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 · 4

i. **5.** Taking away −9 is adding 9: −4 + 9 = 5. She added −9 instead.
ii. **−24.** (−2) × (−3) = 6, then 6 × (−4) = −24. Three negative numbers give a negative product.
iii. **No answer.** Dividing by 0 is not allowed: no number times 0 makes −12.
iv. **10.** The absolute values are 7 and 3, both positive: 7 + 3 = 10. She added −7 and 3 instead.

MARKING SCHEME

✓ i. 5: taking away −9 adds 9.
✓ ii. −24: three negatives give a negative.
✓ iii. No answer: never divide by 0.
✓ iv. 10: absolute values are never negative.

2 Which sign?

ANSWER U · 4

a. ÷: (−12) ÷ (−3) = 4, same signs give a positive quotient.
b. −: (−12) − (−3) = −12 + 3 = −9.
c. ×: (−12) × (−3) = 36.
d. +: (−12) + (−3) = −15.

MARKING SCHEME

✓ a. ÷.
✓ b. −.
✓ c. ×.
✓ d. +.

3 A cold week in Jumla

ANSWER A · 4

i. Warmest 2 °C, coldest −8 °C: 2 − (−8) = **10 degrees**.
ii. The changes from day to day are +3, +5, −3, −7, +8, −5. The biggest rise is **Thursday to Friday**, 0 − (−8) = **8 degrees**.
iii. (−6) + (−3) + 2 + (−1) + (−8) + 0 + (−5) = −21, and (−21) ÷ 7 = **−3 °C**.
iv. Below −3 °C: Sunday (−6), Thursday (−8) and Saturday (−5): **3 days**. (Monday's −3 is equal to it, not below.)

MARKING SCHEME

✓ i. 10 degrees.
✓ ii. Thursday to Friday, 8 degrees.
✓ iii. Sum −21, average −3 °C.
✓ iv. 3 days.

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4 Where do the brackets go?

ANSWER HA · 4

i. Multiply first: $4 \times (-3) = -12$. Then $-8 - 12 - 2 = \mathbf{-22}$.

ii. $\mathbf{[(-8) + 4] \times (-3) - 2} = (-4) \times (-3) - 2 = 12 - 2 = 10$.

iii. $\mathbf{(-8) + 4 \times [(-3) - 2]} = -8 + 4 \times (-5) = -8 - 20 = -28$.

iv. $\mathbf{[(-8) + 4] \times [(-3) - 2]} = (-4) \times (-5) = 20$.

MARKING SCHEME

- ✓ i. −22, multiplying first.
- ✓ ii. Brackets round $(-8) + 4$: 10.
- ✓ iii. Brackets round $(-3) - 2$: −28.
- ✓ iv. Both brackets: 20.

5 Without multiplying

ANSWER A · 3

i. **Negative.** Nine negative numbers: each pair makes a positive, and $9 = 4$ pairs and one left over, which makes the product negative.

ii. **Positive.** Ten negative numbers make 5 pairs, each giving a positive.

iii. **Zero.** Anything multiplied by 0 is 0, whatever the signs of the others.

MARKING SCHEME

- ✓ i. Negative: an odd number of negatives.
- ✓ ii. Positive: an even number of negatives.
- ✓ iii. Zero: one factor is 0.

6 Two integers from clues

ANSWER HA · 3

i. If both were negative, their absolute values would add up to 4, the distance of their sum from 0, not 10. (Both positive is impossible too: the sum would be positive.)

ii. One is negative and one positive. Their distances from 0 add up to 10, and the sum is 4 to the left of 0, so the negative one is 4 further from 0: $10 - 4 = 6$, and half of 6 is 3. So the positive one is 3 from 0 and the negative one $3 + 4 = 7$ from 0: **3 and −7**.

iii. $3 + (-7) = -4$ ✓, and $|3| + |-7| = 3 + 7 = 10$ ✓.

MARKING SCHEME

- ✓ i. Two negatives would have absolute values adding to 4.
- ✓ ii. 3 and −7.
- ✓ iii. Both clues checked.

7 Out of the freezer

ANSWER A · 4

i. 20 minutes is 5 lots of 4 minutes: $-18 + 5 \times 3 = -18 + 15 = \mathbf{-3\ °C}$.

ii. From −18 to 0 is 18 degrees, $18 \div 3 = 6$ lots of 4 minutes: **24 minutes**.

iii. From −18 to 21 is $21 - (-18) = 39$ degrees, $39 \div 3 = 13$ lots of 4 minutes: **52 minutes**.

iv. The change is $-18 - 21 = -39$ degrees, for example $\mathbf{13 \times (-3) = -39}$: 13 drops of 3 degrees.

MARKING SCHEME

- ✓ i. −3 °C.
- ✓ ii. 24 minutes.
- ✓ iii. 52 minutes.
- ✓ iv. −39 as a product, such as $13 \times (-3)$.

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8 Make your own

ANSWER A · 3

For example:

i. $42 \div (-7) = -6$, or $(-30) \div 5 = -6$.

ii. $(-2) - (-9) = -2 + 9 = 7$: the number taken away must be further left than the first.

iii. $(-1) \times 4 \times 6 = -24$, or $2 \times (-3) \times 4 = -24$.

Any answer is right if it works out.

MARKING SCHEME

- ✓ i. A quotient of -6.
- ✓ ii. Negative minus a smaller negative, positive answer.
- ✓ iii. Three different integers with product -24.

9 Think: do they swap and regroup?

ANSWER HA · 4

i. $(-6) - (-2) = -4$, but $(-10) - (-2) = -8$. The answers differ, so **subtraction is not associative**.

ii. $4 \div 2 = 2$, but $(-24) \div (-3) = 8$. **Division is not associative** either.

iii. **No.** $(-7) \div 2$ is not an integer: it lies halfway between -4 and -3. (And dividing by 0 gives no answer at all.)

iv. **Only when** $a = b$: then both are 0. Otherwise $b - a$ is the opposite of $a - b$, one positive and one negative, as with $5 - 2 = 3$ and $2 - 5 = -3$.

MARKING SCHEME

- ✓ i. -4 and -8: not associative.
- ✓ ii. 2 and 8: not associative.
- ✓ iii. No, with an example.
- ✓ iv. Only when a = b.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	8	14	11	**33**

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