Unit 2 · Whole Number

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 36

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. **103.** In the division method he skipped the 0: after the 1, the next pair gives 6, and even $21 \times 1 = 21$ is more than 6, so the quotient digit is 0 and must be written. 10,609 has three pairs of digits (1 06 09), so its root has 3 digits. Check: $103 \times 103 = 10{,}609$.

ii. **40.** $64000 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 5 \times 5 \times 5$: four groups of three, one from each, $2 \times 2 \times 2 \times 5 = 40$. Check: $40 \times 40 \times 40 = 64{,}000$, while $400 \times 400 \times 400 = 6{,}40{,}00{,}000$.

iii. **6.** 36 is the LCM, not the HCF. The HCF can't be more than the smaller number, 12: $12 = 2 \times 2 \times 3$, $18 = 2 \times 3 \times 3$, common $2 \times 3 = 6$.

MARKING SCHEME

- ✓ i. 103: the 0 in the quotient was skipped.
- ✓ ii. 40, by groups of three.
- ✓ iii. 6: he found the LCM.

2 Only one is a square

ANSWER A · 4

i. A square number ends only in 0, 1, 4, 5, 6 or 9, and a square ends in an even number of zeros.

- **4,358** ends in 8, and **7,227** ends in 7: no square ends in 8 or 7.
- **6,410** ends in a single 0: a square has an even number of zeros at the end.

ii. 5,329: pairs 53 | 29. The biggest square under 53 is $49 = 7^2$, leaving 4. Bring down 29: 429. Double 7 is 14; $143 \times 3 = 429$, leaving 0. So $\sqrt{\mathbf{5329}} = \mathbf{73}$. Check: $73 \times 73 = 5{,}329$.

MARKING SCHEME

- ✓ 4,358 and 7,227: squares never end in 8 or 7.
- ✓ 6,410: a single zero at the end.
- ✓ The division method set out: 7, then 143×3.
- ✓ $\sqrt{5329} = 73$.

3 An orchard in a square

ANSWER A · 4

i. $3136 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 7 \times 7$. One from each pair: $2 \times 2 \times 2 \times 7 = 56$. **56 saplings** in each row.

ii. Four sides of 56 is 224, but each corner sapling was counted twice: $224 - 4 =$ **220 saplings**.

iii. 56 saplings in a row have 55 gaps between them: $55 \times 2 =$ **110 m**.

MARKING SCHEME

- ✓ 3,136 in prime factors, in pairs.
- ✓ 56 in each row.
- ✓ 220, with the corners counted once.
- ✓ 110 m: 55 gaps of 2 m.

4 A painted cube

ANSWER

i. $5832 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$, three groups of three, one from each: $2 \times 3 \times 3 = 18$. **18 cubes** along each edge.

ii. Take off the painted layer on each side: $18 - 2 = 16$ cubes along each edge of the inside cube. $16 \times 16 \times 16 =$ **4,096** cubes have no paint.

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iii. $5832 - 4096 = \mathbf{1{,}736}$ cubes have some paint. HA · 4

MARKING SCHEME

- ✓ 5,832 in prime factors, in groups of three.
- ✓ 18 along each edge.
- ✓ The inside cube 16 along each edge: 4,096.
- ✓ 1,736 painted.

5 A square and a cube at once

ANSWER HA · 4

i. The 2s are 2 + 1: one 2 has no partner. Multiply by **2**: $144 = 12 \times 12$.

ii. The 2s make a group of three, but the 3s are one short. Multiply by **3**: $216 = 6 \times 6 \times 6$.

iii. The number of each prime must split into pairs and into threes, so it must be 6, 12, …: at least six 2s and six 3s. 72 has three 2s and two 3s, so multiply by three more 2s and four more 3s: $2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 = \mathbf{648}$. $72 \times 648 = 46656$. Six 2s and six 3s in pairs: $2 \times 2 \times 2 \times 3 \times 3 \times 3 = 216$, and $216 \times 216 = 46656$. In threes: $2 \times 2 \times 3 \times 3 = 36$, and $36 \times 36 \times 36 = 46656$.

MARKING SCHEME

- ✓ i. 2, giving $144 = 12^2$.
- ✓ ii. 3, giving $216 = 6^3$.
- ✓ iii. Six of each prime needed: multiply by 648.
- ✓ iii. $46{,}656 = 216 \times 216 = 36 \times 36 \times 36$.

6 Tiles for a hall

ANSWER A · 4

i. The side must divide both 1,140 and 840: the biggest is their HCF. $1140 \div 840 = 1$, remainder 300; $840 \div 300 = 2$, remainder 240; $300 \div 240 = 1$, remainder 60; $240 \div 60 = 4$, remainder 0. HCF = 60: tiles **60 cm** on a side.

ii. $1140 \div 60 = 19$ tiles along the length and $840 \div 60 = 14$ along the width: $19 \times 14 = \mathbf{266\ tiles}$.

iii. **Yes**: 30 divides 60, so it divides both lengths. $38 \times 28 = \mathbf{1{,}064\ tiles}$, four times as many.

MARKING SCHEME

- ✓ The division method set out.
- ✓ 60 cm.
- ✓ 266 tiles.
- ✓ Yes: 1,064 tiles.

7 Three buses

ANSWER A · 3

i. $12 = 2 \times 2 \times 3$, $18 = 2 \times 3 \times 3$, $30 = 2 \times 3 \times 5$. LCM $= 2 \times 2 \times 3 \times 3 \times 5 = 180$ minutes, **3 hours**.

ii. At 6:00, 9:00 and 12:00: **3 times**.

iii. **No.** 10:30 is 4½ hours, 270 minutes, after 6:00, and 270 is not a multiple of 180. (Only the Dhulikhel and Panauti buses leave then: 270 is a multiple of 18 and of 30, but not of 12.)

MARKING SCHEME

- ✓ LCM 180 minutes, 3 hours.
- ✓ 3 times.
- ✓ No: 270 minutes is not a multiple of 180.

8 HCF or LCM?

ANSWER

a. **HCF** (the longest piece that fits both). $84 = 2 \times 2 \times 3 \times 7$, $126 = 2 \times 3 \times 3 \times 7$: HCF $= 2 \times 3 \times 7 =$ **42 cm**.

b. **LCM** (the smallest number both divide). $12 = 2 \times 2 \times 3$, $15 = 3 \times 5$: LCM = **60 laddoos**.

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c. **LCM**. LCM of 8, 10 and 12 is $2 \times 2 \times 2 \times 3 \times 5 = 120$. The common multiples are 120, 240, …, and only **120** is between 100 and 200. A · 3

MARKING SCHEME

- ✓ a. HCF, 42 cm.
- ✓ b. LCM, 60.
- ✓ c. LCM 120, the only one between 100 and 200.

9 Make your own

ANSWER A · 3

For example **169**: $169 = 13 \times 13$, so $\sqrt{169} = 13$, a prime; its digits 1, 6, 9 are all different. A second: **289** $= 17 \times 17$.

All the answers: 169 (13), 289 (17), 361 (19), 529 (23), 841 (29) and 961 (31). ($121 = 11 \times 11$ repeats the digit 1.)

MARKING SCHEME

- ✓ A three-digit square with different digits and a prime root.
- ✓ Its prime factors in a pair, and the root.
- ✓ A second one.

10 Think: HCF 4, LCM 48

ANSWER HA · 4

i. The LCM is a multiple of each number, so each number divides 48. The HCF divides each number, so each is a multiple of 4.

ii. **4, 8, 12, 16, 24, 48.**

iii. For the LCM $48 = 2 \times 2 \times 2 \times 2 \times 3$, one number needs four 2s: it is 16 or 48. With 48: 4 and 48 have HCF 4, but 8, 12, 16 and 24 with 48 have HCF 8, 12, 16 and 24. With 16: 4 and 16 have LCM 16, 8 and 16 HCF 8, 24 and 16 HCF 8, but 12 and 16 work: $12 = 2 \times 2 \times 3$, $16 = 2 \times 2 \times 2 \times 2$, HCF $2 \times 2 = 4$, LCM $2 \times 2 \times 2 \times 2 \times 3 = 48$. So the pairs are **4 and 48** and **12 and 16**.

iv. $4 + 48 = 52$, $12 + 16 = 28$: **12 and 16**.

MARKING SCHEME

- ✓ i. Each divides the LCM and is divided by the HCF.
- ✓ ii. 4, 8, 12, 16, 24, 48.
- ✓ iii. 4 and 48; 12 and 16.
- ✓ iv. 12 and 16.

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.

- **Pac-Man Cube Mosaic** (exhibit): This wall is built from Rubik's cubes, each 3 small cubes along every edge: $3 \times 3 \times 3 = 27$, a cube number.
- **Woods of Nepal** (exhibit): Each wood block is a cube with 10 cm edges, so its volume is $10 \times 10 \times 10 = 1{,}000$ cm^3. Read it backwards: the cube root of 1,000 is 10.
- **Build a Gear Train** (exhibit): Watch two touching teeth on a pair of meshed gears: they meet again only after as many teeth pass as the LCM of the two gears' tooth counts.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	3	21	12	**36**

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