Unit 2 · Whole Number

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 38

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

1 Where do the brackets go?

ANSWER HA · 5

i. $\mathbf{(6 + 18) \div 3 \times 2 - 1} = 24 \div 3 \times 2 - 1 = 8 \times 2 - 1 = 16 - 1 = 15$

ii. $\mathbf{(6 + 18 \div 3) \times 2 - 1} = (6 + 6) \times 2 - 1 = 12 \times 2 - 1 = 24 - 1 = 23$

iii. $\mathbf{6 + 18 \div (3 \times 2) - 1} = 6 + 18 \div 6 - 1 = 6 + 3 - 1 = 8$

iv. $\mathbf{(6 + 18) \div (3 \times 2) - 1} = 24 \div 6 - 1 = 4 - 1 = 3$

v. **23.** To make it big, add before you multiply, so that the 2 multiplies as much as possible, and take the 1 away last. Every other way of placing brackets gives 3, 8, 12, 15 or 17, or an answer that isn't a whole number.

MARKING SCHEME

- ✓ 15 with $(6 + 18)$ in brackets.
- ✓ 23 with $(6 + 18 \div 3)$ in brackets.
- ✓ 8 with (3×2) in brackets.
- ✓ 3 with $(6 + 18)$ and (3×2) in brackets.
- ✓ 23 is the biggest.

2 The missing digit

ANSWER A · 3

i. The known digits add up to $4 + 7 + 2 = 13$. The sum must be 15, 18 or 21, so □ is **2, 5 or 8** (4722, 4752, 4782).

ii. Cut off the 2 and subtract it from 47□, again and again. Only **5** works: $4752 \to 475 - 2 = 473 \to 47 - 3 = 44 = 11 \times 4$. $(4752 = 11 \times 432.)$

iii. Cut off the 2, double it to 4, and subtract it from 47□. Only **3** works: $473 - 4 = 469 \to 46 - 18 = 28 = 7 \times 4$. $(4732 = 7 \times 676.)$

MARKING SCHEME

- ✓ 2, 5 and 8.
- ✓ 5, checked by the test for 11.
- ✓ 3, checked by the test for 7.

3 Spot the error

ANSWER U · 3

i. She subtracted the last digit **once**. That is the test for 11. For 7 the last digit is **doubled** first.

ii. $3 \times 2 = 6$, and $34 - 6 = 28 = 7 \times 4$. So **343 is divisible by 7**.

iii. $343 \div 7 =$ **49**, with nothing left over.

MARKING SCHEME

- ✓ The last digit must be doubled for 7.
- ✓ $34 - 6 = 28$, so 343 is divisible by 7.
- ✓ $343 \div 7 = 49$.

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4 Four digit cards

ANSWER A · 3

i. It must end in 0 or 5. Ending in 0, the largest is 7540; ending in 5, it is 7405. So **7540**.
ii. It must end in 0 or 4. Ending in 0: 4570. Ending in 4: 0 can't go first, so 5074. So **4570**.
iii. It must end in 5 or 7. Ending in 5: 7405. Ending in 7: 5407. So **7405**.

MARKING SCHEME

✓ 7540.
✓ 4570.
✓ 7405.

5 Work backwards

ANSWER A · 4

i. Multiply back from the end: $11 \times 7 = 77$, $77 \times 3 = 231$, $231 \times 2 = 462$, $462 \times 2 = \mathbf{924}$.
ii. $924 \div 2 = \mathbf{462}$, $462 \div 2 = \mathbf{231}$, $231 \div 3 = \mathbf{77}$, $77 \div 7 = \mathbf{11}$.
iii. $\mathbf{924 = 2 \times 2 \times 3 \times 7 \times 11}$

MARKING SCHEME

✓ Multiplying back from 11.
✓ 924.
✓ 462, 231, 77 and 11.
✓ $2 \times 2 \times 3 \times 7 \times 11$.

6 Odd numbers make squares

ANSWER U · 3

i. 4, 9 and 16: they are **square numbers**, 2×2, 3×3 and 4×4. (On dot paper, each new odd number is an L-shaped row and column that turns one square into the next.)
ii. 1, 3, 5, …, 19 are the first **10** odd numbers, so the sum is $10 \times 10 = \mathbf{100}$.
iii. $81 = 9 \times 9$, so the first **9** odd numbers: $1 + 3 + \ldots + 17$.

MARKING SCHEME

✓ 4, 9, 16: square numbers.
✓ 100, from 10 odd numbers.
✓ 9 odd numbers.

7 Bamboo strips

ANSWER A · 3

i. The longest length that divides all three is their HCF.
$84 = 2 \times 2 \times 3 \times 7$
$126 = 2 \times 3 \times 3 \times 7$
$210 = 2 \times 3 \times 5 \times 7$
In all three: one 2, one 3 and one 7. HCF $= 2 \times 3 \times 7 = \mathbf{42\ cm}$.
ii. $84 \div 42 = 2$, $126 \div 42 = 3$, $210 \div 42 = 5$. In all $2 + 3 + 5 = \mathbf{10\ strips}$.

MARKING SCHEME

✓ The prime factors of the three lengths.
✓ 42 cm.
✓ 10 strips.

8 One sweet left over

ANSWER

Without the left-over sweet, the number is a common multiple of 4, 5 and 6.
List the multiples of the biggest, 6: 6, 12, 18, 24, 30, 36, 42, 48, 54, 60. 12, 24, 36 and 48 are multiples of 4 but not of 5, and 30 is a multiple of 5 but not of 4. The first that 4 and 5 both divide is 60, so the LCM of 4, 5 and 6 is 60.

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The common multiples are 60, 120, …, so the jar holds 60 + 1 = **61 sweets** (120 + 1 is too many). HA · 3
Check: 61 = 4 × 15 + 1 = 5 × 12 + 1 = 6 × 10 + 1 ✓

MARKING SCHEME

- ✓ Without the left-over sweet, a common multiple of 4, 5 and 6.
- ✓ LCM 60.
- ✓ 61 sweets.

9 HCF and LCM together

ANSWER A · 4

i. HCF × LCM = the product of the two numbers: 6 × 72 = 432. So the other number is 432 ÷ 18 = **24**. Check: the HCF of 18 and 24 is 6 and their LCM is 72 ✓

ii. **No.** The HCF divides each number, and each number divides the LCM, so the HCF must divide the LCM. 60 ÷ 8 leaves 4 over, so 8 can't be the HCF of two numbers whose LCM is 60.

MARKING SCHEME

- ✓ 6 × 72 = 432.
- ✓ The other number is 24.
- ✓ The HCF must divide the LCM.
- ✓ 8 does not divide 60, so he is wrong.

10 Find the pair

ANSWER HA · 3

The numbers must be multiples of 7 and factors of 84 = 2 × 2 × 3 × 7. Between 10 and 50 that leaves 14, 21, 28 and 42. Testing the pairs, only **21 and 28** work: 21 = 3 × 7 and 28 = 2 × 2 × 7, so the HCF is 7 and the LCM is 7 × 3 × 2 × 2 = 84. Check: 7 × 84 = 588 = 21 × 28 ✓
No other pair works between 10 and 50: 14 and 21 have LCM 42, and every other pair (14 and 28, 14 and 42, 21 and 42, 28 and 42) has an HCF of 14 or 21.

MARKING SCHEME

- ✓ The numbers are multiples of 7 and factors of 84.
- ✓ 21 and 28, with their HCF and LCM shown.
- ✓ No other pair, with a reason.

11 Think: exactly three factors

ANSWER HA · 4

i. **4, 9, 25 and 49** (4: 1, 2, 4; 9: 1, 3, 9; 25: 1, 5, 25; 49: 1, 7, 49).

ii. Each is a **prime number times itself**, the square of a prime: 2 × 2, 3 × 3, 5 × 5, 7 × 7. Factors come in pairs, so a number has an odd number of factors only when one pair is a number with itself; and if that number is prime, nothing else divides it.

iii. The next primes are 11 and 13, so **121 and 169**.

MARKING SCHEME

- ✓ 4, 9, 25 and 49.
- ✓ They are squares.
- ✓ They are squares of prime numbers.
- ✓ 121 and 169.

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.

- **The Fibonacci Spiral** (exhibit): The squares' sides go 1, 1, 2, 3, 5, 8, so their areas are 1, 1, 4, 9, 25 and 64 unit squares: square numbers.
- **Pac-Man Cube Mosaic** (exhibit): Each cube face is 3 rows of 3 squares, so 9 is a square number and 3 is its square root.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	6	17	15	**38**

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