Unit 11 · Indices

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 30

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Spot the errors

ANSWER U · 3

i. She multiplied the base by the index. $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = \mathbf{32}$.

ii. She multiplied the bases. The base stays 3; count the factors: two 3s and three more, $\mathbf{3^5}$ (= 243).

iii. Swapping the base and the index changes the number: $4^3 = 64$ but $3^4 = 81$, so $\mathbf{4^3 \neq 3^4}$.

MARKING SCHEME

✓ 32.

✓ 3^5, the base kept.

✓ 64 and 81, not equal.

2 Which is bigger?

ANSWER A · 3

i. $2^{10} = 1024$ and $10^2 = 100$: $\mathbf{2^{10}}$ is bigger, more than ten times as big.

ii. $3^4 = 81$ and $4^3 = 64$: $\mathbf{3^4}$ is bigger.

iii. $2^6 = 64$, $4^3 = 64$ and $8^2 = 64$: **all three are equal**.

MARKING SCHEME

✓ 2^{10} is bigger (1024 and 100).

✓ 3^4 is bigger (81 and 64).

✓ All three are 64.

3 The missing index

ANSWER A · 4

i. $2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$: **6**.

ii. $5 \times 5 \times 5 = 125$: **3**.

iii. Seven 3s in all, two of them in 3^2: $7 - 2 = \mathbf{5}$.

iv. Nine xs in all: 4 in x^4, 1 in x, so $9 - 4 - 1 = \mathbf{4}$.

MARKING SCHEME

✓ 6.

✓ 3.

✓ 5.

✓ 4 (the lone x counted as one).

4 News that spreads

ANSWER A · 3

i. Sunday 3, Monday 3×3, Tuesday $3 \times 3 \times 3 = \mathbf{3^3 = 27}$.

ii. Thursday is the 5th day: $3^5 = \mathbf{243}$.

iii. Friday: $3^6 = 729$, the first above 500 (Thursday's 243 is below it). **Friday.**

MARKING SCHEME

✓ $3^3 = 27$.

✓ $3^5 = 243$.

✓ Friday, $3^6 = 729$.

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5 Ropani, aana, paisa, daam

ANSWER A · 3

i. $16 \times 4 \times 4 = 4 \times 4 \times 4 \times 4 = \mathbf{4^4}$ (= 256) daam.
ii. $4 \times 4 = \mathbf{4^2}$ (= 16) daam.
iii. 1 ropani = $16 \times 4 = 64$ paisa; 5 aana = $5 \times 4 = 20$ paisa. $64 + 20 + 3 = \mathbf{87\ paisa}$.

MARKING SCHEME

✓ 4^4.
✓ $4^2 = 16$.
✓ 87 paisa.

6 Count the factors

ANSWER A · 3

i. Three 2s, four more, and one more: $\mathbf{2^8}$ (= 256).
ii. *a*: two and one, three; *b*: one and three, four: $a^3\ b^4$.
iii. Numbers: $2 \times 5 = 10$. *x*: two, one and three, six: $\mathbf{10}x^6$.

MARKING SCHEME

✓ 2^8.
✓ $a^3\ b^4$, each letter counted apart.
✓ $10x^6$.

7 Both a square and a cube

ANSWER HA · 4

i. Squares: 4, 9, 16, 25, 36, 49, 64, 81, 100. Cubes: 8, 27, 64, 125.
ii. **64**.
iii. $\mathbf{2^6}$: $2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$.
iv. Six 3s: $3^6 = \mathbf{729} = 27^2 = 9^3$. (Six factors can be put in 2 equal groups of 3 or 3 equal groups of 2, just as $2^6 = 8^2 = 4^3$.)

MARKING SCHEME

✓ Both lists.
✓ 64.
✓ 2^6.
✓ $729 = 27^2 = 9^3$.

8 Make your own

ANSWER A · 3

For example: **"One bacterium splits into 2 every hour, and each new one does the same. How many are there after 6 hours?"** After 1 hour 2, after 2 hours 2×2, and so on.
$2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = \mathbf{64}$.
Any story is right if the same number, 2, is multiplied 6 times.

MARKING SCHEME

✓ A story where something doubles again and again.
✓ Six 2s multiplied: 2^6.
✓ 64.

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9 Think: the last digit

ANSWER HA · 4

i. 3, 9, 27, 81, 243, 729, 2187, 6561. Last digits: **3, 9, 7, 1, 3, 9, 7, 1**.

ii. They repeat in a group of four: **3, 9, 7, 1**. (Only the last digit of each answer decides the next one: 1×3 ends in 3 again.)

iii. 20 is 5 groups of four exactly, so 3^{20} ends like 3^4: **1**.

iv. 25 is 6 groups of four and 1 more, so 3^{25} ends like 3^1: **3**.

MARKING SCHEME

- ✓ The eight powers and their last digits.
- ✓ The repeating group 3, 9, 7, 1.
- ✓ 1.
- ✓ 3.

See it at Science Playground

Exhibits and plants at the center, Bhaktapur, that go with this unit. Book a class visit at science-playground.com/booking.

- **Woods of Nepal** (exhibit): Each wood block is a 10 cm cube. Write its volume in index form: $10 \times 10 \times 10 = 10^3 = 1{,}000$ cm^3, with base 10 and index 3.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	3	19	8	**30**

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