Grade 5 Unit 1 worksheet: Powers of ten (answer key)

ANSWERS AT A GLANCE

1. (a) 10,000 (b) 5 (c) 2 (d) 1 (e) 8 (f) 6
2. (a) 8,000 (b) 6,400 (c) 3,050 (d) 900,000 (e) 7 (f) 1,200,000
3. The 4 does not mean "times 4". It counts how many tens are multiplied. So $10^4 = 10 \times 10 \times 10 \times 10 = 10{,}000$.
4. (a) 5 (b) the thousands place; the digit 4 (c) the ten thousands place, 10^4; the 0 is worth 0, but it holds the place.
5. (a) 5 (b) 2
6. (a) $3 \times 10^4 + 7 \times 10^3 + 5 \times 10^2 + 8 \times 10^0$ (b) 37,508 clips

WORKED SOLUTIONS

1. Fill in each blank or box.

(a) $10^4 =$ _____

(b) $10 \times 10 \times 10 \times 10 \times 10 = 10^{\square}$

(c) $10^{\square} = 100$

(d) $10^0 =$ _____

(e) $100{,}000{,}000 = 10^{\square}$

(f) $\text{one million} = 10^{\square}$

ANSWER

(a) 10,000 (b) 5 (c) 2 (d) 1 (e) 8 (f) 6

SOLUTION

(a) The exponent 4 means four factors of 10, so the number is a 1 followed by four zeros: $10^4 = 10{,}000$.

(b) Count the factors of 10: there are five, so the exponent is 5.

(c) 100 is a 1 followed by two zeros, so $100 = 10^2$.

(d) Start at 1 and multiply by 10 zero times. Nothing changes, so $10^0 = 1$.

(e) 100,000,000 is a 1 followed by eight zeros, so it is 10^8.

(f) One million is written 1,000,000, a 1 followed by six zeros, so it is 10^6.

2. Multiply.

(a) 8×10^3

(b) 64×10^2

(c) 305×10^1

(d) 90×10^4

(e) 7×10^0

(f) $1{,}200 \times 10^3$

ANSWER

(a) 8,000 (b) 6,400 (c) 3,050 (d) 900,000 (e) 7 (f) 1,200,000

SOLUTION

To multiply a whole number by 10^n, write n zeros after it.

(a) Three zeros after 8: 8,000.

(b) Two zeros after 64: 6,400.

(c) One zero after 305: 3,050. The 0 inside 305 stays where it is.

(d) Four zeros after 90: 900,000. The answer ends in five zeros, since 90 already has one.

(e) $10^0 = 1$, so $7 \times 10^0 = 7 \times 1 = 7$. No zeros are written.

(f) Three zeros after 1,200: 1,200,000, which is one million two hundred thousand.

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3. Lucas says $10^4 = 40$, because 10 times 4 is 40. Explain Lucas's mistake. Then find the right value of 10^4.

ANSWER

The 4 does not mean "times 4". It counts how many tens are multiplied. So $10^4 = 10 \times 10 \times 10 \times 10 = 10{,}000$.

SOLUTION

Lucas multiplied the base by the exponent. But the small raised 4 tells how many times we multiply by 10, starting at 1:

$$10^4 = 1 \times 10 \times 10 \times 10 \times 10$$

Step by step: 10, then 100, then 1,000, then 10,000. So $10^4 = 10{,}000$, a 1 followed by four zeros. The number 40 is 10 × 4, which is only four tens.

4. Use the number 3,604,729.

(a) The 6 is worth $6 \times 10^{\square}$. What exponent goes in the box?

(b) Which place is worth 10^3? What digit is in that place?

(c) The 0 is in which place? Write that place as a power of ten. What is the 0 worth?

ANSWER

(a) 5 (b) the thousands place; the digit 4 (c) the ten thousands place, 10^4; the 0 is worth 0, but it holds the place.

SOLUTION

Count places from the ones place, which is 10^0.

10^6	10^5	10^4	10^3	10^2	10^1	10^0
3	6	0	4	7	2	9

(a) The 6 is five places left of the ones place, so it is worth $6 \times 10^5 = 600{,}000$.

(b) $10^3 = 1{,}000$ is the thousands place. Its digit is 4, worth $4 \times 10^3 = 4{,}000$.

(c) The 0 is in the ten thousands place, which is 10^4. It is worth $0 \times 10^4 = 0$. It still has to be written, so that the 3 and the 6 stay in their places.

5. What exponent goes in each box?

(a) $95 \times 10^{\square} = 9{,}500{,}000$

(b) $380 \times 10^{\square} = 38{,}000$

ANSWER

(a) 5 (b) 2

SOLUTION

Multiplying a whole number by 10^n writes n zeros after it, so count the zeros that were added.

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(a) 9,500,000 is 95 followed by 5 zeros. So the exponent is 5: $95 \times 10^5 = 9{,}500{,}000$.

(b) 38,000 ends in 3 zeros, but one of them was already in 380. Only 2 zeros were added, so the exponent is 2: $380 \times 10^2 = 38{,}000$.

6. Priya counts paper clips in the school supply room. A crate holds 10^4 clips, a carton holds 10^3 clips and a box holds 10^2 clips. She finds 3 crates, 7 cartons, 5 boxes and 8 loose clips.

(a) Write the number of clips in expanded form using powers of ten.

(b) Write the number of clips as a number.

ANSWER

(a) $3 \times 10^4 + 7 \times 10^3 + 5 \times 10^2 + 8 \times 10^0$ (b) 37,508 clips

SOLUTION

(a) Each kind of package is one power of ten, and the loose clips are ones, 10^0:

$$3 \times 10^4 + 7 \times 10^3 + 5 \times 10^2 + 8 \times 10^0$$

There is no term for 10^1, since Priya found nothing that holds ten clips.

(b) Put each digit in its place. The tens place has no term, so it gets a 0:

10^4	10^3	10^2	10^1	10^0
3	7	5	0	8

That is 37,508 clips. Check: 30,000 + 7,000 + 500 + 8 = 37,508.

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