Question

The cost of a car repair bill is £749, including VAT at 17.5%. What is the cost of the bill excluding VAT, in pounds to the nearest penny? (to two decimal places)

Solution

Method 1

The cost of a car repair bill including VAT is the sum of the bill excluding VAT and VAT.
Denote the cost of the bill excluding VAT by x, then VAT, being 17.5% of the cost is $0.175x$, so

$$(1 + 0.175)\, x = £749;$$

$$1.175\, x = £749;$$

dividing both sides by 1.175

$$x = £749 / 1.175.$$

Using a calculator

$$x = £637.4468085…$$

Round a number $x = £637.4468085…$ to two decimal places

$$x \approx £637.45.$$

Answer: £637.45.

Method 2

Let x be the cost of the bill excluding VAT and y be VAT. The cost of a car repair bill including VAT is the sum of the bill excluding VAT and VAT, so

$$x + y = £749;$$

y is given by

$$y = 17.5\% \ of \ x = \frac{17.5}{100}x = 0.175x.$$

Thus,

$$\begin{cases} x + y = £749, \\ y = 0.175x. \end{cases}$$

Substitute y by $0.175x$ in the equation $x + y = £749$ and solve for x which is to be found

$$x + 0.175x = £749$$

$$1.175 \, x = £749$$

dividing both sides by 1.175

$$x = £749 / 1.175.$$

Using a calculator

$$x = £637.4468085…$$

Round a number x = £637.4468085… to two decimal places

$$x \approx £637.45.$$

Answer: £637.45.

Method 3

Let x be the cost of the bill excluding VAT. It corresponds to 100%. VAT corresponds to 17.5% of the cost. The cost of a car repair bill including VAT is the sum of the bill excluding VAT and VAT. This value is equal to £749 and it corresponds to 117.5%.

Using proportions

$$£749 \text{ corresponds to } 117.5\%$$

$$x \text{ corresponds to } 100 \text{ \%}$$

obtain

$$\frac{£749}{x} = \frac{117.5\%}{100\%}.$$

'Cross-multiplication' gives

$$£749 \cdot 100\% = x \cdot 117.5\%,$$

$$x = £749 \frac{100\%}{117.5\%},$$

$$x = \frac{£749}{1.175}.$$

Using a calculator

$$x = £637.4468085….$$

Round a number x = £637.4468085… to two decimal places

$$x \approx £637.45.$$

Answer: £637.45.