

## UNIT 2: POWERS AND ROOTS

**Exercise 1:** Work out the value of the following powers:

a)  $2^8 =$

b)  $13^2 =$

c)  $3^5 =$

d)  $4^6 =$

e)  $10^9 =$

f)  $7^0 =$

**Exercise 2:** Find the value of these powers. Express the answer with words.

a) Five cubed equals \_\_\_\_\_

b) Three to the fourth power equals \_\_\_\_\_

c) Seven squared equals \_\_\_\_\_

d) Ten to the power five equals \_\_\_\_\_

e) Thirty-two to the power one equals \_\_\_\_\_

f) Eighty to the power zero equals \_\_\_\_\_

g) Two to the sixth power equals \_\_\_\_\_

h) Three to the fifth power equals \_\_\_\_\_

**Exercise 3:** Find the value of x in the following expressions:

a)  $5^x = 125$

b)  $x^6 = 64$

c)  $10^x = 10000$

d)  $7^x = 2401$

e)  $x^4 = 1$

f)  $5^x = 1$

**Exercise 4:** Write the value of the following numbers:

a)  $4 \cdot 10^5 + 2 \cdot 10^4 + 7 \cdot 10^3 + 5 \cdot 10^2 + 6 \cdot 10 + 1 =$

b)  $10^7 + 9 \cdot 10^5 + 5 \cdot 10^2 + 3 =$

**Exercise 5:** Express as a single power:

a)  $5^2 \cdot 5^4 =$

b)  $2^4 \cdot 2^5 =$

c)  $7^2 \cdot 7^5 \cdot 7 =$

d)  $x^3 \cdot x^7 \cdot x^2 =$

e)  $y \cdot y^8 =$

f)  $5^9 : 5^2 =$

g)  $7^5 : 7^2 =$

h)  $x^{10} : x =$

i)  $y^9 : y^7 =$

j)  $z^6 : z^5 =$

**Exercise 6:** Express as a single power:

a)  $2 \cdot 2^7 =$

b)  $5^7 : 5^4 =$

c)  $x^2 \cdot x^5 : x^6 =$

d)  $4^9 : (4^2 \cdot 4^7) =$

e)  $3 \cdot 5^2 =$

f)  $2^3 \cdot 3^4 =$

**Exercise 7:** Express as a single power:

a)  $(5^7 : 5) \cdot (5^4 : 5^2) =$

b)  $(x^9 : x^8) \cdot (x^5 \cdot x^3) =$

c)  $(7^4 \cdot 7^5) : (7^3)^3 =$

d)  $(a^7 \cdot a \cdot a^4) : (a^2)^5 =$

e)  $(z^5 : z) : z^2 =$

f)  $(3^7 : 3^4) \cdot (3^5 : 3) =$

**Exercise 8:** Express as a single power:

a)  $(x^5 \cdot x) : (x^2 \cdot x^4) =$

b)  $(5^2)^7 : (5 \cdot 5^3)^2 =$

c)  $(5 \cdot 5^4)^2 \cdot (5^3)^6 =$

d)  $y^{10} : (y \cdot y^4)^2 =$

**Exercise 9:** Work out:

a)  $(4^7 \cdot 3^7) : (24^3 \cdot 2^3) =$

c)  $(2^5 \cdot 10^5) : (4^5 \cdot 5^5) =$

e)  $(30^7 \cdot 5^7) : (3^4 \cdot 2^4) =$

b)  $(12^5 \cdot 2^5) : (2^4 \cdot 3^4) =$

d)  $(18^4 \cdot 9^4) \cdot (6^3 \cdot 3^3) =$

f)  $(18^7 \cdot 3^7) : (3^5 \cdot 2^5) =$

**Exercise 10:** Work out:

a)  $\frac{5^2 \cdot 7^9 \cdot 5^4}{7^3 \cdot 5} =$

c)  $\frac{2 \cdot 7^5 \cdot 7^2 \cdot 2^4}{2^3 \cdot 2 \cdot 7 \cdot 7^3} = \frac{2^5 \cdot 7^7}{2^4 \cdot 7^4} =$

e)  $\frac{x^5 \cdot y^3 \cdot x^2 \cdot y^4}{x \cdot y^2 \cdot x^6} =$

g)  $\frac{a^7 \cdot b^2 \cdot a \cdot b^9}{a^3 \cdot b^4 \cdot a^2} =$

i)  $\frac{(2^3)^4 \cdot 5^{10} \cdot 10}{2^5 \cdot (5^2)^3} =$

b)  $\frac{3^5 \cdot 5^2 \cdot 3 \cdot 5^7}{3^2 \cdot 5^6 \cdot 3^3} =$

d)  $\frac{x^7 \cdot y^2 \cdot x^5 \cdot y^6}{x \cdot y^2 \cdot x^3 \cdot y} =$

f)  $\frac{2^7 \cdot 3 \cdot 3^7 \cdot 2^3}{3^4 \cdot 2^8 \cdot 3^3} =$

h)  $\frac{a^4 \cdot b^2 \cdot c^3 \cdot b^4 \cdot a^6}{b \cdot a^3 \cdot c^2} =$

**Exercise 11:** Express as a product of powers::

a)  $\frac{2^4 \cdot 5^7 \cdot 10}{25^3 \cdot 2^2} =$

c)  $\frac{9^4 \cdot 3^3 \cdot 32}{3 \cdot 2^4} =$

b)  $\frac{14^5 \cdot 49^2}{2^2 \cdot 7^5} =$

d)  $\frac{10 \cdot 5^3 \cdot 2^4}{20} =$

**Exercise 12:** Express as a product of powers:

a)  $\frac{3^4 \cdot 18 \cdot 2^5}{12 \cdot 2^2} =$

c)  $\frac{28^6 \cdot 25^3}{49^2 \cdot 5^4} =$

e)  $\frac{10^2 \cdot 5^3 \cdot 2^4}{2^3} =$

b)  $\frac{4^5 \cdot 6^3}{2^6 \cdot 3^2} =$

d)  $\frac{2^3 \cdot 8^2 \cdot 5^6}{16 \cdot 25} =$

**Exercise 13:** Write these numbers with three significant figures using scientific notation:

a) 425 millions

b) 63250074892

c) 507831000000

d) 271828182845

e) 168653972590

f) 251943891

**Exercise 14:** Last year, 24789342 tourists visited Spain. Write that number using scientific notation with two significant figures.

**Exercise 15:** The speed of light is 299 792 458 m/s . Write that number using scientific notation with two significant figures.

**Exercise 16:** The mass of planet Earth is about  $5.98 \cdot 10^{24}$  kg. Write that number with all its figures.

**Exercise 17:** The prefix giga in gigabyte represents 1 000 000 000 bytes. Write this prefix as a power of ten.

**Exercise 18:** A cell divides in half every hour to form two new cells. How many cells do we have ten hours later?

**Exercise 19:** In a warehouse we have placed 12 rows of squared boxes making a square. How many boxes do we have?

**Exercise 20:** To find the volume of a rectangular box you multiply the length times the width times the height. In a cube all sides are the same length. If the cube has length, width, and height of 9 inches, write the volume as a product. Then write it in exponential form.

**Exercise 21:** An old legend tells us about the invention of chess. It is said that the sultan was so happy with the new game that he told the inventor he could ask for anything he wanted in return. So the inventor told him he wanted a grain of wheat on the first square, two grains on the second, four grains on the third.... doubling the number of grains on each square. How many grains of wheat will we have on the last square? Round the number to three significant figures and use scientific notation.

Note: A chessboard has 64 squares.

**Exercise 22:** Without using a calculator, write the integer square root of:

a)  $\sqrt{50}$

b)  $\sqrt{157}$

c)  $\sqrt{67}$

**Exercise 23:** Work out the value of the following square roots:

a)  $\sqrt{1521} =$

b)  $\sqrt{6561} =$

c)  $\sqrt{30625} =$

d)  $\sqrt{117649} =$

e)  $\sqrt{4900000000} =$

f)  $\sqrt{81000000000} =$

g)  $\sqrt{2304} =$

h)  $\sqrt{1764} =$

i)  $\sqrt{148225} =$

**Exercise 24:** Work out the value of the following expressions:

a)  $3^2 + \sqrt{20+5} =$

b)  $3 \cdot 2 + \sqrt{16} : \sqrt{4} =$

c)  $2 + 30 : 15 - 1^{20} + \sqrt{25} - 2 \cdot \sqrt{9} =$

d)  $(4+1) \cdot \sqrt{36} - (2-1)^3 =$

e)  $2 \cdot 3^2 + 3 \cdot \sqrt{64} + 7 \cdot 0 + 1 - 4^2 =$

**Exercise 25:** Work out the value of the following expressions:

a)  $\sqrt{49} : 7 + 20 : \sqrt{10+6} + (7-5)^2 - 3^2 =$

b)  $5 + 2 \cdot \sqrt{16} - (\sqrt{81} - \sqrt{36})^2 + 2^3 =$

c)  $2 + 5 \cdot 2^3 - (\sqrt{25} - \sqrt{9})^2 =$

d)  $(5 - \sqrt{4})^2 + 2^2 \cdot 5 - (\sqrt{12+4})^2 =$

e)  $(\sqrt{121} - 5)^2 + (\sqrt{25} - \sqrt{16})^7 =$

**Exercise 26:** Find the length of the side of a square with an area of  $81 \text{ cm}^2$ .

**Exercise 27:** I have 196 small cubes of the same size and I want to form a square with them. How many cubes do I have to place in each side?

**Exercise 28:** If I have 425 cubes instead, how many cubes do I need now to form each side? How many cubes are left? Could I construct another square with them?

**Exercise 29:** A square field has a surface of  $900 \text{ m}^2$ . How many meters of wire mesh do we need in order to fence it? If every meter costs €1.5, how much money will it cost?

**Exercise 30:** I have 57 muffins and I want to form the biggest possible square with them.

- a) How many muffins do I have to place on each side?
- b) How many muffins are left?

**Exercise 31:** I have a flock with one hundred and seventy three sheep and I want to form the biggest possible square with them to shear them.

- a) How many sheep can I place on each side?
- b) How many sheep are left?
- c) Can I form another square with the sheep that have wool?
- d) Is there any sheep left for a stew?

**Exercise 32:** I have one hundred and thirty-five pumpkins and I want to place them in front of my house forming a square.

- a) How many pumpkins do I have to use?
- b) How many pumpkins are left?
- c) How many candles do I have to buy? Why?

**Exercise 33:** Matthew wants a window put in the living room of his house. The window is to be square with an area of 49 square feet. How long should each side of the window be?

**Exercise 34:** John is planning to put a square garden with an area of 289 square feet in his back yard. What will be the length of each side of the garden?