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1.4 Highest common factors — worked answers

Find out about highest common factors. · 56 questions

A · Fluency — Find the HCF of pairs and triples.

1 Find the highest common factor of 12 and 18.

Answer: 6

12 = 6 × 2 and 18 = 6 × 3, and no larger number divides into both, so the HCF is 6.

2 Find the highest common factor of 24 and 36.

Answer: 12

24 = 12 × 2 and 36 = 12 × 3, and no larger number divides into both, so the HCF is 12.

3 Find the highest common factor of 15 and 25.

Answer: 5

15 = 5 × 3 and 25 = 5 × 5, and no larger number divides into both, so the HCF is 5.

4 Find the highest common factor of 16 and 24.

Answer: 8

16 = 8 × 2 and 24 = 8 × 3, and no larger number divides into both, so the HCF is 8.

5 Find the highest common factor of 21 and 28.

Answer: 7

21 = 7 × 3 and 28 = 7 × 4, and no larger number divides into both, so the HCF is 7.

6 Find the highest common factor of 9 and 20.

Answer: 1

9 and 20 share no factor except 1, so the HCF is 1 — they are co-prime.

7 Find the highest common factor of 30 and 45.

Answer: 15

30 = 15 × 2 and 45 = 15 × 3, and no larger number divides into both, so the HCF is 15.

8 Find the highest common factor of 100 and 75.

Answer: 25

100 = 25 × 4 and 75 = 25 × 3, and no larger number divides into both, so the HCF is 25.

9 Find the highest common factor of 42 and 56.

Answer: 14

42 = 14 × 3 and 56 = 14 × 4, and no larger number divides into both, so the HCF is 14.

10 Find the highest common factor of 18 and 27.

Answer: 9

18 = 9 × 2 and 27 = 9 × 3, and no larger number divides into both, so the HCF is 9.

11 Find the highest common factor of 36 and 60.

Answer: 12

36 = 12 × 3 and 60 = 12 × 5, and no larger number divides into both, so the HCF is 12.

12 Find the highest common factor of 14 and 35.

Answer: 7

14 = 7 × 2 and 35 = 7 × 5, and no larger number divides into both, so the HCF is 7.

13 Find the highest common factor of 8 and 27.

Answer: 1

8 and 27 share no factor except 1, so the HCF is 1 — they are co-prime.

14 Find the highest common factor of 48 and 72.

Answer: 24

48 = 24 × 2 and 72 = 24 × 3, and no larger number divides into both, so the HCF is 24.

15 Find the highest common factor of 26 and 39.

Answer: 13

26 = 13 × 2 and 39 = 13 × 3, and no larger number divides into both, so the HCF is 13.

16 Find the highest common factor of 33 and 44.

Answer: 11

33 = 11 × 3 and 44 = 11 × 4, and no larger number divides into both, so the HCF is 11.

17 Find the highest common factor of 50 and 80.

Answer: 10

50 = 10 × 5 and 80 = 10 × 8, and no larger number divides into both, so the HCF is 10.

18 Find the highest common factor of 64 and 96.

Answer: 32

64 = 32 × 2 and 96 = 32 × 3, and no larger number divides into both, so the HCF is 32.

19 Find the highest common factor of 12, 18 and 30.

Answer: 6

6 divides into all three numbers and nothing larger does.

20 Find the highest common factor of 24, 36 and 60.

Answer: 12

12 divides into all three numbers and nothing larger does.

21 Find the highest common factor of 16, 40 and 24.

Answer: 8

8 divides into all three numbers and nothing larger does.

22 Find the highest common factor of 45, 75 and 90.

Answer: 15

15 divides into all three numbers and nothing larger does.

23 Find the highest common factor of 14, 28 and 42.

Answer: 14

14 divides into all three numbers and nothing larger does.

24 Find the highest common factor of 20, 50 and 35.

Answer: 5
5 divides into all three numbers and nothing larger does.

B · Reasoning — Factors, common factors and simplifying.

25 List all the factors of 24, in order, separated by commas.

Answer: 1, 2, 3, 4, 6, 8, 12, 24
Work in pairs: 1 × 24, 2 × 12, 3 × 8, 4 × 6.

26 List all the factors of 36, in order, separated by commas.

Answer: 1, 2, 3, 4, 6, 9, 12, 18, 36
Pairs: 1 × 36, 2 × 18, 3 × 12, 4 × 9, 6 × 6.

27 List the common factors of 12 and 18, separated by commas.

Answer: 1, 2, 3, 6
Factors of 12: 1, 2, 3, 4, 6, 12. Factors of 18: 1, 2, 3, 6, 9, 18. The shared ones are 1, 2, 3 and 6.

28 How many common factors do 24 and 36 have?

Answer: 6
Their HCF is 12, and the common factors are exactly the factors of 12: 1, 2, 3, 4, 6, 12 — that is 6 of them.

29 Is 8 a common factor of 24 and 36?

☐ Yes
☐ No

Answer: No
8 divides 24 but 36 ÷ 8 = 4.5, so 8 is not a factor of 36.

30 Are 9 and 20 co-prime (HCF = 1)?

☐ Yes
☐ No

Answer: Yes
Factors of 9: 1, 3, 9. Factors of 20: 1, 2, 4, 5, 10, 20. Only 1 is shared.

31 Use the HCF to simplify 24/36. What is the new numerator?

Answer: 2
HCF(24, 36) = 12. Dividing both parts by 12 gives 2/3, so the numerator is 2.

32 Use the HCF to simplify 45/60. What is the new denominator?

Answer: 4
HCF(45, 60) = 15. 45 ÷ 15 = 3 and 60 ÷ 15 = 4, giving 3/4.

33 Why can the fraction 25/36 not be simplified?

☐ Because 25 is smaller than 36
☐ Because the HCF of 25 and 36 is 1
☐ Because 36 is a square number
☐ Because 25 is not a factor of 36

Answer: Because the HCF of 25 and 36 is 1
25 = 5 × 5 and 36 = 2 × 2 × 3 × 3. They share no factor except 1, so the fraction is already in its simplest form.

34 Zara says “the HCF of two numbers is always smaller than both of them”. Is she right?

☐ Yes

☐ No

Answer: No

If one number is a factor of the other, the HCF is the smaller number itself. For example HCF(6, 18) = 6.

35 The HCF of 12 and n is 12, and n is between 20 and 30. What is n?

Answer: 24

For the HCF to be 12, n must be a multiple of 12. The only multiple of 12 between 20 and 30 is 24.

36 Two numbers have HCF 6 and LCM 72. One number is 24. What is the other?

Answer: 18

HCF × LCM = product of the two numbers, so 6 × 72 = 432 and the other number is 432 ÷ 24 = 18. Check: HCF(24, 18) = 6 ✓ LCM(24, 18) = 72 ✓

C · Challenge — Work backwards from an HCF.

37 Two numbers have a highest common factor of 4. The first number is 12 and the second is greater than 20 and less than 40. What is the smallest possible value of the second number?

Answer: 28

The second must be a multiple of 4 whose HCF with 12 is exactly 4 — so it must not also be a multiple of 12. Multiples of 4 strictly between 20 and 40: 24 (HCF 12 ✗), 28 (HCF 4 ✓). So 28.

38 The HCF of two numbers is 3 and their LCM is 45. What is the larger of the two numbers?

Answer: 15

The product is 3 × 45 = 135. The pair must be 9 and 15: HCF(9, 15) = 3 ✓ LCM(9, 15) = 45 ✓ So the larger is 15.

39 The HCF of two numbers is 3 and their LCM is 45. What is the smaller of the two numbers?

Answer: 9

The pair is 9 and 15, so the smaller is 9.

40 Find the HCF of 8 and 12, then the LCM of 8 and 12, then multiply them together. What do you get?

Answer: 96

HCF = 4, LCM = 24, and 4 × 24 = 96. Notice 8 × 12 = 96 too — HCF × LCM always equals the product of the two numbers.

41 n is a number between 1 and 100. The HCF of n and 30 is 15. What is the largest possible n?

Answer: 75

n must be a multiple of 15 but not of 30 (or the HCF would be 30). Multiples of 15 under 100: 15, 30✗, 45, 60✗, 75, 90✗. The largest is 75.

42 What is the HCF of two consecutive whole numbers, such as 14 and 15?

Answer: 1

Consecutive numbers can never share a factor bigger than 1, because any common factor would also have to divide their difference, which is 1.

43 The HCF of 36 and n is 9. What is the smallest possible value of n if n is greater than 9?

Answer: 27

n must be a multiple of 9. Test them in order: n = 18 gives HCF(36, 18) = 18 ✗; n = 27 gives HCF(36, 27) = 9 ✓. So n = 27.

44 A rectangle is 84 cm by 60 cm. It is cut into identical squares with no waste. What is the largest possible side length, in cm?

Answer: 12
The side must divide both 84 and 60, so it is HCF(84, 60) = 12 cm.

D · Word problems — Sharing into the largest equal groups.

45 Anya has 48 red pens and 36 blue pens. She makes identical packs using all the pens. What is the greatest number of packs she can make?

Answer: 12
HCF(48, 36) = 12 packs, each with 4 red and 3 blue pens.

46 A florist has 30 roses and 45 tulips. She makes identical bunches using all the flowers. What is the largest number of bunches?

Answer: 15
HCF(30, 45) = 15 bunches.

47 In the question above, how many roses are in each bunch?

Answer: 2
30 ÷ 15 = 2 roses per bunch.

48 A room is 3 m 60 cm long and 2 m 40 cm wide. It is tiled with identical square tiles with no cutting. What is the largest tile side length, in cm?

Answer: 120
HCF(360, 240) = 120 cm.

49 Two ribbons are 72 cm and 120 cm long. They are cut into equal pieces as long as possible with none left over. How long is each piece, in cm?

Answer: 24
HCF(72, 120) = 24 cm.

50 In the question above, how many pieces are there altogether?

Answer: 8
72 ÷ 24 = 3 pieces and 120 ÷ 24 = 5 pieces, giving 8 in total.

51 A teacher has 84 pencils and 63 rulers. She makes identical sets. What is the greatest number of sets?

Answer: 21
HCF(84, 63) = 21 sets.

52 Two lengths of rope, 90 m and 126 m, are cut into equal pieces as long as possible. How long is each piece, in metres?

Answer: 18
HCF(90, 126) = 18 m.

53 A baker has 56 muffins and 98 cookies. He fills identical boxes. What is the greatest number of boxes he can fill?

Answer: 14
HCF(56, 98) = 14 boxes.

54 150 boys and 225 girls take part in a parade. They march in identical rows, each row containing only boys or only girls. What is the greatest number of students in a row?

Answer: 75
HCF(150, 225) = 75 students.

55 Three bells ring 24, 36 and 60 times an hour. A student groups the rings into identical blocks. What is the largest block size that works for all three?

Answer: 12
HCF(24, 36, 60) = 12.

56 A shop packs 48 apples, 72 oranges and 96 pears into identical fruit boxes using all the fruit. What is the greatest number of boxes?

Answer: 24
HCF(48, 72, 96) = 24 boxes.