

Percentages: Non-calculator questions — Worked Solutions

Q1. A badge has a grid of 100 squares, and 51 squares are coloured.

(a) Since there are 100 squares, the percentage coloured is the number of coloured squares out of 100:

$$\frac{51}{100} = 51\%.$$

(b) $51\% = \frac{51}{100} = 0.51.$

(c) 51% as a fraction of the badge is $\frac{51}{100}.$

Q2. Fill in the gaps. Multiply by 100 to change a decimal to a percentage; divide by 100 to change a percentage to a decimal.

(a) $0.4 = 40\%$

(c) $1.25 = 125\%$

(e) $7\% = 0.07$

(b) $0.06 = 6\%$

(d) $45\% = 0.45$

(f) $130\% = 1.3$

Q3. From the bar chart, the numbers of votes are:

$$\text{Neon} = 18, \quad \text{Retro} = 12, \quad \text{Space} = 15, \quad \text{Jungle} = 5.$$

There are 50 votes altogether.

(a) Neon:

$$\frac{18}{50} \times 100\% = 36\%.$$

(b) Jungle:

$$\frac{5}{50} \times 100\% = 10\%.$$

(c) Space or Retro received

$$15 + 12 = 27$$

votes out of 50, which is

$$\frac{27}{50} \times 100\% = 54\%.$$

Since $54\% > 50\%$, Ravi is right.

Q4. Work these out:

(a) $10\% \text{ of } 250 = \frac{1}{10} \times 250 = 25.$

$60 \div 3 = 20.$

and $5\% \text{ of } 80 = 4.$ Hence

(b) $10\% \text{ of } 60 = 6,$ so $5\% \text{ of } 60 = 3.$ (c) $10\% \text{ of } 80 = 8,$ so $30\% \text{ of } 80 = 24.$

$35\% \text{ of } 80 = 24 + 4 = 28.$

Q5. Work out each new price.

(a) $10\% \text{ of } £45 \text{ is } £4.50,$ so $20\% \text{ is } £9.$ The trainers are reduced by $£9,$ so the sale price is $£36.$

(b) $25\% \text{ of } £32 \text{ is } £8.$ The hoodie is increased by $£8,$ so the new price is $£40.$

Q6. (a) A reduction of 20% means the coat now costs 80% of its original price.

$$80\% = £48$$

so

$$10\% = £6$$

and therefore

$$100\% = £60.$$

The original price was $£60.$

(b) After a 30% increase, the new price is 130% of the original price.

$$130\% = £91$$

so

$$10\% = 91 \div 13 = £7$$

and therefore

$$100\% = 7 \times 10 = £70.$$

The membership before the rise was $£70$ per month.

Q7. For a repair cost of £64:

$$10\% \text{ of } 64 = 6.40,$$

so

$$5\% = 6.40 \div 2 = 3.20$$

and

$$2.5\% = 3.20 \div 2 = 1.60.$$

Therefore

$$17.5\% = 10\% + 5\% + 2.5\% = 6.40 + 3.20 + 1.60 = 11.20.$$

The VAT is £11.20.

Q8. Coffee and tea together make

$$35\% + 20\% = 55\%.$$

So the cold drinks are

$$100\% - 55\% = 45\%.$$

Now

$$10\% \text{ of } 240 = 24,$$

so

$$40\% \text{ of } 240 = 96$$

and

$$5\% \text{ of } 240 = 12.$$

Hence

$$45\% \text{ of } 240 = 96 + 12 = 108.$$

The café sold 108 cold drinks.

Q9. The customer is **not** right.

Take an example price of £100.

- After a 20% increase:

$$100 \times 1.20 = 120.$$

- Then 20% is taken off the new, larger price:

$$20\% \text{ of } 120 = 24.$$

- Final sale price:

$$120 - 24 = 96.$$

So the final price is £96, not £100. The 20% decrease takes off £24, while the original 20% increase had added only £20.

Q10. The normal price of the headphones is £80.

(a) Shop A: 30% off £80 means the customer pays

$$70\% \text{ of } 80 = 0.70 \times 80 = 56,$$

so the price is £56.

Shop B: a quarter off means the customer pays

$$75\% \text{ of } 80 = 0.75 \times 80 = 60,$$

and then a further £8 off gives

$$60 - 8 = 52.$$

So Shop B is cheaper, by

$$£56 - £52 = £4.$$

- (b) One possible third offer is: take off 20%, then take off a further £15.

For £80:

$$20\% \text{ of } 80 = 16,$$

so the price after 20% off is

$$80 - 16 = 64.$$

Taking off another £15 gives

$$64 - 15 = 49.$$

This is cheaper than Shop A's £56 and Shop B's £52. Also, half of the normal price is £40, and £49 is more than £40.

- (c) Let the normal price be x pounds.

$$\text{Shop A price} = 0.70x.$$

$$\text{Shop B price} = 0.75x - 8.$$

They charge the same when

$$0.70x = 0.75x - 8.$$

Subtract $0.70x$ from both sides:

$$0 = 0.05x - 8$$

so

$$0.05x = 8$$

and

$$x = \frac{8}{0.05} = 160.$$

The headphones would need to cost £160 for both shops to charge the same price. Both would then charge £112.