Answers - Negative numbers, factors, multiples and primes

Year: Year 7

Answer to Question 1

On a number line, numbers get bigger as you move to the right. A negative number with a larger digit, such as -10, is further left, so it is smaller.

a. **-10, -7, -2, 0, 3, 5**
b. **-4** is greater because it is closer to zero.
c. The distance is 12, half is 6, so $-8 + 6 =$**-2**
d. -6 < -3; 0 > -1; -2 = -2.0.

Answer to Question 2

a. Start at -5 and move 8 to the right: **3**.
b. Start at 3 and move 9 to the left, passing zero: -6.
c. Start at -4 and move 6 further left: -10.
d. Subtracting a negative is adding: $-7 - (-3) = -7 + 3 = -4$.
e. $5 - (-2) = 5 + 2 =$**7**.
f. Adding a negative is subtracting: $-3 + (-4) = -3 - 4 = -7$.

Check each answer on a number line: right for adding a positive, left for subtracting a positive.

Answer to Question 3

a. Different signs give a negative: $4 \times 6 = 24$, so -24.
b. Same signs give a positive: $5 \times 8 = 40$, so **40**.
c. Different signs: $36 \div 9 = 4$, so -4.
d. Same signs: $42 \div 7 = 6$, so **6**.
e. Work in two steps: $(-3) \times (-2) = 6$, then $6 \times (-5) = -30$. Three negatives give a negative.
f. A fraction is a division: $-48 \div 6 = -8$ (different signs).

Answer to Question 4

a. 1, 2, 3, 4, 6, 8, 12, 24
b. 1, 2, 3, 4, 6, 9, 12, 18, 36
c. Common factors: 1, 2, 3, 4, 6, 12. HCF = **12**.
d. Multiples of 8: 8, 16, 24, 32, 40. Multiples of 12: 12, 24, 36, 48, 60. LCM = **24**.

Answer to Question 5

a. 31, 37, 41, 43, 47, 53, 59.
b. $51 = 3 \times 17$, so it has more than two factors.
c. The number 1 has only one factor, itself, so it does not have exactly two factors.
d. **2**

To test whether a number is prime, try dividing it by the primes 2, 3, 5, 7, ... up to its square root. If none of them divides exactly, the number is prime.

Answer to Question 6

a. Divide by primes: $60 = 2 \times 30 = 2 \times 2 \times 15 = 2 \times 2 \times 3 \times 5$, so $60 = 2^2 \times 3 \times 5$.
b. $84 = 2 \times 42 = 2 \times 2 \times 21 = 2 \times 2 \times 3 \times 7$, so $84 = 2^2 \times 3 \times 7$.
c. The HCF uses the primes in both lists: two 2s and one 3. $2 \times 2 \times 3 =$**12**.
d. The LCM uses every prime with the highest power: $2^2 \times 3 \times 5 \times 7 =$**420**. Check: $60 \times 84 \div 12 = 420$.

Answer to Question 7

a. Coldest: **Moscow** (-14 °C). Warmest: **Madrid** (9 °C).
b. $9 - (-14) = 23$, so **23 °C**.
c. $-6 - 8 =$**-14 °C**
d. $3 - 5 = -2$ °C. This is the same as Reykjavik at noon, so it is **0 °C** colder.

Remember that the difference between two temperatures is always found by subtracting the lower one from the higher one, which gives a positive number of degrees.

Answer to Question 8

a. Down means subtract: $2 - 4 = -2$, the lower car-park level.
b. Up means add: $-2 + 3 =$**1**, floor 1.
c. Floors travelled is the difference: $3 - (-2) = 3 + 2 =$**5 floors** (−2 to −1, 0, 1, 2, 3).
d. From 3 down to −1 is $3 - 4 = -1$ (4 floors down). Then up 2: $-1 + 2 =$**1**.

Answer to Question 9

a. Add money in and subtract money out each week. Week 1: $10 + 25 - 40 = -£5$. Week 2: $-5 + 15 - 12 = -£2$. Week 3: $-2 + 0 - 30 = -£32$. Week 4: $-32 + 50 - 20 = -£2$.
b. The balance is first negative at the end of **week 1** (−£5).

c. The smallest (most negative) balance is **−£32**, at the end of week 3.
d. From −£2 to £20 is a difference of $20 - (-2) =$**£22**.

Answer to Question 10

a. Above sea level is positive, below is negative: Snowdon **1 085 m**, Dead Sea **−430 m**, cave **−90 m**.
b. Difference: $1085 - (-430) = 1085 + 430 =$**1 515 m**.
c. Going down 35 m means subtracting: $-430 - 35 =$**−465 m**.
d. $-90 - (-430) = -90 + 430 = 340$, so the Dead Sea shore is **340 m** deeper than the cave.

Answer to Question 11

a. The number of teams must be a factor of 36: **1, 2, 3, 4, 6, 9, 12, 18, 36**.
b. Team sizes are also factors of 36. Those from 4 to 9 are **4, 6 and 9** (making 9, 6 or 4 teams).
c. Each set must use a factor of 48 and of 36, and we want the largest: HCF(48, 36) = **12** sets.
d. Brushes: $48 \div 12 =$**4**. Pots: $36 \div 12 =$**3**. Each set has 4 brushes and 3 pots.

Answer to Question 12

a. Bus 12: 8:15, 8:30, 8:45, 9:00, 9:15. Bus 40: 8:20, 8:40, 9:00, 9:20, 9:40.
b. LCM(15, 20) = 60 minutes, so **9:00 am**.
c. Every 60 minutes: 9:00, 10:00, 11:00, 12:00, that is **4 times**.
d. LCM(15, 20, 25) = 300 minutes = 5 hours, so **1:00 pm**.

Answer to Question 13

a. 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47. That is **15 tickets**.
b. $91 = 7 \times 13$, so it is not prime.
c. 37 is not divisible by 2, 3 or 5 (and $7 \times 7 = 49 > 37$), so 37 is prime and the ticket is a winner.
d. Multiples of 7 between 20 and 50: 21, 28, 35, 42, 49. Factors of 84 among them: 21 ($84 = 21 \times 4$), 28 ($84 = 28 \times 3$), 42 ($84 = 42 \times 2$). The tickets are **21, 28 and 42**.

Answer to Question 14

a. $-18 + 7 =$**-11 °C**

b. $-11-3=$**-14 °C**
c. The freezer is at -14 °C. Each hour adds 2, so after 7 hours it is 0 °C and after **8 hours** it is +2 °C, first above zero.
d. $-14+2\times4=$**-6 °C**

Each change is applied to the temperature at that moment: add a rise and subtract a fall, then read the answer from left to right.

Answer to Question 15

a. 2000 m is 2 lots of 1000 m, so $8-2\times6=-4$. Correct.
b. $8-3\times6=$**-10 °C**.
c. Below -10 °C needs more than 3000 m: at 3500 m it is $8-3.5\times6=-13$. First fall below -10 is just above 3000 m, so at **3001 m** or higher.
d. Ben Nevis: $1345\div1000\times6=8.07$, so about $8-8.07=$**0 °C** (about -0.07 °C).

Answer to Question 16

a. Diagonal: $-8+(-5)+(-2)=-15$.
b. Row 1: $a=-15-(-8)-(-3)=-4$. Row 2: $b=-15-(-5)-(-9)=-1$. Column 1: $c=-15-(-8)-(-1)=-6$. Column 2: $d=-15-(-3)-(-5)=-7$.
c. Other diagonal: $a+(-5)+c=-4-5-6=-15$. It matches the magic total.
d. The three rows each total −15, so all nine numbers add to $3\times(-15)=-45$.

Answer to Question 17

a. Jess: 18 = 2×3×3 and 10 = 2×5. Ravi: 12 = 2×2×3 and 15 = 3×5. Both give 2, 2, 3, 3, 5.
b. $180=2^2\times3^2\times5$.
c. 150 = $2\times3\times5^2$. HCF = $2\times3\times5=$**30**. LCM = $2^2\times3^2\times5^2=$**900**.
d. Add 1 to each power and multiply: $(2+1)(2+1)(1+1)=18$. There are 18 factors.

Answer to Question 18

a. Factors of 90 between 3 and 15: 3, 5, 6, 9, 10, 15.
b. Number of posts = $90\div\text{gap}+1$: gap 3 gives 31, gap 5 gives 19, gap 6 gives 16, gap 9 gives 11, gap 10 gives 10, gap 15 gives 7.
c. Gap 15 m: 7 posts, $7\times4=$**£28**.
d. Factors of 60 between 3 and 15: 3, 4, 5, 6, 10, 12, 15. Common to both: **3, 5, 6, 10, 15**.

Answer to Question 19

In each case, find the rule that has been broken before writing the correct answer.

a. Subtracting a negative is adding: $-3 + 5 =$**2**.
b. 36 is the LCM. HCF is the greatest common factor: **6**.
c. $27 = 3 \times 9$, so 27 is not prime.
d. 4 is not prime. Correct: $40 = 2^3 \times 5$, so the prime factors are 2 and 5.

Answer to Question 20

a. Pupils 1, 2, 3, 4, 6 and 12 (the factors of 12).
b. 6 times, which is an even number, so the locker ends **closed**.
c. Each factor corresponds to one change. Open lockers have been changed an odd number of times.
d. Only square numbers have an odd number of factors: **1, 4, 9, 16, 25, 36, 49, 64, 81, 100** (10 lockers).