

Indices

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Worked example

Simplify:

$$2^3 \times 4^3 \times 8 \div 2^7$$

Your turn

Simplify:

$$3^5 \times 9^2 \times 27^4 \div 3^6$$

$$3^{15}$$

Worked example

Simplify:

$$(x^2)^3$$

$$(2x^3y^4)^5$$

$$(4ab^2c^4)^3$$

Your turn

Simplify:

$$(5a^7bc^5)^3$$

$$125a^{21}b^3c^{15}$$

Worked example

Simplify:

$$\sqrt{16x^2y^6z^4}$$

$$\sqrt[3]{27x^4y^6z}$$

Your turn

Simplify:

$$\sqrt{9a^3b^6c^2d}$$

$$3a^{\frac{3}{2}}b^3cd^{\frac{1}{2}}$$

Worked example

Simplify:

$$(16x^2y^6z^4)^{\frac{1}{2}}$$

$$(27x^4y^6z)^{\frac{1}{3}}$$

Your turn

Simplify:

$$(9a^3b^6c^2d)^{\frac{1}{2}}$$

$$3a^{\frac{3}{2}}b^3cd^{\frac{1}{2}}$$

Worked example

Write $81^4 \times 9^7$ as 3^n

Write $8^{\frac{1}{2}} \times 128^{-\frac{3}{4}}$ as 2^n

Your turn

Write $25^{\frac{1}{3}} \times 125^{-\frac{2}{5}}$ as 5^n

$$5^{-\frac{8}{15}}$$

Worked example

Write $\frac{81^4}{9^7}$ as 3^n

Write $\frac{16^3}{32^7}$ as 2^n

Your turn

Write $\frac{25^4}{125^6}$ as 5^n

5^{-10}

Worked example

Evaluate:

$$\left(\frac{32}{243}\right)^{-\frac{3}{5}}$$

Your turn

Simplify the following:

$$\left(\frac{64}{125}\right)^{-\frac{2}{3}}$$

$$\frac{25}{16}$$

Worked example

Evaluate:

$$\left(\sqrt{\frac{3}{2}}\right)^4$$

$$\left(\sqrt{\frac{5}{7}}\right)^4$$

Your turn

Evaluate:

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

$$\frac{9}{64}$$

Worked example

Express in index form:

$$\frac{2}{3\sqrt{x}}$$

$$\frac{5}{7\sqrt[3]{x}}$$

$$\frac{1}{4\sqrt[5]{x}}$$

Your turn

Express in index form:

$$\frac{2}{5\sqrt[7]{x}}$$

$$\frac{2}{5}x^{-\frac{1}{7}}$$

Worked example

Simplify fully:

$$\frac{(x^2y)^{\frac{2}{3}}}{\left(x^3y^{\frac{1}{2}}\right)^{-4}}$$

Your turn

Simplify fully:

$$\frac{(x^3y^2)^{\frac{3}{4}}}{\left(x^2y^{\frac{2}{3}}\right)^{-5}}$$
$$x^{\frac{49}{4}}y^{\frac{29}{6}}$$

Worked example

Express as a power of 3:

$$9 \times \frac{1}{27^{5x-2}}$$

Express as a power of 5:

$$125 \times \frac{1}{625^{3-2x}}$$

Your turn

Express as a power of 2:

$$16 \times \frac{1}{8^{5-4x}}$$

$$2^{12x-11}$$

Worked example

Express a in terms of p and q :

$$3^a = \frac{243^{p+2q}}{27^q}$$

Your turn

Express a in terms of p and q :

$$2^a = \frac{16^{3p-q}}{8^{5q}}$$

$$a = 12p - 19q$$

Worked example

$$x = 3^p, y = 3^q$$

$$xy = 9$$

$$3x^2y = 729$$

Find the values of p and q

Your turn

$$x = 2^p, y = 2^q$$

$$xy = 32$$

$$2xy^2 = 32$$

Find the values of p and q

$$p = 6, q = -1$$

Worked example

Given $y = 2^x$ express $\frac{64}{8^{2-3x}}$ in terms of y

Your turn

Given $y = 3^x$ express $\frac{81}{9^{3-2x}}$ in terms of y

$$\frac{y^4}{9}$$

Worked example

Solve:

$$2^{3x-5} = \frac{16}{\sqrt[5]{64}}$$

Your turn

Solve:

$$3^{2x-5} = \frac{27}{\sqrt{243}}$$

$$x = \frac{11}{4}$$

Worked example

Solve:

$$\frac{16^{4x-3}}{8^{5-2x}} = 4$$

Your turn

Solve:

$$\frac{9^{3-5x}}{27^{4x-3}} = 81$$

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

Worked example

If $x = 3^m$ and $y = 3^n$, write:
 3^{m+n} in terms of x and y

$$3^{\frac{2m+n}{3}}$$

Your turn

If $x = 5^m$ and $y = 5^n$, write:
 $5^{\frac{m+n}{2}}$ in terms of x and y

$$x^{\frac{1}{2}}y^{\frac{1}{2}}$$

Worked example

Solve (without trial and improvement):

$$3^{a^2} = 9^a \times 27$$

Your turn

Solve (without trial and improvement):

$$2^{a^2} = 8^a \times 16$$

$$a = -1 \text{ or } a = 4$$

Worked example

Given that $\frac{12 \times (\sqrt{32})^{3y-1}}{3 \times 4^{2y+3}}$ can be written in the form 2^p , find an expression for p in terms of y

Your turn

Given that $\frac{12 \times (\sqrt{8})^{2y+2}}{6 \times 4^{2y+1}}$ can be written in the form 2^p , find an expression for p in terms of y

$$p = 2 - y$$

Worked example

Given that $5^{-n} = 0.4$, find the value of $(5^3)^n$

Your turn

Given that $3^{-n} = 0.2$, find the value of $(3^4)^n$

625

Worked example

Solve the equation

$$2x^{\frac{5}{3}} + 5x^{\frac{2}{3}} = 3x^{-\frac{1}{3}}, \quad x > 0$$

Give your answer to 3 significant figures

Your turn

Solve the equation

$$2x^{\frac{3}{2}} - 3x^{\frac{1}{2}} = 7x^{-\frac{1}{2}}, \quad x > 0$$

Give your answer to 3 significant figures

$$x = 2.77$$

Worked example

Work out the value of p when

$$25^{0.25q} \times 625 = 125^{3q+1}$$

Your turn

Work out the value of p when

$$9^{0.5p} \times 81 = 27^{2p-1}$$

$$p = \frac{7}{5}$$