

# Solutions

Page 22 #s 2, 4abhik, 5bc, 6aceg, 7bdfh,  
12acf, 15abhi, 17cd, 20, 23ac, 24bc

2. Which is greater,  $3^4$  or  $4^3$ ? Explain.

$$\begin{aligned}3^4 &= 3 \times 3 \times 3 \times 3 \\ &= 81\end{aligned}$$

$$\begin{aligned}4^3 &= 4 \times 4 \times 4 \\ &= 64\end{aligned}$$

$\implies 3^4$  is greater than  $4^3$   
because  $81 > 64$

4. Evaluate.

a)  $4^2 + 5^2$

b)  $2(3)^3 - 3^2$

h)  $-2^4$

i)  $(-2)^4$

k)  $(3^2 - 2^4)^2$

$$\begin{aligned} \text{a)} \quad & 4^2 + 5^2 \\ & = 16 + 25 \\ & = 41 \end{aligned}$$

$$\begin{aligned} \text{h)} \quad & -2^4 \\ & = -(16) \\ & = -16 \end{aligned}$$

$$\begin{aligned} \text{k)} \quad & (3^2 - 2^4)^2 \\ & = (9 - 16)^2 \\ & = (-7)^2 \\ & = 49 \end{aligned}$$

$$\begin{aligned} \text{b)} \quad & 2(3)^3 - 3^2 \\ & = 2(27) - 9 \\ & = 54 - 9 \\ & = 45 \end{aligned}$$

$$\begin{aligned} \text{i)} \quad & (-2)^4 \\ & = 16 \end{aligned}$$

5. Continue the pattern to fill in each box. Use fractions to express values that are less than 1.

b)  $2^4 = 16$

$2^3 = 8$

$2^2 = 4$

$2^1 = \boxed{2}$

$2^0 = \boxed{1}$

$2^{-1} = \boxed{\frac{1}{2}}$

$2^{-2} = \boxed{\frac{1}{4}}$

c)  $3^4 = 81$

$3^3 = 27$

$3^2 = 9$

$3^1 = \boxed{3}$

$3^0 = \boxed{1}$

$3^{-1} = \boxed{\frac{1}{3}}$

$3^{-2} = \boxed{\frac{1}{9}}$

As the exponent reduces by one,  
divide the previous answer by the base.

6. Evaluate.

a)  $7^1$

$= 7$

c)  $(-16)^1$

$= -16$

e)  $\left(\frac{6}{7}\right)^0$

$= 1$

g)  $0^1$

$= 0$

7. Evaluate. Use fractions to express values that are less than 1.

b)  $5^{-2}$

$$\begin{aligned} b) \quad & 5^{-2} \\ &= \left(\frac{1}{5}\right)^2 \\ &= \frac{1^2}{5^2} \\ &= \frac{1}{25} \end{aligned}$$

d)  $7^{-2}$

$$\begin{aligned} d) \quad & 7^{-2} \\ &= \left(\frac{1}{7}\right)^2 \\ &= \frac{1^2}{7^2} \\ &= \frac{1}{49} \end{aligned}$$

f)  $2^{-3}$

$$\begin{aligned} f) \quad & 2^{-3} \\ &= \left(\frac{1}{2}\right)^3 \\ &= \frac{1^3}{2^3} \\ &= \frac{1}{8} \end{aligned}$$

h)  $3^{-4}$

$$\begin{aligned} h) \quad & 3^{-4} \\ &= \left(\frac{1}{3}\right)^4 \\ &= \frac{1^4}{3^4} \\ &= \frac{1}{81} \end{aligned}$$

Alternatively work out the base to power of the POSITIVE exponent and then take the reciprocal of that answer.

12. Express each of the following as a power of 5.

a) 5

c) 125

f)  $\frac{1}{125}$

$$\begin{aligned} \text{a) } 5 \\ = 5^1 \end{aligned}$$

$$\begin{aligned} \text{b) } 125 \\ = 5 \times 5 \times 5 \\ = 5^3 \end{aligned}$$

$$\begin{aligned} \text{f) } \frac{1}{125} \\ = \frac{1}{5 \times 5 \times 5} \\ = \frac{1}{125} \end{aligned}$$

15. Evaluate.

a)  $1^3$

b)  $(-1)^3$

h)  $-1^4$

i)  $-1^{-3}$

$$\begin{aligned} \text{a) } 1^3 \\ = 1 \times 1 \times 1 \\ = 1 \end{aligned}$$

$$\begin{aligned} \text{h) } -1^4 \\ = -(1 \times 1 \times 1 \times 1) \\ = -1 \end{aligned}$$

$$\begin{aligned} \text{b) } (-1)^3 \\ = (-1) \times (-1) \times (-1) \\ = -1 \end{aligned}$$

$$\begin{aligned} \text{i) } -1^{-3} \\ = -\left(\frac{1}{1} \times \frac{1}{1} \times \frac{1}{1}\right) \\ = -1 \end{aligned}$$

reciprocal  
of 1 = 1

17. Express without negative exponents.

c)  $c^{-4}$       d)  $d^{-7}$

$$\begin{aligned} \text{c) } & c^{-4} \\ &= \left(\frac{1}{c}\right)^4 \\ &= \frac{1^4}{c^4} \\ &= \frac{1}{c^4} \end{aligned}$$

$$\begin{aligned} \text{d) } & d^{-7} \\ &= \left(\frac{1}{d}\right)^7 \\ &= \frac{1^7}{d^7} \\ &= \frac{1}{d^7} \end{aligned}$$

20. Alpha particles are emitted when radioactive Plutonium-239 decays. The mass of an alpha particle is  $6.645 \times 10^{-28}$  kilograms. Express this mass in standard notation.

$$6.645 \times 10^{-28}$$

↑  
decimal place  
moves 28 places  
to the left

⇒ Well I can't fit it on the board!  
Not a friendly question.

However ⇒ 0. "27 zeros" 6645

23. Express each of the following values in standard notation.

a)  $8 \times 10^5$

c)  $6.54 \times 10^{-3}$

a)  $8 \times 10^5$   
 decimal place  
 moves 5 places  
 to the right

$\Rightarrow 800,000$

c)  $6.54 \times 10^{-3}$   
 decimal place  
 moves 3 places  
 the left

$\Rightarrow 0.00654$

24. Express each of the following values in scientific notation.

b) 0.000000007    c) -65200000

b) 0.000000007  
 9 places

$\Rightarrow 7 \times 10^{-9}$

c) -65200000  
 7 places

$\Rightarrow -6.52 \times 10^7$