

QQQ – Pure Year 1 – Chapter 1 – Indices (Version 2)

Total Marks: 24

(24 = Platinum, 22 = Gold, 19 = Silver, 16 = Bronze)

1. Express as a single power of a

$$\frac{a^2}{\sqrt{a}}$$

where $a \neq 0$

Circle your answer.

[1 mark]

- a^1
- $a^{\frac{3}{2}}$
- $a^{\frac{5}{2}}$
- a^4

(Total 1 marks)

AQA June 2021 Paper 2 Q1

2. Express 9^{3x+1} in the form 3^y , giving y in the form $ax + b$, where a and b are constants. **(2)**

(Total 2 marks)

Edexcel C1 June 2016 Q2

3.

(a) Evaluate $(32)^{\frac{3}{5}}$, giving your answer as an integer. **(2)**

(b) Simplify fully $\left(\frac{25x^4}{4}\right)^{-\frac{1}{2}}$ **(2)**

(Total 4 marks)

Edexcel C1 June 2012 Q2

4. Solve $x^{-\frac{2}{3}} = 12\frac{1}{4}$ **[3 marks]**

(Total 3 marks)

AQA Specimen 2020 Paper 1 Q18

5. Simplify $\frac{\sqrt{x^3}(\sqrt{x^3} + x^3)}{\sqrt{x}}$

Give your answer in the form $x^{\frac{a}{b}} + x^c$ where a, b and c are integers.

[3 marks]

(Total 3 marks)

AQA June 2024 Paper 2 Q16

6.

(a) Circle the expression equivalent to $3x^{-7}$

[1 mark]

- $-\frac{3}{x^7}$
- $-\frac{1}{3x^7}$
- $\frac{1}{3x^7}$
- $\frac{3}{x^7}$

(b) Simplify fully $\frac{12w^8}{(4w^3)^2}$

[2 marks]

(c) $\sqrt{y} \times \sqrt[3]{y} = \sqrt[c]{y^d}$ where c and d are positive integers.

Work out the **least** possible values of c and d .

[3 marks]

(Total 6 marks)

AQA June 2023 Paper 2 Q13

7.

$$(2^{x+3})^{4x+1} = 8^{x-1}$$

Work out the possible values of x .

[5 marks]

(Total 5 marks)

AQA June 2024 Paper 1 Q21

Solutions

1.

Scheme	Marks	AO
Circles correct answer	B1	1.1b
	(1 mark)	

Typical solution

$$a^{\frac{3}{2}}$$

2.

Scheme	Marks
$9^{3x+1} = \text{for example}$ $3^{2(3x+1)}$ or $(3^2)^{3x+1}$ or $(3^{(3x+1)})^2$ or $3^{3x+1} \times 3^{3x+1}$ or $(3 \times 3)^{3x+1}$ or $3^2 \times (3^2)^{3x}$ or $(9^{\frac{1}{2}})^y$ or $9^{\frac{1}{2}y}$ or $y = 2(3x + 1)$	M1
$= 3^{6x+2}$ or $y = 6x + 2$ or $a = 6, b = 2$	A1
	(2)
	(2 marks)

Notes

M1: Expresses 9^{3x+1} correctly as a power of 3 or expresses 3^y correctly as a power of 9 or expresses y correctly in terms of x

(This mark is not for just $3^2 = 9$)

A1: Cao (isw if necessary)

Providing there is no incorrect work, allow sight of $6x + 2$ to score both marks

Correct answer only implies both marks

Special case: 3^{6x+1} **only** scores M1A0

Alternative using logs

Scheme	Marks
$9^{3x+1} = 3^y \Rightarrow \log 9^{3x+1} = \log 3^y$	

$(3x + 1) \log 9 = y \log 3$	M1
$y = \frac{\log 9}{\log 3}(3x + 1)$	
$y = 6x + 2$	A1

M1: Use power law correctly on both sides

A1: cao

3.

Mark scheme (a)

Scheme	Marks
$\left\{ (32)^{\frac{3}{5}} \right\} = \left(\sqrt[5]{32} \right)^3 \text{ or } \sqrt[5]{(32)^3} \text{ or } 2^3 \text{ or } \sqrt[5]{32768}$	M1
$= 8$	A1
	(2)

Notes

M1: for a full correct interpretation of the fractional power. **Note:** $5 \times (32)^3$ is M0.

A1: for 8 only.

Note: Award M1A1 for writing down 8.

Mark scheme (b)

Scheme	Marks
$\left\{ \left(\frac{25x^4}{4} \right)^{-\frac{1}{2}} \right\} = \left(\frac{4}{25x^4} \right)^{\frac{1}{2}} \text{ or } \left(\frac{5x^2}{2} \right)^{-1} \text{ or } \frac{1}{\left(\frac{25x^4}{4} \right)^{\frac{1}{2}}} \text{ See notes below}$	M1
$= \frac{2}{5x^2} \text{ or } \frac{2}{5}x^{-2} \text{ See notes for other alternatives}$	A1
	(2)
	(4 marks)

Notes

M1: For use of $\frac{1}{2}$ OR use of -1

Use of $\frac{1}{2}$: Candidate needs to demonstrate that they have rooted all three elements in their bracket. **Use of**

-1: Either Candidate has $\frac{1}{\text{Bracket}}$ or $\left(\frac{Ax^C}{B}\right)$ becomes $\left(\frac{B}{Ax^C}\right)$.

Allow M1 for...

- $\left(\frac{4}{25x^4}\right)^{\frac{1}{2}}$ or $\left(\frac{5x^2}{2}\right)^{-1}$ or $\frac{1}{\left(\frac{25x^4}{4}\right)^{\frac{1}{2}}}$ or $\sqrt{\left(\frac{4}{25x^4}\right)}$ or $\frac{1}{\sqrt{\left(\frac{25x^4}{4}\right)}}$ or $\left(\frac{1}{\frac{25x^4}{4}}\right)^{\frac{1}{2}}$ or $\frac{1}{\frac{5x^2}{2}}$ or $\frac{1}{\frac{1}{2}}x^{-2}$
 or $-\left(\frac{5x^2}{2}\right)$ or $\left(\frac{-5x^{-2}}{-2}\right)$ or $-\left(\frac{5x^{-2}}{2}\right)$ or $\frac{5x^{-2}}{2}$
- $\left(\frac{4}{25x^4}\right)^K$ or $\left(\frac{5x^2}{2}\right)^C$ where K, C are any powers including 1.

A1: for either $\frac{2}{5x^2}$ or $\frac{2}{5}x^{-2}$ or $0.4x^{-2}$ or $\frac{0.4}{x^2}$.

Note: $\left(\sqrt{\left(\frac{25x^4}{4}\right)}\right)^{-1}$ is not enough work by itself for the method mark. **Note:** A final answer of $\frac{1}{\frac{5}{2}x^2}$ or $\frac{1}{2\frac{1}{2}x^2}$ or $\frac{1}{2.5x^2}$ is A0. **Note:** Also allow $\pm\frac{2}{5x^2}$ or $\pm\frac{2}{5}x^{-2}$ or $\pm 0.4x^{-2}$ or $\pm\frac{0.4}{x^2}$ for A1.

4.

Answer	Mark	Comments
$\left(x^{-\frac{2}{3}} = \right) \frac{49}{4}$ or $x^{\frac{2}{3}} = \frac{4}{49}$	M1	
$\left(\frac{49}{4}\right)^{\frac{3}{2}}$ or $\left(\frac{4}{49}\right)^{\frac{3}{2}}$	M1dep	oe
$\frac{8}{343}$	A1	

5.

Answer	Mark	Comments
$x^{\frac{5}{2}} + x^4$	B3	B2 $x^{\frac{5}{2}} (+ \dots)$ or $(\dots +) x^4$ B1 correct expansion of numerator eg $\sqrt{x^3} \times \sqrt{x^3} + \sqrt{x^3} \times x^3$ or $x^3 + x^{\frac{9}{2}}$

or

correct expression with fraction eliminated

eg $\sqrt{x^2} (\sqrt{x^3} + x^3)$ or $x (\sqrt{x^3} + x^3)$

or $\sqrt{x^3} (\sqrt{x^2} + x^{\frac{5}{2}})$

Additional guidance

B1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts

B1 may be awarded after multiplication by $\frac{\sqrt{x}}{\sqrt{x}}$

eg $\frac{\sqrt{x^3} (\sqrt{x^3} + x^3)}{\sqrt{x}} \times \frac{\sqrt{x}}{\sqrt{x}} = \frac{\sqrt{x^4} (\sqrt{x^3} + x^3)}{x}$

$\frac{\sqrt{x^7} + x^3 \sqrt{x^4}}{x}$ (B1 at this stage for correct expansion of numerator)

B1

Check the answer line and award B3 or B2 if possible

Otherwise check the working for B2 or B1

Condone $x^4 + x^{\frac{5}{2}}$

B3

Accept oe values for fractional powers for up to B2

Accept eg $x^{\frac{10}{4}} + x^4$

B3

6.

Mark scheme (a)

Answer	Mark	Comments
$\frac{3}{x^7}$	B1	

Mark scheme (b)

Answer	Mark	Comments
$\frac{3w^2}{4}$ or $0.75w^2$	B2	B1 unsimplified equivalent fraction with brackets processed eg $\frac{12w^8}{16w^6}$ or $\frac{12w^2}{16}$ or $\frac{6w^2}{8}$ or $\frac{3w^5}{4w^3}$ SC1 $\frac{3w^3}{4}$ or $0.75w^3$ or $3w^2$

Additional guidance

B1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts

$\frac{3}{4}w^2$ is equivalent to $\frac{3w^2}{4}$ etc

Mark scheme (c)

Answer	Mark	Comments
$c = 6$ and $d = 5$	B3	B2 $y^{\frac{5k}{6k}}$ or $\sqrt[6k]{y^{5k}}$ or $(y^{5k})^{\frac{1}{6k}}$ or $(y^{\frac{1}{6k}})^{5k}$ where k is an integer ≥ 1 or $\left(\frac{1}{2} + \frac{1}{3} =\right) \frac{5}{6}$ oe fractions or $\left(\frac{c}{2} + \frac{c}{3} =\right) \frac{5c}{6}$ oe fractions or $5c = 6d$ oe equation B1 $y^{\frac{1}{2}}$ or $y^{\frac{1}{3}}$ or $y^{\frac{c}{2}}$ or $y^{\frac{c}{3}}$ or $(y^c)^{\frac{1}{2}}$ or $(y^c)^{\frac{1}{3}}$ or $y^{\frac{d}{c}}$ or $(y^{\frac{1}{c}})^d$ or $(y^d)^{\frac{1}{c}}$ or $\frac{1}{2} + \frac{1}{3}$ oe sum of fractions or $\frac{c}{2} + \frac{c}{3}$ oe sum of fractions SC2 $c = 6k$ and $d = 5k$ where k is an integer ≥ 2

Additional guidance

Up to B2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts

$\frac{3}{6} + \frac{2}{6} = \frac{5}{6}$	B2
$\frac{3}{6} + \frac{2}{6}$	B1
$\frac{10}{12}$ or $y^{\frac{10}{12}}$	B2
$c = 18$ and $d = 15$	SC2
$\frac{1}{2}$ may be 0.5	
Only trialling numerical values for y is B0 or B3	

7.

Answer	Mark	Comments
$2^{(4x+1)(x+3)}$ or $2^{4x^2+13x+3}$	M1	lhs
$(2^3)^{x-1}$ or $2^{3(x-1)}$ or 2^{3x-3}	M1	rhs
$4x^2 + 12x + x + 3 = 3x - 3$ or $4x^2 + 10x + 6 (= 0)$ or $2x^2 + 5x + 3 (= 0)$	M1dep	oe with expanded brackets dependent on both M marks $4x^2 + 12x + x + 3$ implies first M mark $3x - 3$ implies second M mark
$(2x + 3)(x + 1) (= 0)$ or if quadratic formula used $\frac{-5 \pm \sqrt{5^2 - 24}}{4}$ or better	M1dep	oe factorised
-1 and	A1	

$$-1\frac{1}{2} \text{ or } \frac{-3}{2} \text{ or } -1.5$$

Additional guidance

Both answers correct without working will get all marks	M4A1
Only one solution correct without working scores nothing	M0A0
No oe for A mark	
Possible to make both sides powers of 8. Mark to the equivalent of this MS	