# Prime Factors, HCFs, LCMs

2, 3, 5, 7, 11, 13

All integers greater than 1 can be factorised into prime factors

Ex1 24

$$\begin{array}{r|l} 2 & 24 \\ 2 & 12 \\ 2 & 6 \\ 3 & 3 \\ & 1 \end{array}$$

$24 = 2 \times 2 \times 2 \times 3$

$24 = 2^3 \times 3$

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Ex2 78

$$\begin{array}{r|l} 2 & 78 \\ 3 & 39 \\ 13 & 13 \\ & 1 \end{array}$$

$78 = 2 \times 3 \times 13$

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Ex3 100

$$\begin{array}{r|l} 2 & 100 \\ 2 & 50 \\ 5 & 25 \\ 5 & 5 \\ & 1 \end{array}$$

$100 = 2 \times 2 \times 5 \times 5$

$100 = 2^2 \times 5^2$

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Exercise Write these numbers as a product of their prime factors

1) 84 2) 60 3) 35 4) 90 5) 120

1) 84

$$\begin{array}{r|l} 2 & 84 \\ 2 & 42 \\ 3 & 21 \\ 7 & 7 \\ & 1 \end{array}$$

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

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

2) 60

$$\begin{array}{r|l} 2 & 60 \\ 2 & 30 \\ 3 & 15 \\ 5 & 5 \\ & 1 \end{array}$$

$60 = 2 \times 2 \times 3 \times 5$

$60 = 2^2 \times 3 \times 5$

3) 35

$$\begin{array}{r|l} 5 & 35 \\ 7 & 7 \\ & 1 \end{array}$$

$35 = 5 \times 7$

4) 90

$$\begin{array}{r|l} 2 & 90 \\ 3 & 45 \\ 3 & 15 \\ 5 & 5 \\ & 1 \end{array}$$

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

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

5) 120

$$\begin{array}{r|l} 2 & 120 \\ 2 & 60 \\ 2 & 30 \\ 3 & 15 \\ 5 & 5 \\ & 1 \end{array}$$

$120 = 2 \times 2 \times 2 \times 3 \times 5$

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

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## Highest Common Factors HCFs

The HCF of two integers A and B is the biggest number which divides into both of them.

With small numbers we can often identify the HCF by inspection

Ex1 8 and 12 HCF = 4

Ex2 15 and 20 HCF = 5

Ex3 9 and 14 HCF = 1

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We can use prime factors to find an HCF

Ex1 60 and 96

$$\begin{array}{r|l} 2 & 60 \\ \hline 2 & 30 \\ \hline 3 & 15 \\ \hline 5 & 5 \\ \hline & 1 \end{array} \qquad \begin{array}{r|l} 2 & 96 \\ \hline 2 & 48 \\ \hline 2 & 24 \\ \hline 2 & 12 \\ \hline 2 & 6 \\ \hline 3 & 3 \\ \hline & 1 \end{array}$$

$60 = 2 \times 2 \times 3 \times 5$

$96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3$

HCF $= 2 \times 2 \times 3$

HCF $= 12$

Ex2 75 and 125

$$\begin{array}{r|l} 3 & 75 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array} \qquad \begin{array}{r|l} 5 & 125 \\ \hline 5 & 25 \\ \hline 5 & 5 \\ \hline & 1 \end{array}$$

$75 = 3 \times 5 \times 5$

$125 = 5 \times 5 \times 5$

HCF $= 5 \times 5$

HCF $= 25$

Exercise Find the HCF of

1) 48 and 32

2) 144 and 96

3) 70 and 105

4) 56 and 84

1)

$$\begin{array}{r|l} 2 & 48 \\ 2 & 24 \\ 2 & 12 \\ 2 & 6 \\ 3 & 3 \\ & 1 \end{array} \qquad \begin{array}{r|l} 2 & 32 \\ 2 & 16 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ & 1 \end{array}$$

$48 = 2 \times 2 \times 2 \times 2 \times 3$

$32 = 2 \times 2 \times 2 \times 2 \times 2$

$HCF = 2 \times 2 \times 2 \times 2$

$HCF = 16$

2)

$$\begin{array}{r|l} 2 & 144 \\ 2 & 72 \\ 2 & 36 \\ 2 & 18 \\ 3 & 9 \\ 3 & 3 \\ & 1 \end{array} \qquad \begin{array}{r|l} 2 & 96 \\ 2 & 48 \\ 2 & 24 \\ 2 & 12 \\ 2 & 6 \\ 3 & 3 \\ & 1 \end{array}$$

$144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3$

$96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3$

$HCF = 2 \times 2 \times 2 \times 2 \times 3$

$HCF = 48$

3) $HCF = 35$

4) $HCF = 28$

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LOWEST COMMON MULTIPES LCMs

The LCM of two integers A and B is the lowest number that A and B will divide into exactly.

Examples with small numbers

1) 8 and 12 $\rightarrow$ LCM = 24

8, 16, 24, 32, 40

12, 24

2) 10 and 15 $\rightarrow$ LCM = 30

3) 48 and 72

48, 96, 144, 192

72, 144

LCM = 144

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Exercise Find LCMs

1) 45 and 60 LCM = 180

2) 27 and 54 LCM = 54

3) 64 and 96 LCM = 192

1) 45 90 135 180

60 120 180

LCM = 180

3) 64 128 192 256 320 384

96 192 288 384