

GCSE & High School Topic Questions

Fractional & Negative Indices

Part 2

Example 1

$$\sqrt[3]{3 \times 9 \times 10^{15}}$$

Solution:

$$\begin{aligned}\sqrt[3]{3 \times 9 \times 10^{15}} &= \sqrt[3]{27 \times 10^{15}} \\ &= (3^3 \times 10^{15})^{\frac{1}{3}} \\ &= (3 \times 10^5) \\ &= 300,000\end{aligned}$$

Example 2

Given that $3^{-n} = 0.2$
Find the value of $(3^n)^2$

Solution:

$$\begin{aligned}3^{-n} &= 0.2 \\ (3)^{-n} &= 1/5 \\ 3^n &= 5 \\ (3^n)^2 &= (5)^2 \\ (3^n)^2 &= 25\end{aligned}$$

Example 3

Given that $4^{-n} = 32$, Find the value of n.

Solution:

$$\begin{aligned}4^{-n} &= 32 \\ (2^2)^{-n} &= (2)^5 \\ 2^{-2n} &= 2^5 \\ -2n &= 5 \\ n &= -2.5\end{aligned}$$

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Part 2

1 $\sqrt[3]{5 \times 25 \times 10^{15}}$

(2 marks)

2 $\sqrt[4]{3 \times 27 \times 10^{12}}$

(2 marks)

3 Given that $5 \times \sqrt{5} = 5^n$
Find the value of n.

(2 marks)

4 Given that $2 \times \sqrt{8} = 2^n$
Find the value of n.

(2 marks)

5 Given that $p = 3^a$ and $q = 3^b$
Express in terms of p and/or q.

(1) 3^{a+b}

(2) 3^{2b}

(3) 3^{a-2}

(4) 3^{b-1}

(4 marks)

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Part 2

- 6 Given that $25^n = 125$
Find the value of n .

(2 marks)

- 7 Given that $4^{-n} = 16$
Find the value of n .

(2 marks)

- 8 Given that $3^{-n} = 0.25$
Find the value of $(3^n)^2$

(2 marks)

- 9 Given that $4^{-n} = 0.5$
Find the value of $(4^n)^3$

(2 marks)

- 10 Write the numbers below in the form of 5^n .

- | | |
|----------------|-------------------|
| (1) 25 | (2) 625 |
| (3) 1 | (4) $\frac{1}{5}$ |
| (5) $\sqrt{5}$ | (6) $\sqrt{125}$ |

(6 marks)

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Part 2:Answers

1 $\sqrt[3]{5 \times 25 \times 10^{15}}$

Solution:

$$\begin{aligned}\sqrt[3]{5 \times 25 \times 10^{15}} &= \sqrt[3]{125 \times 10^{15}} \\ &= (5^3 \times 10^{15})^{\frac{1}{3}} \\ &= (5 \times 10^5) \\ &= 500,000\end{aligned}$$

2 $\sqrt[4]{3 \times 27 \times 10^{12}}$

Solution:

$$\begin{aligned}\sqrt[4]{3 \times 27 \times 10^{12}} &= \sqrt[4]{81 \times 10^{12}} \\ &= (3^4 \times 10^{12})^{\frac{1}{4}} \\ &= (3 \times 10^3) \\ &= 3000\end{aligned}$$

3 Given that $5 \times \sqrt{5} = 5^n$
Find the value of n.

Solution:

$$\begin{aligned}5 \times \sqrt{5} = 5^n &= 5^1 \times 5^{\frac{1}{2}} \\ &= 5^{\frac{3}{2}} \\ n &= \frac{3}{2}\end{aligned}$$

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Part 2:Answers

- 4 Given that $2 \times \sqrt{8} = 2^n$
Find the value of n.

Solution:

$$\begin{aligned} 2 \times \sqrt{8} &= 2^n = 2^1 \times 2^{\frac{3}{2}} \\ &= 2^{\frac{5}{2}} \\ n &= \frac{5}{2} \end{aligned}$$

- 5 Given that $p = 3^a$ and $q = 3^b$
Express in terms of p and/or q.

- (1) 3^{a+b}
- (2) 3^{2b}
- (3) 3^{a-2}
- (4) 3^{b-1}

Solution:

$$(1) \quad 3^{a+b} = 3^a \times 3^b = (p) \times (q) = pq$$

$$(2) \quad 3^{2b} = 3^b \times 3^b = (q) \times (q) = q^2$$

$$(3) \quad 3^{a-2} = 3^a \div 3^2 = \frac{3^a}{3^2} = \frac{p}{9}$$

$$(4) \quad 3^{b-1} = 3^b \div 3^1 = \frac{3^b}{3^1} = \frac{q}{3}$$

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Part 2:Answers

- 6 Given that $25^n = 125$, Find the value of n .

Solution:

$$25^n = 125$$

$$(5^2)^n = (5)^3$$

$$5^{2n} = 5^3$$

$$2n = 3$$

$$n = 3/2$$

$$n = 1.5$$

-
- 7 Given that $4^{-n} = 16$
Find the value of n .

Solution:

$$4^{-n} = 16$$

$$(2^2)^{-n} = (2)^4$$

$$2^{-2n} = 2^4$$

$$-2n = 4$$

$$n = -4/2$$

$$n = -2$$

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Fractional & Negative Indices

Part 2:Answers

- 8 Given that $3^{-n}=0.25$
Find the value of $(3^n)^2$

Solution:

$$3^{-n} = 0.25$$

$$(3)^{-n} = 1/4$$

$$3^n = 4$$

$$(3^n)^2 = (4)^2$$

$$(3^n)^2 = 16$$

-
- 9 Given that $4^{-n}=0.5$
Find the value of $(4^n)^3$

Solution:

$$4^{-n} = 0.5$$

$$(4)^{-n} = 1/2$$

$$4^n = 2$$

$$(4^n)^3 = (2)^3$$

$$(4^n)^3 = 8$$

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Part 2:Answers

10 Write the numbers below in the form of 5^n .

(1) 25

(2) 625

(3) 1

(4) $\frac{1}{5}$

(5) $\sqrt{5}$

(6) $\sqrt{125}$

Solution:

1) $25 = 5^2$

2) $625 = 5^4$

3) $1 = 5^0$

4) $\frac{1}{5} = 5^{-1}$

5) $\sqrt{5} = 5^{\frac{1}{2}}$

6) $\sqrt{125} = \sqrt{25} \times \sqrt{5}$

$$= 5\sqrt{5}$$

$$= 5^1 \times 5^{\frac{1}{2}}$$

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