



- 1 Is 51 a prime number? Give a reason for your answer.

(2 marks)

$$3 \times 17 = 51$$

51 has a factor other than 1 and itself

Not prime

- 2 Write 84 as a product of its prime factors.

(2 marks)

$$84 = 2 \times 42$$

$$42 = 2 \times 21 \text{ and } 21 = 3 \times 7$$

$$\text{So } 84 = 2 \times 2 \times 3 \times 7 = 2^2 \times 3 \times 7$$

$$2^2 \times 3 \times 7$$

- 3 Here is part of a factor tree for 90.

90 splits into 9 and 10. 9 splits into 3 and A. 10 splits into B and 5. All the numbers at the ends of the branches are prime.

a. Work out the values of A and B.

b. Write 90 as a product of its prime factors.

(3 marks)

a)

$$9 = 3 \times 3, \text{ so } A = 3$$

$$10 = 2 \times 5, \text{ so } B = 2$$

b)

$$90 = 2 \times 3 \times 3 \times 5$$

$$2 \times 3^2 \times 5$$

- 4 Write 264 as a product of its prime factors.

(2 marks)

$$264 = 2 \times 132, 132 = 2 \times 66, 66 = 2 \times 33$$

$$33 = 3 \times 11, \text{ and } 11 \text{ is prime}$$

$$\text{So } 264 = 2 \times 2 \times 2 \times 3 \times 11 = 2^3 \times 3 \times 11$$

$$2^3 \times 3 \times 11$$

5

Here is a list of numbers.

8 14 19 27 35

Write down the number from the list that is a prime number.

(1 mark)

$8 = 2 \times 4$, $14 = 2 \times 7$, $27 = 3 \times 9$, $35 = 5 \times 7$, so none of these are prime

19 has no factors other than 1 and 19, so 19 is prime

19

6

Is 97 a prime number? Show how you know.

(2 marks)

Only test primes up to 7 ($11^2 = 121 > 97$)

Not even

$9 + 7 = 16$, not a multiple of 3

Does not end in 0 or 5

$7 \times 13 = 91$, $7 \times 14 = 98$, so not a multiple of 7

97 is prime

7

a. Write 168 as a product of its prime factors.

b. Write 252 as a product of its prime factors.

c. Work out the highest common factor (HCF) of 168 and 252.

(3 marks)

a)

$$168 = 2 \times 84 = 2 \times 2 \times 42 = 2 \times 2 \times 2 \times 21 \\ = 2^3 \times 3 \times 7$$

b)

$$252 = 2 \times 2 \times 63 = 2 \times 2 \times 3 \times 21 \\ = 2^2 \times 3^2 \times 7$$

c) smallest power of each prime

$$2^2 \times 3 \times 7 = 84$$

c) 84

8

$$A = 2^3 \times 3 \times 5 \quad \text{and} \quad B = 2^2 \times 3^2 \times 7$$

- Find the lowest common multiple (LCM) of A and B .
- Find the highest common factor (HCF) of A and B .

Give each answer as an ordinary number.

(4 marks)

a) highest power of each prime

$$2^3 \times 3^2 \times 5 \times 7$$

$$= 8 \times 9 \times 35 = 2520$$

b) lowest power of shared primes

$$2^2 \times 3 = 12$$

$$\boxed{\text{a) } 2520 \text{ b) } 12}$$

9

Use prime factors to show that 1764 is a square number.

(3 marks)

$$1764 = 2 \times 882 = 2 \times 2 \times 441$$

$$441 = 3 \times 147 = 3 \times 3 \times 49$$

$$49 = 7 \times 7$$

$$1764 = 2^2 \times 3^2 \times 7^2$$

Every power is even

$$\boxed{= (2 \times 3 \times 7)^2 = 42^2}$$

10

- Write 90 and 150 as products of prime factors, in index form.
- Find the highest common factor (HCF) of 90 and 150.
- Find the lowest common multiple (LCM) of 90 and 150.

(5 marks)

a)

$$90 = 2 \times 45 = 2 \times 3 \times 15 = 2 \times 3 \times 3 \times 5$$

$$= 2 \times 3^2 \times 5$$

$$150 = 2 \times 75 = 2 \times 3 \times 25$$

$$= 2 \times 3 \times 5^2$$

b) lowest powers

$$2 \times 3 \times 5 = 30$$

c) highest powers

$$2 \times 3^2 \times 5^2 = 2 \times 9 \times 25 = 450$$

$$\boxed{\text{b) } 30 \text{ c) } 450}$$

- 11 72 is multiplied by a whole number n to give a square number.
Find the smallest possible value of n , and the square number.

(3 marks)

$$72 = 8 \times 9 = 2^3 \times 3^2$$

2 has an odd power, so multiply by 2

$$72 \times 2 = 2^4 \times 3^2 = 144$$

$$n = 2, \text{ square number } 144$$

- 12 $120 = 2^3 \times 3 \times 5$

Write 1200 as a product of its prime factors.

(3 marks)

$$1200 = 120 \times 10$$

$$= 2^3 \times 3 \times 5 \times 2 \times 5$$

Collect powers

$$2^4 \times 3 \times 5^2$$

- 13 Write 360 as a product of powers of its prime factors.

(3 marks)

$$360 = 2 \times 180, 180 = 2 \times 90, 90 = 2 \times 45$$

$$45 = 3 \times 15 \text{ and } 15 = 3 \times 5$$

$$\text{So } 360 = 2 \times 2 \times 2 \times 3 \times 3 \times 5 = 2^3 \times 3^2 \times 5$$

$$2^3 \times 3^2 \times 5$$

- 14 List all the prime numbers between 20 and 35.

(2 marks)

Check each number from 21 to 34

21 = 3 x 7, 25 = 5 x 5, 27 = 3 x 9, 33 = 3 x 11 and all even numbers in this interval are divisible by 2 and greater than 2, so are not prime

The primes between 20 and 35 are 23, 29 and 31

$$23, 29, 31$$

- 15 a. Write 126 as a product of its prime factors.
b. Find the lowest common multiple (LCM) of 126 and 60

(4 marks)

$$\text{a) } 126 = 2 \times 63, 63 = 9 \times 7 = 3^2 \times 7, \text{ so } 126 = 2 \times 3^2 \times 7$$

$$\text{b) } 60 = 2^2 \times 3 \times 5$$

b) Take the highest power of each prime

$$2^2, 3^2, 5 \text{ and } 7, \text{ so } \text{LCM} = 4 \times 9 \times 5 \times 7 = 1260$$

16

a. Write 448 as a product of powers of its prime factors.

b. Find the highest common factor (HCF) of 448 and 168

(4 marks)

$$\begin{aligned} \text{a) } 448 &= 2 \times 224 = 2 \times 2 \times 112 = 2 \times 2 \times 2 \times 56 = 2 \times 2 \times 2 \times 2 \times 28 = 2 \times 2 \times 2 \times 2 \\ &\times 2 \times 14 = 2^7 \times 7 \end{aligned}$$

$$\text{b) } 168 = 2^3 \times 3 \times 7$$

b) Take the lowest power of each common prime

$$2^3 \text{ and } 7, \text{ so HCF} = 8 \times 7 = 56$$