Exponential equations

1 Consider the following equations:

i Rewrite each side of the equation with a base of 2.

ii Hence, solve for x.

a $8^x = 4$ **b** $16^x = \frac{1}{2}$ **c** $\frac{1}{1024} = 4^x$ **d** $\left(\sqrt{2}\right)^x = \sqrt[5]{32}$

2 Solve the following exponential equations:

a $4^x = 4^8$ **b** $3^x = 3^{\frac{2}{9}}$ **c** $3^x = 27$ **d** $7^x = 1$

e $8^x = \frac{1}{8^2}$ **f** $3^y = \frac{1}{27}$ **g** $10^x = 0.01$ **h** $3^x = 3^6$

i $6^x = 6^{-3}$ **j** $6^x = 6^{\frac{4}{3}}$ **k** $2^x = 64$ **l** $9^x = 1$

m $5^x = \frac{1}{5^2}$ **n** $10^x = 0.0001$ **o** $9^y = 81$

3 Solve for x in the following equations:

a $9^y = 27$ **b** $25^y = 125$

c $3^{5x-10} = 1$ **d** $25^{x+1} = 125^{3x-4}$

e $9^{x+4} = 27^x$ **f** $3^{4x-8} = 1$

g $8^{x+3} = 32^{2x-1}$ **h** $30 \times 2^{x-6} = 15$

i $2^x \times 2^{x+3} = 32$ **j** $3^x \times 9^{x-k} = 27$

k $a^{x-1} = a^4$ **l** $a^{x+1} = a^3\sqrt{a}$

m $3^{x^2-3x} = 81$ **n** $27\left(2^x\right) = 6^x$

o $3^x \times 3^{nx} = 81$ **p** $24 \times 2^{x-6} = 12$

q $2^x \times 2^{x+2} = 16$ **r** $3^x \times 9^{x-k} = 9$

4 Solve the following exponential equations:

a $5^x = \sqrt[3]{5}$ **b** $30^n = \sqrt[3]{30}$ **c** $5^x = \sqrt{5}$ **d** $5^x = \sqrt[4]{5}$

e $9^x = \sqrt[9]{9}$ **f** $\left(\sqrt{7}\right)^y = 49$ **g** $\left(\sqrt{6}\right)^y = 36$ **h** $\left(\sqrt{2}\right)^k = 0.5$

i $20^n = \sqrt[4]{20}$

5 Solve the following exponential equations:

a $\left(\frac{5}{8}\right)^{x} = \left(\frac{5}{8}\right)^{9}$

b $7\left(4^{x}\right) = \frac{7}{4^{3}}$

c $\frac{1}{3^{x-3}} = \sqrt[3]{9}$

d $\left(\frac{1}{9}\right)^{x+5} = 81$

e $\left(\frac{1}{8}\right)^{x-3} = 16^{4x-3}$

f $\frac{25^{y}}{5^{4-y}} = \sqrt{125}$

g $8^{x+5} = \frac{1}{32\sqrt{2}}$

h $\left(\frac{1}{25}\right)^{x-4} = 125^{3x-1}$

i $8^{x+4} = \frac{1}{32\sqrt{2}}$

j $\left(\frac{1}{27}\right)^{x-5} = 81$

k $\frac{1}{5^{x+3}} = \sqrt[3]{25}$

l $9\left(8^{x}\right) = \frac{9}{8^{2}}$