



1 Work out the value of

a. 5^{-2}

b. 4^{-3}

(2 marks)

a)

$$5^{-2} = 1/5^2$$

$$= \frac{1}{25}$$

b)

$$4^{-3} = 1/4^3$$

$$4^3 = 64$$

$$= \frac{1}{64}$$

2 a. Work out the value of 9^0

b. Work out the value of 2^{-4}

(2 marks)

(a) Any non-zero number to the power 0 is 1, so $9^0 = 1$

(b) A negative index means the reciprocal

$$2^{-4} = \frac{1}{2^4} = \frac{1}{16}$$

The reciprocal rule keeps the index laws consistent

$2^4 \times 2^{-4} = 2^0 = 1$. Since $2^4 = 16$, the other factor must be $1/16$.

A negative power does not make the answer negative

3 Write each number as a power with a negative index.

a. Write $\frac{1}{81}$ as a power of 3.

b. Write $\frac{1}{125}$ as a power of 5.

(2 marks)

a)

$$81 = 3 \times 3 \times 3 \times 3 = 3^4$$

$$\frac{1}{81} = \frac{1}{3^4}$$

$$\boxed{3^{-4}}$$

b)

$$125 = 5^3$$

$$\boxed{\frac{1}{125} = 5^{-3}}$$

4 Work out the value of $(3^5 \times 3^{-2}) \div 3$

(2 marks)

$$3^5 \times 3^{-2} = 3^{(5-2)} = 3^3$$

$$3^3 \text{ divided by } 3 = 3^{(3-1)} = 3^2$$

$$3^2 = 9$$

$$\boxed{9}$$

5 Work out the value of

a. $(\frac{2}{3})^{-2}$

b. $(\frac{1}{4})^{-3}$

(3 marks)

a)

flip the fraction

$$(\frac{2}{3})^{-2} = (\frac{3}{2})^2$$

$$\boxed{= \frac{9}{4}}$$

b)

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

$$\boxed{= 64}$$

6

- a. Work out the value of $8^{\frac{2}{3}}$
 b. Work out the value of $25^{-\frac{1}{2}}$
 c. Work out the value of 10^{-2}

(3 marks)

$$\begin{aligned} \text{(a)} \quad 8^{\frac{2}{3}} &= (\text{cube root of } 8)^2 = 2^2 = 4 \\ \text{(b)} \quad 25^{-\frac{1}{2}} &= \frac{1}{25^{\frac{1}{2}}} = \frac{1}{\sqrt{25}} = \frac{1}{5} \\ \text{(c)} \quad 10^{-2} &= \frac{1}{10^2} = \frac{1}{100} = 0.01 \end{aligned}$$

7

Work out the value of the letter in each equation.

- a. $2^k = \frac{1}{32}$
 b. $5^m = 0.04$

(3 marks)

a)

$$32 = 2^5$$

$$\frac{1}{32} = 2^{-5}$$

$$\boxed{k = -5}$$

b)

$$0.04 = \frac{4}{100} = \frac{1}{25}$$

$$\frac{1}{25} = \frac{1}{5^2} = 5^{-2}$$

$$\boxed{m = -2}$$

8

Work out the value of

a. $49^{-\frac{1}{2}}$

b. $27^{-\frac{2}{3}}$

c. $32^{-\frac{3}{5}}$

(3 marks)

a)

$$49^{-1/2} = \frac{1}{49^{1/2}}$$

$$49^{1/2} = \sqrt{49} = 7$$

$$\boxed{\frac{1}{7}}$$

b)

$$27^{-2/3} = \frac{1}{27^{2/3}}$$

$$27^{1/3} = 3, \text{ then } 3^2 = 9$$

$$\boxed{\frac{1}{9}}$$

c)

$$32^{-3/5} = \frac{1}{32^{3/5}}$$

$$32^{1/5} = 2, \text{ then } 2^3 = 8$$

$$\boxed{\frac{1}{8}}$$

9

Simplify

a. $3x^{-2} \times 2x^5$

b. $12x^3 \div 4x^{-2}$

c. $(2x^{-2})^3$

(4 marks)

a)

$$3 \times 2 = 6$$

$$x: -2 + 5 = 3$$

$$\boxed{6x^3}$$

b)

$$12 \div 4 = 3$$

$$x: 3 - (-2) = 5$$

$$\boxed{3x^5}$$

c)

$$2^3 = 8$$

$$x: -2 \times 3 = -6$$

$$\boxed{8x^{-6}}$$

10

Work out the value of

a. $(\frac{4}{9})^{-\frac{1}{2}}$

b. $(\frac{1}{8})^{-\frac{2}{3}}$

(4 marks)

a)

$$(\frac{4}{9})^{-1/2} = (\frac{9}{4})^{1/2}$$

$$= \frac{\sqrt{9}}{\sqrt{4}}$$

$$\boxed{\frac{3}{2}}$$

b)

$$(\frac{1}{8})^{-2/3} = 8^{2/3}$$

$$\text{cube root of } 8 = 2$$

$$2^2 = 4$$

$$\boxed{4}$$

11

a. Simplify $n^{-5} \times n^8$ b. Write down the value of 2^{-3}

(3 marks)

a) Add the indices

$$n^{(-5+8)} = n^3$$

$$b) 2^{-3} = 1 / 2^3 = \frac{1}{8}$$

A negative power means a reciprocal, not a negative answer

$2^3 \times 2^{-3}$ must equal $2^0 = 1$, so $2^{-3} = 1/8$. Here n must be non-zero because n^{-5} occurs in the original expression

12

Write $\frac{5}{2x^3}$ in the form ax^n , where a and n are constants.Write down the value of a and the value of n .

(2 marks)

$$\left(\frac{5}{2x^3}\right) = \frac{5}{2} \times \frac{1}{x^3}$$

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

$$\frac{5}{2} x^{-3}$$

$$a = \frac{5}{2}, n = -3$$

13

Expand and simplify

a. $x^{-2}(x^5 + 4x^2)$

b. $3x^{-1}(2x^3 - 5x)$

(4 marks)

a)

$$x^{-2} \times x^5 = x^3$$

$$x^{-2} \times 4x^2 = 4x^0 = 4$$

$$x^3 + 4$$

b)

$$3x^{-1} \times 2x^3 = 6x^2$$

$$3x^{-1} \times -5x = -15x^0 = -15$$

$$6x^2 - 15$$

14

- a. Write down the value of 17^0
- b. Write down the value of 4^{-2}
- c. Simplify $(m^{-3})^4 \times m^{14}$

(4 marks)

a) Any non-zero number to the power 0 is 1

$$b) 4^{-2} = 1 / 4^2 = \frac{1}{16}$$

$$c) (m^{-3})^4 = m^{-12}, \text{ then } m^{-12} \times m^{14} = m^{(-12+14)} = m^2$$

Keep the original restriction: m must be non-zero wherever they occur in a denominator or with a negative power