Worksheet - Negative numbers, factors, multiples and primes

Year: Year 7 · 20

Show your working.

Question 1

Question 1 – Ordering and comparing negative numbers *(Section A · Skills practice)*

Negative numbers are used for temperatures, bank balances and floors below ground level.

a. Write in order, smallest first: 3, -7, 0, -2, 5, -10.
b. Which is greater, -4 or -9?
c. What number is halfway between -8 and 4?
d. Fill in the symbol <, > or = : -6 ☐ -3, 0 ☐ -1, -2 ☐ -2.0.

Question 2

Question 2 – Adding and subtracting negative numbers *(Section A · Skills practice)*

Work these out. You may use a number line.

a. $-5 + 8$
b. $3 - 9$
c. $-4 - 6$
d. $-7 - (-3)$
e. $5 - (-2)$
f. $-3 + (-4)$

Question 3

Question 3 – Multiplying and dividing negative numbers *(Section A · Skills practice)*

Use the rules for signs to work these out.

a. -4×6
b. $-5 \times (-8)$
c. $36 \div (-9)$
d. $-42 \div (-7)$
e. $(-3) \times (-2) \times (-5)$
f. $\dfrac{-48}{6}$

Question 4

Question 4 – Factors and multiples *(Section A · Skills practice)*

Use lists to answer these questions.

a. List all the factors of 24.
b. List all the factors of 36.
c. Write down the common factors of 24 and 36 and state the highest common factor (HCF).
d. List the first five multiples of 8 and of 12, and find the lowest common multiple (LCM) of 8 and 12.

Question 5

Question 5 – Prime numbers *(Section A · Skills practice)*

A prime number has exactly two factors: 1 and itself.

a. List all the prime numbers between 30 and 60.
b. Explain why 51 is not prime.
c. Explain why 1 is not a prime number.
d. Write down the only even prime number.

Question 6

Question 6 – Prime factors, HCF and LCM *(Section A · Skills practice)*

Use prime factor decomposition to answer these questions.

a. Write 60 as a product of its prime factors.
b. Write 84 as a product of its prime factors.
c. Use your answers to find the HCF of 60 and 84.
d. Find the LCM of 60 and 84.

Question 7

Question 7 – Temperatures around the world *(Section B · Real-life practice)*

The table shows the temperature at noon on one winter day in five places.

Place	Temperature (°C)
Edinburgh	3
Oslo	-6
Reykjavik	-2
Moscow	-14
Madrid	9

a. Which place is the coldest and which is the warmest?
b. Work out the difference in temperature between Madrid and Moscow.
c. At midnight the temperature in Oslo falls by 8 degrees. What is the new temperature?
d. The temperature in Edinburgh falls by 5 degrees overnight. What is the temperature in Edinburgh at midnight? How much colder is this than Reykjavik at noon?

Question 8

Question 8 – The lift in the shopping centre *(Section B · Real-life practice)*

A shopping centre has 3 floors above ground (floors 1, 2 and 3), the ground floor (0) and two underground car-park levels (-1 and -2). Aisha takes the lift several times.

a. She starts at floor 2 and goes down 4 floors. Which floor does she reach?
b. She then goes up 3 floors. Where is she now?
c. Her mum starts at level -2 and goes up to floor 3. How many floors does she travel?
d. Dad goes from floor 3 to level -1, then up 2 floors. Where does he end up?

Question 9

Question 9 – Bank balance *(Section B · Real-life practice)*

Tom checks his bank account each week. His balance is shown with negative numbers when he is overdrawn.

Week	Money in (£)	Money out (£)
1	25	40
2	15	12
3	0	30
4	50	20

a. Tom starts with a balance of £10. Work out his balance at the end of each week.
b. At what point is he overdrawn for the first time?
c. What is the lowest balance he reaches?
d. How much does he need to pay in at the end of week 4 to have exactly £20?

Question 10

Question 10 – The Dead Sea expedition *(Section B · Real-life practice)*

A geography class studies heights above and below sea level. The Dead Sea shore is 430 m below sea level. The top of Mount Snowdon is 1 085 m above sea level. A cave in Wales is 90 m below sea level.

a. Write each height as a positive or negative number.
b. Work out how much higher Snowdon is than the Dead Sea shore.
c. A diver at the Dead Sea shore goes down a further 35 m. Write down her new height.
d. How much deeper is the Dead Sea than the Welsh cave?

Question 11

Question 11 – Teams and sets *(Section B · Real-life practice)*

Class 7C has 36 pupils. The PE teacher wants to split the class into equal teams with no one left out. The art teacher has 48 brushes and 36 pots of paint and wants to make identical sets with nothing left over.

a. List all the ways to divide the class into equal teams (the number of teams that work).
b. The PE teacher wants teams of at least 4 pupils but no more than 9 pupils. Which team sizes are possible?
c. What is the greatest number of identical sets the art teacher can make from the brushes and the paint?
d. How many brushes and pots are in each set?

Question 12

Question 12 – Bus timetable *(Section B · Real-life practice)*

At a bus station, a number 12 bus leaves every 15 minutes and a number 40 bus leaves every 20 minutes. Both buses leave together at 8:00 am.

a. List the first five departure times of each bus after 8:00.
b. When do both buses next leave at the same time?
c. How many times between 8:00 am and 12:00 noon (not counting 8:00) do both buses leave together?
d. A third bus leaves every 25 minutes. When do all three buses next leave together at the same time?

Question 13

Question 13 – Prime time at the school fair *(Section B · Real-life practice)*

At the school fair, the raffle tickets are numbered from 1 to 50. The prizes are won by tickets that are prime numbers.

a. How many tickets between 1 and 50 are prime? List them.
b. The teacher says "Ticket 91 is prime." Explain why she is wrong.
c. A pupil buys ticket 37. Is it a winner? Show how you know.
d. A ticket is a multiple of 7 and a factor of 84 and is between 20 and 50. Which tickets could it be?

Question 14

Question 14 – The fridge in the school kitchen *(Section B · Real-life practice)*

The temperature inside a school freezer is -18 °C. The cook takes some food out and the temperature rises by 7 °C. After the door is closed it falls by 3 °C. Later the freezer is switched off and the temperature rises by 2 °C every hour.

a. What is the temperature after the door has been opened?
b. What is the temperature after it is closed again?
c. How many hours after switching off does the temperature first rise above 0 °C?
d. What is the temperature after 4 hours?

Question 15

Question 15 – Temperatures on a mountain *(Section C · Problem solving)*

A hiker records the temperature at different heights on a mountain in Scotland. At sea level the temperature is 8 °C and it falls by 6 °C for every 1000 m climbed.

Height (m)	0	500	1000	1500	2000
Temperature (°C)	8	5	2	-1	-4

a. Check that the table is correct. Show the calculation for 2000 m.
b. What would the temperature be at 3000 m?
c. At what height does the temperature first fall below -10 °C? (Assume the pattern continues.)
d. The summit of Ben Nevis is 1345 m. Estimate the temperature there.

Question 16

Question 16 – Magic square of negative numbers *(Section C · Problem solving)*

In a magic square every row, column and diagonal has the same total. Complete this one.

-8	-3	a
b	-5	-9
c	d	-2

a. Work out the magic total using the diagonal from top left to bottom right.
b. Find the missing numbers a, b, c and d.
c. Check that the other diagonal also gives the magic total.
d. What is the sum of all nine numbers?

Question 17

Question 17 – Prime factor trees *(Section C · Problem solving)*

Jess and Ravi each draw a factor tree for 180. Jess splits 180 into 18 and 10. Ravi splits it into 12 and 15.

a. Complete both factor trees until all branches end in prime numbers.
b. Write 180 as a product of prime factors in index form.
c. Find the HCF and the LCM of 180 and 150.
d. Explain how you know that 180 has 18 factors using its prime factors.

Question 18

Question 18 – Fences and fence posts *(Section C · Problem solving)*

A farmer needs to put posts along a straight fence that is 90 m long. Posts are placed at equal gaps (a whole number of metres) with a post at each end. The gap has to be at most 15 m and at least 3 m.

a. List all the possible gaps.
b. For each possible gap, work out how many posts are needed.
c. Posts cost £4 each. Which gap gives the cheapest fence and how much does it cost?
d. The farmer also has a second fence of 60 m and wants to use the same gap on both. List the gaps that work for both.

Question 19

Question 19 – Spot the mistake *(Section C · Problem solving)*

Four pupils each made a mistake. Explain it and write the correct answer.

a. Ali says: -3 - (-5) = -8.
b. Beth says: the HCF of 12 and 18 is 36.
c. Carl says: 27 is a prime number because it is odd.
d. Dina says: the prime factors of 40 are 2, 4, 5.

Question 20

Question 20 – Challenge: the locker problem *(Section D · Challenge)*

A school has 100 lockers numbered 1 to 100, all closed. Pupil 1 opens every locker. Pupil 2 changes every 2nd locker (opens it if closed, closes it if open). Pupil 3 changes every 3rd locker, and so on until pupil 100.

a. Which pupils change locker 12? List them.
b. How many times is locker 12 changed? Is it open or closed at the end?
c. Explain why a locker is open at the end only if it has an odd number of factors.
d. Which lockers are open at the end? (Hint: look at square numbers.)