Find the value of m.

$m =$ .....

(3)

(Total for Question 20 is 6 marks)

4.

(a) Simplify $2a^3b^4 \times 4a^2b^5$

.....

(2)

$$c^k = \frac{1}{\sqrt[4]{c^2}}$$

(b) Work out the value of k

.....

(2)

5.

(a) $(\sqrt{a})^7 = k\sqrt{a}$, where $k = a^n$

Find the value of n.

$n =$ .....

(2)

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

.....

(2)

(Total 4 marks)

6.

(a) Write $3^8 \times 3^6$ as a power of 3

.....

(1)

(b) Write $\frac{7^5}{7^2}$ as a power of 7

.....

(1)

(c) $\frac{5^n \times 5^3}{5^7} = 5^2$

Find the value of n.

$n =$ .....

(2)

7.

(a) Simplify, leaving your answers in index form,

(i) $7^5 \times 7^3$

.....

(ii) $5^9 \div 5^3$

.....

(2)

(b) Solve $\frac{2^9 \times 2^4}{2^n} = 2^8$

$n =$ .....

(2)

(Total 4 marks)

8.

(c) Write $\frac{\sqrt[4]{y}}{y}$ in the form y^b where b is a fraction.

.....

(2)

9.

$\frac{\sqrt{a} \times a}{a^{-2}}$ can be written in the form a^k

(c) Find the value of k.

10.

Solve the equation $\frac{2^{(n^2)}}{2^n \times 2^6} = 1$

Show clear algebraic working.

.....

(Total for Question 20 is 3 marks)

11.

(a) Given that $a = 3^x$ and $b = 3^y$

express in terms of a or b or a and b,

(i) 3^{2x}

.....

(ii) 3^{x+4y}

.....

(iii) 3^{y-1}

.....

(3)

$a = 3^x$ and $b = 3^y$

$ab = 2187$

$a^2b = 177147$

(b) Work out the value of x and the value of y.
Show your working clearly.

$x =$.....

$y =$.....

(3)

(Total for Question 14 is 6 marks)

Answers

1.

11a		−3	1	B1 cao	

2.

13	(a)		$64h^2$	2	B2	B1 for 64 or h^2 written as a product
	(b)	$\frac{a \times a^{\frac{1}{2}}}{a^{\frac{2}{3}}}$ or $\frac{a^{\frac{3}{2}}}{a^{\frac{2}{3}}}$			M1	For $\sqrt{a} = a^{\frac{1}{2}}$ or $a\sqrt{a} = a^{\frac{3}{2}}$ or $\sqrt[3]{a^2} = a^{\frac{2}{3}}$
		$a^{\left(1+\frac{1}{2}-\frac{2}{3}\right)}$ or $k = \left(1+\frac{1}{2}-\frac{2}{3}\right)$ oe or $1+\frac{1}{2} = k+\frac{2}{3}$ oe			M1	For $a^{\left(1+\frac{1}{2}-\frac{2}{3}\right)}$ or $k = \left(1+\frac{1}{2}-\frac{2}{3}\right)$
			$\frac{5}{6}$	3	A1	oe Accept $0.8\dot{3}$
						Total 5 marks

3.

	(b)	$\frac{1}{p \times p^{\frac{2}{3}}}$ or $p^{m+1+\frac{2}{3}} = 1$		3	M1	
		$\frac{1}{p^{\frac{5}{3}}}$ or $p^{\frac{-5}{3}}$ or $m+1+\frac{2}{3} = 0$			M1	
			$-\frac{5}{3}$		A1	$p^{\frac{-5}{3}}$ gains M2 only
						Total 6 marks

4.

11	(a)		$8a^5b^9$	2	M1 A1	For two correct from 8, a^5 or b^9 written as a product.
	(b)	Eg $\frac{1}{c^{\frac{2}{4}}}$ or $c^{2/4}$ or $\left(c^k\right)^4 = \frac{1}{c^2}$ or $c^{4k} = \frac{1}{c^2}$ or $4k = -2$	$-\frac{1}{2}$ oe	2	M1 A1	For a correct first step Eg $-\frac{2}{4}$

5.

25.	(a)	$a^{3.5} = k\,a^{0.5}$ or $a^3\sqrt{a}(=k\sqrt{a})$	n=3	2	M1 A1	M1 for 3.5 and 0.5 seen or $(\sqrt{a})^6$ or a^3
	(b)	$2^{-1} \times 2^{-0.5}$	$2^{-1.5}$	2	M1 A1	$1/2^{1.5}$ or $\sqrt{2}/4$ or $2^{0.5}/2^2$ or $2^{0.5} \times 2^{-2}$
						Total 4 marks

6.

7.	(a)		3^{14}	1	B1	
	(b)		7^3	1	B1	
	(c)	$5^n = \frac{5^2 \times 5^7}{5^3}$ or n + 3 - 7 = 2			M1	Accept $5^{n+3} = 5^9$
			n = 6	2	A1	
	(d)	Product of positive integer powers of both 2 and 3 only			M1	Powers and/or products may be evaluated.
			24 or $2^3 \times 3$	2	A1	
						Total 6 marks

7.

5.	(ai)		7^8	**2**	B1	cao
	(ii)		5^6		B1	cao
	(b)	$9 + 4 - n = 8$ or $13 - n = 8$		**2**	M1	Also award for $2^n = 2^5$ or 2^5 on answer line
			5		A1	cao
						Total 4 marks

8.

12 contd	(c)	$\frac{y^{\frac{1}{4}}}{y}$ **or** $\sqrt[4]{y} = y^{\frac{1}{4}}$ **or** $y^{\frac{1}{4}-1}$		2	M1	or b = $-\frac{3}{4}$
			$y^{-\frac{3}{4}}$		A1	
						Total 8 marks

9.

(c)	$a^{\frac{1}{2}} \times a = a^{\frac{3}{2}}$ or $\frac{a}{a^{-2}} = a^3$ or $\frac{a^{\frac{1}{2}}}{a^{-2}} = a^{\frac{5}{2}}$	$\frac{7}{2}$	2	M1	for one correct step
				A1	oe

10.

20.	$n^2 - n - 6 = 0$ or $n^2 = n + 6$ oe		3	M1	For correct quadratic equation.
	$(n + 2)(n - 3)$ (=0) or $(n =) \frac{-(-1) \pm \sqrt{(-1)^2 - 4 \times 1 \times (-6)}}{2 \times 1}$ or $(n =) \frac{1 \pm \sqrt{1 + 24}}{2}$ or $(n =) \frac{1 \pm 5}{2}$			M1	For correct factorisation or correct use of quadratic formula.
		$(n =) -2, (n =) 3$		A1	Both correct - dep on at least M1 scored.
					Total 3 marks

11.

14	(a)(i)		a^2	1	B1	
	(ii)		ab^4	1	B1	
	(iii)		$\frac{1}{3}b$	1	B1oe	
	(b)	$177\,147 \div 2187$ (= 81) or $a = 81$	$x = 4, y = 3$	3	M1	or $x + y = 7$,
		$2187 \div 81$ (= 27) or $b = 27$			M1	$2x + y = 11$
					A1	$x = 4$ **and** $y = 3$