Calculating with Roots and Indices

1 Simplify these expressions, giving your answer in index form.

a $3^4 \times 3^5$ **b** $2^5 \times 2^2$ **c** $a^4 \div a$

d $5^6 \div 5^6$ **e** $4^2 \times 4^2 \times 4^2$ **f** $x^2 \times x^3 \times x^4$

g $6^5 \div 6^3 \times 6$ **h** $8^2 \times 8^6 \div 8^3$

2 Solve these equations.

a $2^x = 16$ **b** $y^2 = 5^4$ **c** $64 = (2^a)^2$ **d** $72 = b^3 \times 3^b$

3 Evaluate these expressions.

a 100^0 **b** 500^1

c $(2^2)^4$ **d** $(\sqrt{7})^2$

e $36^{\frac{1}{2}}$ **f** 5^{-1}

g $8^{\frac{1}{3}}$ **h** $4^{\frac{3}{2}}$

4 Simplify these expressions, giving your answer in index form.

a $(3^2)^4$ **b** $(5^3)^2$ **c** $\left(9^{\frac{1}{2}}\right)^4$ **d** $(8^4)^{\frac{1}{3}}$

5 Evaluate these expressions.

a 12^0 **b** $25^{\frac{1}{2}}$ **c** 3^{-1}

d $27^{\frac{1}{3}}$ **e** 2^{-3} **f** 9^{-2}

g $36^{-\frac{1}{2}}$ **h** $16^{-\frac{1}{4}}$ **i** $8^{\frac{2}{3}}$

j $16^{\frac{3}{4}}$

6 Simplify these expressions, giving your answer as a power of 10.

a $10^4 \times 10^8$ **b** $10^{12} \div 10^7$

c $10^3 \div 10^9$ **d** $10^5 \times 10^4 \div 10^2$

e $10^8 \div 10^4 \times 10^{-3}$ **f** $10^5 \div 10^{-4} \times 10^6$

g $10^2 \times 10^2 \times 10^2 \times 10^2$ **h** $\dfrac{10^{-8} \times 10^3}{10^7 \times 10^{-9}}$

Standard Form

1 Write these numbers in standard form.

a 600 **b** 19340 **c** 2000000

d 15 **e** 17504 **f** 718300

2 Write these numbers in standard form.

a 0.16 **b** 0.00532 **c** 0.06001

d 0.04 **e** 0.0000007 **f** 0.004321

3 Change these numbers in standard form to ordinary numbers.

a 3.6×10^3 **b** 5.91×10^{-5}

c 2.15×10^{-1} **d** 9.009×10^2

4 Evaluate these calculations, giving your answer in standard form. Do not use a calculator.

a $(3 \times 10^2) \times (3 \times 10^4)$ **b** $(2.4 \times 10^2) \div (2 \times 10^4)$

c $(3.2 \times 10^{-4}) \times (3 \times 10^{-2})$ **d** $(9.6 \times 10^{-6}) \div (3.2 \times 10^4)$

5 Work these out without using a calculator, giving your answer in standard form.

a $(8 \times 10^4) \div (4 \times 10^2)$ **b** $(9.6 \times 10^{-8}) \div (3 \times 10^{-5})$

c $(6 \times 10^{-4}) \times (5 \times 10^9)$ **d** $(2.4 \times 10^3) \times (5 \times 10^4)$

e $(3 \times 10^5) \div (6 \times 10^{-2})$

6 Evaluate these calculations, giving your answer in standard form.

a $(1.7 \times 10^5) + (3.2 \times 10^5)$ **b** $(9.4 \times 10^3) + (3.6 \times 10^3)$

c $(4.2 \times 10^4) + (6.5 \times 10^3)$ **d** $(8.6 \times 10^5) - (3.5 \times 10^4)$

7 The population of Sweden is approximately 9×10^6 people.

a Write this number given in standard form as an ordinary number.

Sweden has an area of approximately 450000 km^2.

b Write this number in standard form.

c Work out the population density without using a calculator and give your answer in standard form.