

Factors, Multiples, Primes, Squares and Cubes

Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (5 marks)

Here is a list of numbers.

4 9 12 17 21 27 36 64

From the list, write down

(a) a multiple of 7

A multiple of 7 is in the 7 times table.

$$21 = 3 \times 7$$

Answer: 21

(b) a factor of 24

A factor of 24 divides into 24 exactly.

$$24 \div 12 = 2$$

$$24 \div 4 = 6 \text{ also works.}$$

Answer: 12 (or 4)

Tip: Factors are the numbers that divide **into** a number, so they are never bigger than it. Multiples are in its times table, so they are never smaller than it.

(c) a prime number

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

17 has only the factors 1 and 17.

The others are not prime, e.g. $21 = 3 \times 7$ and $27 = 3 \times 9$.

Answer: 17

(d) a cube number

A cube number is a number multiplied by itself three times.

$$27 = 3 \times 3 \times 3 = 3^3$$

$$64 = 4 \times 4 \times 4 = 4^3$$

Answer: 27 (or 64)

Tip: Learn the first few cube numbers: 1, 8, 27, 64, 125, 1000. 9 is a square number, not a cube number.

(e) a number that is both a square number and a cube number

$64 = 8 \times 8 = 8^2$, so it is a square number.

$64 = 4 \times 4 \times 4 = 4^3$, so it is also a cube number.

Answer: 64

2 (2 marks)

Write down all the factors of 30

Find the factor pairs, starting with 1:

$$1 \times 30$$

$$2 \times 15$$

$$3 \times 10$$

$$5 \times 6$$

4 does not divide into 30, and after 5 and 6 the pairs repeat.

Now list every number from the pairs.

Answer: 1, 2, 3, 5, 6, 10, 15, 30

Tip: Do not forget 1 and the number itself (30). Write the factors as a list, not as pairs like 2×15 .

Marks: 2 marks for all eight factors and no extra numbers. 1 mark for at least six correct factors.

3 (2 marks)

Write a number in each box to make the calculation correct.

(a) Use two different factors of 36

$$\boxed{} + \boxed{} = 13$$

Factors of 36: 1, 2, 3, 4, 6, 9, 12, 18, 36

Find two different numbers from this list that add to 13.

$$4 + 9 = 13 \quad \checkmark \quad (\text{or } 1 + 12 = 13)$$

Answer: $4 + 9$ or $1 + 12$

Tip: Check that both numbers really divide into 36. For example, $5 + 8 = 13$ but neither 5 nor 8 is a factor of 36.

(b) Use a cube number and a square number

$$\boxed{} + \boxed{} = 17$$

Cube numbers less than 17: 1, 8

Take each one away from 17 and check if the answer is a square number:

$$17 - 8 = 9 = 3 \times 3 \quad (\text{square } \checkmark)$$

$$17 - 1 = 16 = 4 \times 4 \quad (\text{square } \checkmark)$$

Answer: $8 + 9$ (or $1 + 16$)

4 (1 mark)

Circle the prime number.

Options: 21, 27, 29, 33

Check each number for factors other than 1 and itself.

$$21 = 3 \times 7$$

$$27 = 3 \times 9$$

$$33 = 3 \times 11$$

29 has only the factors 1 and 29.

Answer: 29

Tip: Odd numbers are not always prime. Check if 3 divides into them: add the digits, and if the total is in the 3 times table, so is the number.

5 (1 mark)

Write down the first five multiples of 8

The multiples of 8 are the 8 times table.

$$8 \times 1 = 8, \quad 8 \times 2 = 16, \quad 8 \times 3 = 24, \quad 8 \times 4 = 32, \quad 8 \times 5 = 40$$

Answer: 8, 16, 24, 32, 40

6 (1 mark)

Sian says,

‘All prime numbers are odd.’

Is Sian correct? Tick a box.

Give a reason for your answer.

2 has exactly two factors, 1 and 2, so it is a prime number.

But 2 is even.

So not all prime numbers are odd.

Answer: No, 2 is a prime number that is even

7 (2 marks)

Work out the sum of the prime numbers between 20 and 40

Check the odd numbers from 21 to 39:

$21 = 3 \times 7$, $25 = 5 \times 5$, $27 = 3 \times 9$, $33 = 3 \times 11$, $35 = 5 \times 7$, $39 = 3 \times 13$ are not prime.

The primes are 23, 29, 31 and 37.

“Sum” means add: $23 + 29 + 31 + 37 = 120$

Answer: 120

Tip: 21, 25, 27 and 39 are often wrongly thought to be prime. Check each odd number for factors.

Marks: 1 mark for listing the four primes (23, 29, 31, 37). 1 mark for 120.

8 (4 marks)

(a) Work out 7^2

7^2 means 7×7

$$7 \times 7 = 49$$

Answer: 49

(b) Work out $\sqrt{81}$

Which number times itself makes 81?

$$9 \times 9 = 81$$

Answer: 9

(c) Work out 5^3

5^3 means $5 \times 5 \times 5$

$$5 \times 5 = 25$$

$$25 \times 5 = 125$$

Answer: 125

(d) Work out $\sqrt[3]{8}$

Which number, used three times in a multiplication, makes 8?

$$2 \times 2 \times 2 = 8$$

Answer: 2

9 (2 marks)

Find a number that is a factor of 60 **and** a multiple of 4 **and** greater than 10

Factors of 60: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

Which of these are multiples of 4? 4, 12, 20, 60

Which of those are greater than 10? 12, 20, 60

Any one of these is correct.

Answer: 12 (or 20 or 60)

Marks: 2 marks for 12, 20 or 60. 1 mark for a factor of 60 that is a multiple of 4 (e.g. 4).

10 (1 mark)

Explain why 51 is not a prime number.

The digits of 51 add up to $5 + 1 = 6$, which is in the 3 times table.

So 3 is a factor: $51 = 3 \times 17$

51 has factors other than 1 and 51, so it is not prime.

Answer: $51 = 3 \times 17$

11 (1 mark)

n is an integer greater than 1

Circle the expression that is **always** a square number.

Options: $2n$, $n + 4$, $4n^2$, n^3

$$4n^2 = 2 \times 2 \times n \times n$$

$$= (2n) \times (2n)$$

$$= (2n)^2, \text{ which is always a square number.}$$

The others are not always square, e.g. $n = 3$ gives $2n = 6$, $n + 4 = 7$, $n^3 = 27$.

Answer: $4n^2$

12 (2 marks)

Kofi chooses a multiple of 5 and a prime number.

(a) He subtracts the prime number from the multiple of 5

His answer is a cube number.

Write down a possible pair of numbers.

multiple of 5 = _____ prime number = _____

Cube numbers: 1, 8, 27, 64, ...

Try multiples of 5 and take away a prime:

$$10 - 2 = 8 = 2 \times 2 \times 2 \quad \checkmark$$

Other answers are possible, e.g. $15 - 7 = 8$ or $30 - 3 = 27$.

Answer: e.g. 10 and 2 (or 15 and 7, or 30 and 3)

Tip: 1 is not a prime number, so an answer like $65 - 1 = 64$ does not work, even though 64 is a cube number. Check that your prime really is prime.

- (b) He multiplies the two numbers together.
His answer is an even number less than 30
Write down a possible pair of numbers.

multiple of 5 = _____ prime number = _____

Try the prime number 2: $5 \times 2 = 10$

10 is even and less than 30 ✓

$10 \times 2 = 20$ also works.

$10 \times 3 = 30$ does not work, because 30 is not **less** than 30.

Answer: e.g. 5 and 2 (or 10 and 2)

13 (2 marks)

The difference between two prime numbers is 9
Work out the two prime numbers.

“Difference” means the bigger number take away the smaller number.

9 is odd.

odd – odd = even, so the two primes cannot both be odd.

The only even prime is 2, so one of the numbers is 2.

The other number is $2 + 9 = 11$, which is prime ✓

Answer: 2 and 11

Tip: Remember that 2 is a prime number. It is the only even prime, and it is often the key to questions like this.

Marks: 1 mark for using 2 as one of the primes, or for two primes with a difference that is odd.
1 mark for 2 and 11.