

N54 Index Laws

OCR

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8 (a) Evaluate.

(i) $\sqrt{121}$

(a)(i) [1]

(ii) 4^{-2}

(ii) [1]

(b) Work out.

$(9 - 3 \times 2)^2$

(b) [2]

(c) Fill in the power.

$5^{\boxed{}} = 125$

[1]

8 (a) Evaluate.

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(i) $\sqrt{121}$ \times = 121

(a)(i) 11 [1]

(ii) 4^{-2} $\frac{1}{4^2} =$

(ii) $\frac{1}{16}$ [1]

(b) Work out.

B ✓ $(9 - 3 \times 2)^2$

D ✓
M ✓
A
S

$(9 - 6)^2$
 3^2

(b) 9 [2]

(c) Fill in the power.

$5^{\boxed{3}} = 125$

$5 \times 5 \times 5 = 125$ [1]

3 (a) Round 7874 to

(i) the nearest hundred,

(a)(i) [1]

(ii) 1 significant figure.

(ii) [1]

(b) Find the value of x .

$$3^5 \times 3^2 = 3^x$$

(b) $x =$ [1]

3 (a) Round 7874 to

(i) the nearest hundred,

(ii) 1 significant figure.

7874

(a)(i)7900..... [1]

(ii)8000..... [1]

(b) Find the value of x .

$$3^5 \times 3^2 = 3^x$$

(b) $x =$ 7..... [1]

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20 (a) Show that $a^5 \times (a^3)^2$ can be expressed as a^{11} .

[2]

N18

20 (a) Show that $a^5 \times (a^3)^2$ can be expressed as a^{11} .

[2]

N18

$$(a^3)^2 \dots \text{mult indices} \quad a^6$$

$$a^5 \times a^6 = a^{11} \dots \text{as you add indices}$$

(b) Write $\frac{1}{125} \times 25^9$ as a power of 5.

N18

N54H

(b) [3]

(b) Write $\frac{1}{125} \times 25^9$ as a power of 5.

N18
N54H

$$\frac{1}{125} = 125^{-1} \\ = (5^3)^{-1} \\ = 5^{-3}$$

$$25^9 \\ = (5^2)^9 \\ = 5^{18}$$

$$5^{-3} \times 5^{18} = 5^{15}$$

$$5^{15}$$

(b) [3]

7 (a) Write down the value of $\sqrt[3]{27}$.

N19

(a) [1]

(b) Work out 7^2 .

N19

(b) [2]

(c) Write 6^{-1} as a fraction.

N54

(c) [1]

7 (a) Write down the value of $\sqrt[3]{27}$.

N19

$$\underline{3} \times \underline{3} \times \underline{3} = 27$$

(a) [1]

3

(b) Work out 7^2 .

N19

$$7 \times 7$$

(b) [2]

49

(c) Write 6^{-1} as a fraction.

N54

(c) [1]

$\frac{1}{6}$

(b) There are two errors in Sam's method for finding the value of $64^{-\frac{2}{3}}$ shown below.

Find the cube root of 64 and then multiply by 2.

The cube root of 64 is 4 and then $4 \times 2 = 8$.

The negative power makes the answer negative so answer equals -8.

Describe these errors and then give the correct value of $64^{-\frac{2}{3}}$.

.....
.....

Correct value [3]

(b) There are two errors in Sam's method for finding the value of $64^{-\frac{2}{3}}$ shown below.

NS4

Find the cube root of 64 and then multiply by 2.

The cube root of 64 is 4 and then $4 \times 2 = 8$.

The negative power makes the answer negative so answer equals -8.

Describe these errors and then give the correct value of $64^{-\frac{2}{3}}$.

$$64^{-\frac{2}{3}} \Rightarrow \left(\frac{1}{64}\right)^{\frac{2}{3}} \Rightarrow \left(\sqrt[3]{\frac{1}{64}}\right)^2 = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$$

She needed to get the reciprocal of 64 to deal with the negative. She $\times 2$ rather than squaring.

Correct value $\frac{1}{16}$ [3]

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17 Show that $\frac{\sqrt[3]{81}}{3}$ can be written as $3^{\frac{1}{3}}$.

17 Show that $\frac{\sqrt[3]{81}}{3}$ can be written as $3^{\frac{1}{3}}$.

NS4

$$81 = 3^4$$

$$\frac{\sqrt[3]{3^4}}{3}$$

$$\frac{3^{\frac{4}{3}}}{3^1}$$

$$\frac{4}{3} = 1\frac{1}{3}$$

$$1\frac{1}{3} - 1 = \frac{1}{3}$$

$$= 3^{\frac{1}{3}} \quad \checkmark$$

(b) Work out.

NS4 $16^{-\frac{3}{4}}$

(b) **[3]**

(b) Work out.

NS4 $16^{-\frac{3}{4}}$

$$\left(\frac{1}{16}\right)^{\frac{3}{4}} = \left(\sqrt[4]{\frac{1}{16}}\right)^3 = \left(\frac{1}{2}\right)^3 = \frac{1}{8}$$

(b) [3]

$$2 \times 2 \times 2 \times 2 = 16$$

12 Carol says that $64^{-\frac{1}{2}} = \frac{1}{32}$.

NS4H Explain her error and give the correct value of $64^{-\frac{1}{2}}$ in the form $\frac{p}{q}$.

.....

.....

.....

..... [3]

12 Carol says that $64^{-\frac{1}{2}} = \frac{1}{32}$.

NS44 Explain her error and give the correct value of $64^{-\frac{1}{2}}$ in the form $\frac{p}{q}$.

$$64^{-\frac{1}{2}} = \frac{1}{64^{\frac{1}{2}}} = \frac{1}{\sqrt{64}} = \frac{1}{8}$$

Carol \div 64 by 2. She did not get the $\sqrt{\quad}$ [3]

$$= \frac{1}{8} \checkmark$$

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(b) Write $\frac{1}{125} \times 25^9$ as a power of 5.

(b) [3]

(b) Write $\frac{1}{125} \times 25^9$ as a power of 5.

N18
N54H

$$\frac{1}{125} = 125^{-1} \\ = (5^3)^{-1} \\ = 5^{-3}$$

$$25^9 \\ = (5^2)^9 \\ = 5^{18}$$

$$5^{-3} \times 5^{18} = 5^{15}$$

$$5^{15}$$

(b) [3]

1 Work out.

(a) $\sqrt[3]{64} \times 2^{-1}$

N54

(a) [2]

(b) $4.3 \times 10^5 + 3.8 \times 10^4$
Give your answer in standard form.

N48

(b) [3]

1 Work out.

(a) $\sqrt[3]{64} \times 2^{-1}$

$$4 \times \frac{1}{2}$$

N54

$$\sqrt[3]{64} = 4$$

$$2^{-1} = \frac{1}{2}$$

(a) [2]

(b) $4.3 \times 10^5 + 3.8 \times 10^4$

Give your answer in standard form.

N48

$$\begin{array}{r} 430000 + 38000 \\ 38000 \\ \hline 468000 \end{array}$$

(b) [3]

$$4.68 \times 10^5$$

Edexcel

20 (a) Write $\frac{3^5 \times 3^4}{3^2}$ as a power of 3

.....
(2)

(b) Write down the value of 12^0

.....
(1)

(c) Write down the value of 3^{-2}

.....
(1)

20 (a) Write $\frac{3^5 \times 3^4}{3^2}$ as a power of 3

$$\frac{3^9}{3^2} =$$

$$3^7$$

(2)

(b) Write down the value of 12^0

$$1$$

(1)

(c) Write down the value of 3^{-2}

$$\frac{1}{3^2} = \frac{1}{9}$$

(1)

22 (a) Work out $\frac{2}{5} + \frac{1}{4}$

(b) Write down the value of 2^{-3}

.....
(1)

(Total for Question 22 is 3 marks)

22 (a) Work out $\frac{2}{5} + \frac{1}{4}$

$$2^3 = 2 \times 2 \times 2 = 8$$

$$\frac{8}{20} + \frac{5}{20} = \frac{13}{20} \checkmark$$

(b) Write down the value of 2^{-3}

$$\frac{1}{2^3} \quad \frac{1}{8} \checkmark$$

.....
(1)

(Total for Question 22 is 3 marks)

12 (a) Write down the value of 25^0

N54

.....
(1)

12 (a) Write down the value of 25^0

N54

1

(1)

(b) Find the value of $49^{-\frac{1}{2}}$

N54

(b) Find the value of $49^{-\frac{1}{2}}$

N54

$$\frac{1}{49^{\frac{1}{2}}} = \frac{1}{\sqrt[2]{49}} = \frac{1}{7} = \frac{1}{7^1}$$

$\frac{1}{7}$

(2)
✓

(c) Find the value of $64^{\frac{2}{3}}$

N54

(c) Find the value of $64^{\frac{2}{3}}$

N54

$$= \sqrt[3]{64^2}$$

$$= 4^2$$

$$\begin{array}{r} 16 \\ \hline (2) \end{array}$$

Given that $n^{\frac{2}{3}} = 8$ and $n > 0$

(c) work out the value of n .

Give your answer in the form $a\sqrt{b}$ where a and b are integers.

N54

A12/13

Given that $n^{\frac{2}{3}} = 8$ and $n > 0$

$$\sqrt{8} \dots \frac{\sqrt{4}\sqrt{2}}{2\sqrt{2}}$$

(c) work out the value of n .

Give your answer in the form $a\sqrt{b}$ where a and b are integers.

N54

A12/13

$$n^{\frac{2}{3}} = 8$$

$$\sqrt[3]{n^2} = 8$$

$$\sqrt[3]{n} = \sqrt{8}$$

$$n = \sqrt{8}^3$$

$$\rightarrow \sqrt{8} \times \sqrt{8} \times \sqrt{8}$$

$$8\sqrt{8} \checkmark$$

or

$$8(2)\sqrt{2} = 16\sqrt{2} \checkmark$$

$$\frac{8\sqrt{8}}{2}$$

(2)

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12 (a) Find the value of $81^{-\frac{1}{2}}$

.....
(2)

(b) Find the value of $\left(\frac{64}{125}\right)^{\frac{2}{3}}$

.....
(2)

(Total for Question 12 is 4 marks)

12 (a) Find the value of $81^{\frac{1}{2}}$

$$\frac{1}{81^{\frac{1}{2}}} = \frac{1}{\sqrt[2]{81}} = \frac{1}{9} = \frac{1}{9} \checkmark$$

(2)

(b) Find the value of $\left(\frac{64}{125}\right)^{\frac{2}{3}}$

$$\left(\sqrt[3]{\frac{64}{125}}\right)^2 = \left(\frac{4}{5}\right)^2 = \frac{16}{25} \checkmark$$

(2)

$$\begin{array}{r} -X - X - \\ 4 \quad 4 \quad 4 = 64 \\ 5 \quad 5 \quad 5 = 125 \end{array}$$

(Total for Question 12 is 4 marks)

10 (a) Write down the value of $100^{\frac{1}{2}}$

.....
(1)

(b) Find the value of $125^{\frac{2}{3}}$

.....
(2)

(Total for Question 10 is 3 marks)

10 (a) Write down the value of $100^{\frac{1}{2}}$

$$\sqrt[2]{100} \quad 10^1$$

10

(1)

(b) Find the value of $125^{\frac{2}{3}}$

$$\sqrt[3]{125}^2 \quad 5^2$$

25

(2)

(Total for Question 10 is 3 marks)

9 (a) Write down the value of $36^{\frac{1}{2}}$

NS4

.....
(1)

(b) Write down the value of 23^0

.....
(1)

9 (a) Write down the value of $36^{\frac{1}{2}}$

NS4

$$\sqrt[2]{36} = 6$$

6

(1)

(b) Write down the value of 23^0

1

(1)

14 (a) Work out the value of $\left(\frac{16}{81}\right)^{\frac{3}{4}}$

N54

14 (a) Work out the value of $\left(\frac{16}{81}\right)^{\frac{3}{4}}$

N54

$$\left(\sqrt[4]{\frac{16}{81}}\right)^3 = \left(\frac{2}{3}\right)^3 = \frac{8}{27}$$

$$\frac{8}{27}$$

(2)

$$3^a = \frac{1}{9} \quad 3^b = 9\sqrt{3} \quad 3^c = \frac{1}{\sqrt{3}}$$

(b) Work out the value of $a + b + c$

N54

.....
(2)

(Total for Question 14 is 4 marks)

$$3^a = \frac{1}{9} \quad 3^b = 9\sqrt{3} \quad 3^c = \frac{1}{\sqrt{3}}$$

$$3^c = \frac{1}{\sqrt{3}} = \sqrt{3}^{-1} = (3^{\frac{1}{2}})^{-1}$$

(b) Work out the value of $a + b + c$

N54

$$3^a = \frac{1}{9}$$

$$3^2 = 9 \quad a = -2$$

$$3^{-2} = \frac{1}{9}$$

$$3^b = 9\sqrt{3}$$

$$3^b = 9(3^{\frac{1}{2}})$$

$$3^2 \times 3^{\frac{1}{2}}$$

$$3^{2\frac{1}{2}}$$

$$b = 2\frac{1}{2}$$

$$a + b + c = -2 + 2\frac{1}{2} - \frac{1}{2} = 0$$

$$3^{-\frac{1}{2}} = c = -\frac{1}{2}$$

0 ✓

(2)

(Total for Question 14 is 4 marks)

AQA

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24 (b) Work out $\sqrt[3]{16}$ as a power of 2

NS4

[2 marks]

Answer _____

24 (b) Work out $\sqrt[3]{16}$ as a power of 2

NS4

[2 marks]

$$16^{\frac{1}{3}} = \sqrt[3]{16}$$

$$16 \dots 2 \times 2 \times 2 \times 2 \\ = 2^4$$

$$16^{\frac{1}{3}} = (2^4)^{\frac{1}{3}}$$

$$2^{\frac{4}{3}} \checkmark$$

$$2^{\frac{4}{3}} \checkmark$$

Answer _____

6

Work out the value of $(\sqrt{3})^2 \times (\sqrt{2})^2$

[2 marks]

N54

N39

Answer _____

6

Work out the value of $(\sqrt{3})^2 \times (\sqrt{2})^2$ **[2 marks]**

N61

$$\sqrt{3} \times \sqrt{3} = 3$$

$$\sqrt{2} \times \sqrt{2} = 2$$

$$3 \times 2$$

Answer $\underline{\hspace{2cm}} = 6$

30 (a) Work out the value of $81^{-\frac{1}{4}}$

[2 marks]

N54

Answer _____

30 (a) Work out the value of $81^{-\frac{1}{4}}$

N54

[2 marks]

$$\left(\frac{1}{81}\right)^{\frac{1}{4}}$$

$$3 \times 3 \times 3 \times 3 = 81$$

$$\sqrt[4]{\frac{1}{81}} = \frac{1}{3}$$

Answer $\frac{1}{3}$

30 (b) Write 16×8^{2x} as a power of 2 in terms of x .

[3 marks]

N54

Answer _____

30 (b) Write 16×8^{2x} as a power of 2 in terms of x .

[3 marks]

N54

$$16 \times 8^{2x}$$

$$2^4 \times (2^3)^{2x}$$

$$2^4 \times 2^{6x}$$

Answer

$$2^{6x+4} \quad \checkmark$$

28 $y = p \times q^{x-1}$ where p and q are numbers.

N54 $y = 10$ when $x = 1$

A6 $y = 0.3125$ when $x = 6$

Work out the value of y when $x = 3$

[5 marks]

Answer _____

28

$$y = p \times q^{x-1} \quad \text{where } p \text{ and } q \text{ are numbers.}$$

N54

$$y = 10 \text{ when } x = 1 \checkmark$$

A6

$$y = 0.3125 \text{ when } x = 6 \checkmark$$

Work out the value of y when $x = 3$

$$y = p \times q^{x-1}$$

$$10 = p \times q^{1-1}$$

$$10 = p \times q^0$$

$$10 = p \times 1$$

$$p = 10 \checkmark$$

$$y = p \times q^{x-1}$$

$$0.3125 = 10 \times q^5$$

$$0.03125 = q^5 \quad \downarrow \div 10$$

$$q = \frac{1}{2}$$

$$y = p \times q^{x-1}$$

$$y = 10 \times \left(\frac{1}{2}\right)^2$$

$$y = 10 \times \frac{1}{4}$$

$$y = 2.5 \checkmark$$

$$y = 2.5 \checkmark$$

Answer

24 (a) Work out the value of $2^{14} \div (2^9)^2$

N54 Give your answer as a fraction in its simplest form.

[3 marks]

Answer _____

24 (a) Work out the value of $2^{14} \div (2^9)^2$

N54 Give your answer as a fraction in its simplest form.

[3 marks]

$$2^{14} \div 2^{18}$$

$$2^{-4} = \left(\frac{1}{2}\right)^4 = \frac{1}{16}$$

Answer

$$\frac{1}{16} \checkmark$$

24 (a) Work out the value of $2^{14} \div (2^9)^2$

N54 Give your answer as a fraction in its simplest form.

[3 marks]

Answer _____

24 (b) Work out the value of

$25^{\frac{3}{2}}$

[2 marks]

N54

$$25^{\frac{3}{2}} = \sqrt{25}^3 = 5^3$$

Answer 125

17

Work out the exact value of $\left(\frac{3}{4}\right)^{-3}$

N54

[2 marks]

Answer _____

17

Work out the exact value of $\left(\frac{3}{4}\right)^{-3}$

N54

[2 marks]

$$\left(\frac{4}{3}\right)^3 = \frac{64}{27}$$

Answer

$$\frac{64}{27}$$



27 The point $\left(3, \frac{1}{64}\right)$ lies on the curve $y = k^x$ where k is a constant.

N54 Show that the point $\left(\frac{1}{2}, \frac{1}{2}\right)$ lies on the curve.

[3 marks]

27 The point $\left(3, \frac{1}{64}\right)$ lies on the curve $y = k^x$ where k is a constant.

N54 Show that the point $\left(\frac{1}{2}, \frac{1}{2}\right)$ lies on the curve.

[3 marks]

$$y = k^x$$

$$\frac{1}{64} = k^3$$

$$\sqrt[3]{\frac{1}{64}} = k$$

$$\frac{1}{4} = k$$

$$y = \frac{1}{4}^x$$

$$\frac{1}{2} = \left(\frac{1}{4}\right)^{\frac{1}{2}}$$

$$\frac{1}{2} = \sqrt{\frac{1}{4}}$$

$$\frac{1}{2} = \left(\frac{1}{2}\right)^1 \checkmark$$