



Manipulating powers (2)

Getting ready for A-Level Maths...

What you need...

- Your brain and attention
- A device to watch connected to internet
- A pen and paper
- Can do attitude

Manipulating powers (2)

Important rules

$$a^1 = a$$

$$a^0 = 1$$

$$a^m \times a^n = a^{m+n}$$

$$a^m \div a^n = \frac{a^m}{a^n} = a^{m-n}$$

$$(a^m)^n = a^{mn}$$

$$(ka^m)^n = k^n a^{mn}$$

$$a^{-m} = \frac{1}{a^m}$$

$$a^{\frac{1}{m}} = \sqrt[m]{a}$$

$$a^{\frac{n}{m}} = \left(\sqrt[m]{a}\right)^n$$

Manipulating powers (2)

My turn

Write $\sqrt{128}$ as a power of 2.

$$\sqrt{128} = 2^n$$

$$\begin{aligned}\sqrt{128} &= \sqrt{2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2} \\ &= \sqrt{2^7} \\ &= (2^7)^{\frac{1}{2}} \\ \sqrt{128} &= 2^{\frac{7}{2}}\end{aligned}$$

Your turn

Write $\sqrt{125}$ as a power of 5.

$$\sqrt{125} = 5^n$$

$$\begin{aligned}\sqrt{125} &= \sqrt{5 \times 5 \times 5} \\ &= \sqrt{5^3} \\ &= (5^3)^{\frac{1}{2}} \\ \sqrt{125} &= 5^{\frac{3}{2}}\end{aligned}$$

Manipulating powers (2)

My turn

Write $\sqrt[3]{32}$ as a power of 2.

$$\sqrt[3]{32} = 2^n$$

$$\sqrt[3]{32} = \sqrt[3]{2 \times 2 \times 2 \times 2 \times 2}$$

$$= \sqrt[3]{2^5}$$

$$= (2^5)^{\frac{1}{3}}$$

$$\sqrt[3]{32} = 2^{\frac{5}{3}}$$

Your turn

Write $\sqrt[3]{81}$ as a power of 3.

$$\sqrt[3]{81} = 3^n$$

$$\sqrt[3]{81} = \sqrt[3]{3 \times 3 \times 3 \times 3}$$

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

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

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

Manipulating powers (2)

My turn

Write $\frac{1}{\sqrt[4]{27}}$ as a power of 3.

$$\frac{1}{\sqrt[4]{27}} = 3^n$$

$$\frac{1}{\sqrt[4]{27}} = \frac{1}{\sqrt[4]{3 \times 3 \times 3}}$$

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

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

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

$$\frac{1}{\sqrt[4]{27}} = \underline{\underline{3^{-\frac{3}{4}}}}$$

Your turn

Write $\frac{1}{\sqrt[4]{128}}$ as a power of 2.

$$\frac{1}{\sqrt[4]{128}} = 2^n$$

$$\frac{1}{\sqrt[4]{128}} = \frac{1}{\sqrt[4]{2 \times 2 \times 2 \times 2 \times 2 \times 2}}$$

$$= \frac{1}{\sqrt[4]{2^6}}$$

$$= \frac{1}{(2^{\frac{6}{4}})}$$

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

$$\frac{1}{\sqrt[4]{128}} = \underline{\underline{2^{-\frac{3}{2}}}}$$

Manipulating powers (2)

My turn

Write $64\sqrt{32}$ as a power of 2.

$$64\sqrt{32} = 2^n$$

$$64\sqrt{32} = (2 \times 2 \times 2 \times 2 \times 2) \sqrt{2 \times 2 \times 2 \times 2 \times 2}$$

$$= 2^6 \times \sqrt{2^5}$$

$$= 2^6 \times (2^5)^{\frac{1}{2}}$$

$$= 2^6 \times 2^{\frac{5}{2}}$$

$$= 2^{6+\frac{5}{2}} \quad \omega$$

$$\underline{\underline{64\sqrt{32} = 2^{\frac{17}{2}}}}$$

$$\begin{aligned} \omega: 6 + \frac{5}{2} &= \frac{12}{2} + \frac{5}{2} \\ &= \frac{17}{2} \end{aligned}$$

Your turn

Write $9\sqrt{27}$ as a power of 3.

$$9\sqrt{27} = 3^n$$

$$9\sqrt{27} = (3 \times 3) \sqrt{3 \times 3 \times 3}$$

$$= 3^2 \sqrt{3^3}$$

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

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

$$= 3^{2+\frac{3}{2}} \quad \omega$$

$$\underline{\underline{9\sqrt{27} = 3^{\frac{7}{2}}}}$$

$$\begin{aligned} \omega: 2 + \frac{3}{2} &= \frac{4}{2} + \frac{3}{2} \\ &= \frac{7}{2} \end{aligned}$$

Manipulating powers (2)

My turn

Write $\sqrt[3]{128} \div 8^2$ as a power of 2.

$$\sqrt[3]{128} \div 8^2 = 2^n$$

$$\begin{aligned}\sqrt[3]{128} \div 8^2 &= \sqrt[3]{2^7} \div (2^3)^2 \\ &= (2^7)^{\frac{1}{3}} \div (2^3)^2 \\ &= 2^{\frac{7}{3}} \div 2^6 \\ &= 2^{\frac{7}{3}-6} \quad \text{w:}\end{aligned}$$

$$\underline{\underline{\sqrt[3]{128} \times 8^2 = 2^{-\frac{11}{3}}}}$$

$$\begin{aligned}\text{w: } \frac{7}{3} - 6 &= \frac{7}{3} - \frac{18}{3} \\ &= -\frac{11}{3}\end{aligned}$$

Your turn

Write $\sqrt[3]{81} \div 9^4$ as a power of 3.

$$\sqrt[3]{81} \div 9^4 = 3^n$$

$$\begin{aligned}\sqrt[3]{81} \div 9^4 &= \sqrt[3]{3^4} \div (3^2)^4 \\ &= (3^4)^{\frac{1}{3}} \div (3^2)^4 \\ &= 3^{\frac{4}{3}} \div 3^8 \\ &= 3^{\frac{4}{3}-8} \quad \text{w}\end{aligned}$$

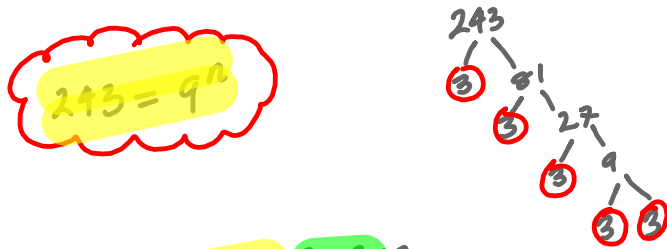
$$\underline{\underline{\sqrt[3]{81} \div 9^4 = 3^{-\frac{20}{3}}}}$$

$$\begin{aligned}\text{w: } \frac{4}{3} - 8 &= \frac{4}{3} - \frac{24}{3} \\ &= -\frac{20}{3}\end{aligned}$$

Manipulating powers (2)

My turn

Express 243 as a power of 9.



$$243 = 3 \times 3 \times 3 \times 3 \times 3$$

$$= 9 \times 9 \times 3$$

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

$$= 9^{2+\frac{1}{2}} \text{ w}$$

$$\underline{\underline{243 = 9^{\frac{5}{2}}}}$$

$$\begin{aligned} \text{w: } 2 + \frac{1}{2} &= \frac{4}{2} + \frac{1}{2} \\ &= \frac{5}{2} \end{aligned}$$

Your turn

Write 32 as a power of 4.

$$32 = 4^{\text{?}}$$

$$32 = 2 \times 2 \times 2 \times 2 \times 2$$

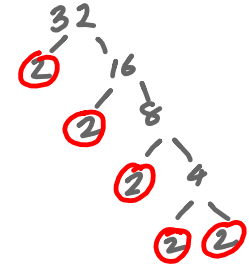
$$= 4 \times 4 \times 2$$

$$= 4^2 \times 2$$

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

$$= 4^{2+\frac{1}{2}}$$

$$\underline{\underline{32 = 4^{\frac{5}{2}}}}$$



Manipulating powers (2)

Review Exercise

1. Write $\sqrt{216}$ as a power of 6.
2. Write $\sqrt[3]{625}$ as a power of 5.
3. Write $\frac{1}{\sqrt[4]{32}}$ as a power of 2.
4. Write $3 \times \sqrt[4]{3}$ as a power of 3.
5. Write $32\sqrt{8}$ as a power of 2.
6. Write $\sqrt[3]{625} \div 25^2$ as a power of 5.
7. Write $\frac{27}{\sqrt[4]{3}}$ as a power of 3.
8. Express 128 as a power of 4.

Manipulating powers (2)

Review Exercise (Answers)

1. Write $\sqrt{216}$ as a power of 6. $6^{\frac{3}{2}}$

2. Write $\sqrt[3]{625}$ as a power of 5. $5^{\frac{4}{3}}$

3. Write $\frac{1}{\sqrt[4]{32}}$ as a power of 2. $2^{-\frac{5}{4}}$

4. Write $3 \times \sqrt[4]{3}$ as a power of 3. $3^{\frac{5}{4}}$

5. Write $32\sqrt{8}$ as a power of 2. $2^{\frac{13}{2}}$

6. Write $\sqrt[3]{625} \div 25^2$ as a power of 5. $5^{-\frac{8}{3}}$

7. Write $\frac{27}{\sqrt[4]{3}}$ as a power of 3. $3^{\frac{11}{4}}$

8. Express 128 as a power of 4. $4^{\frac{7}{2}}$