Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Indices in algebra

Time allowed: 40 minutes

Subject code **0580**

Mathematics

Questions from Paper 1, Paper 2 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.
You may use a calculator.

Total marks

/ 31

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.
- Unless a question says otherwise, give answers that are not exact to 3 significant figures, and angles in degrees to 1 decimal place.

Information

- This paper has 10 questions worth 31 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 Simplify.

(a) $(y^5)^3$

..... [1]

(b) $w^7 \div w^{-2}$

..... [1]

(a) Roots and indices in algebra (b) Laws of indices Click for more variations

1(a)	y^{15} cao	**1**	
1(b)	w^9 cao	**1**	

2 Simplify. $4p^5q^3 \times p^2q^{-4}$

..... [2]

Roots and indices in algebra Click for more variations

2	$4p^7q^{-1}$	**2**	**B1** for $4p^7q^a$ or $4p^bq^{-1}$ or $\frac{4p^b}{q}$

3 Simplify $8t^8 \div 4t^4$.

..... [2]

Roots and indices in algebra Click for more variations

3	$2t^4$	**2**	**B1** for $2t^n$ or kt^4 $(n,k \neq 0)$

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4 **(a)** Write $\frac{1}{2\times2\times2\times2\times2}$ as a power of 2.

..... [1]

(b) **(i)** $3^{18} \div 3^{t} = 3^{6}$

Find the value of t.

$t =$ ..... [1]

(ii) Simplify.

$8w^{10} \times 6w^{5}$

..... [2]

(a) Laws of indices (b)(i) Laws of indices (b)(ii) Roots and indices in algebra Click for more variations

4(a)	2^{-5}	**1**	
4(b)(i)	12	**1**	
4(b)(ii)	$48w^{15}$ final answer	**2**	**B1** for answer $48w^{k}$ or kw^{15} $(k \neq 0)$

5 Simplify.

(a) $3t^{5} \times 5t^{3}$

..... [2]

(b) $\left(64u^{36}\right)^{\frac{5}{6}}$

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..... [2]

(a) Roots and indices in algebra (b) Roots and indices in algebra Click for more variations

5(a)	$15t^8$ final answer	**2**	**B1** for answer kt^8 or $15t^k$ $(k > 0)$ or correct answer seen
5(b)	$32u^{30}$ final answer	**2**	**B1** for answer ku^{30} or $32u^k$ $(k > 0)$ or correct answer seen

6 Simplify.

$$\left(\frac{x^3}{8}\right)^{-\frac{4}{3}}$$

..... [2]

Roots and indices in algebra Click for more variations

6	$\frac{16}{x^4}$ or $16x^{-4}$	**2**	**M1** for $\left(\frac{x}{2}\right)^{-4}$ or $\left(\frac{8}{x^3}\right)^{\frac{4}{3}}$ or $\left(\frac{x^{12}}{4096}\right)^{-\frac{1}{3}}$ or better or **B1** for $\frac{16}{x^k}$ or $16x^k$ or $\frac{k}{x^4}$ or kx^{-4} final answer

7 $\sqrt[3]{y^2} = \sqrt[6]{x}$ and $y = \sqrt[n]{x}$.

Find the value of n.

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$n =$ ..... [2]

Fractional and negative indices Click for more variations

7	4	**2**	**M1** for $y^{\frac{2}{3}} = x^{\frac{1}{6}}$ or $y^2 = \sqrt{x}$ or $y^4 = x$

8 Solve.

$$\left(\frac{1}{3}\right)^{x} = 9^{x+4}$$

$x =$ ..... [3]

Fractional and negative indices Click for more variations

8	$-\frac{8}{3}$ or $-2\frac{2}{3}$ oe	**3**	**M2** for $-x = 2(x + 4)$ oe or **M1** for $(3^{-1})^{x}$, 3^{-x}, $(3^{2})^{x+4}$, $3^{2(x+4)}$ or $\left(\frac{1}{3}\right)^{-2(x+4)}$ oe

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9 **(a)** Simplify.

$$\frac{x^{\frac{2}{3}}}{x^{\frac{8}{3}}}$$

..... [1]

(b) $16 = 64^k$

Find the value of k.

$k =$ ..... [1]

(c) Solve.

$$3^{3x} \times \left(\frac{1}{9}\right)^{4-3x} = 3$$

$x =$ ..... [3]

(a) Laws of indices (b) Fractional and negative indices (c) Fractional and negative indices Click for more variations

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9(a)	x^{-2} or $\frac{1}{x^2}$ final answer	**1**	
9(b)	$\frac{2}{3}$	**1**	
9(c)	1 nfww	**3**	**M1** for $3^{-2(4-3x)}$ oe or better or $9^{\frac{3x}{2}} \times 9^{-(4-3x)} = 9^{\frac{1}{2}}$ oe or better **M1** for $3x + (their - 2) \times (4 - 3x) = 1$ oe or better or $their\frac{3x}{2} - (4-3x) = their\frac{1}{2}$ oe or better

10 **(a)** $3^{-2} \times 3^{x} = 81$

Find the value of x.

$x =$ ..... [2]

(b) $x^{-\frac{1}{3}} = 32x^{-2}$

Find the value of x.

$x =$ ..... [3]

(a) Laws of indices (b) Fractional and negative indices Click for more variations

10(a)	6	**2**	**B1** for 3^4 or 3^{x-2} or **M1** for $3^x = 81 \times 3^2$ or better
10(b)	8	**3**	**M2** for $x^{\frac{5}{3}} = 32$ or better or **M1** for $\frac{1}{x^{\frac{1}{3}}} = \frac{32}{x^2}$ or better or $x^{-\frac{1}{3}--2} = 32$ or better

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