



H25-30min Recognising Misleading Graphs (Higher): 30-minute Pack

EDEXCEL 1ST0 · Calculator allowed · about 30 minutes

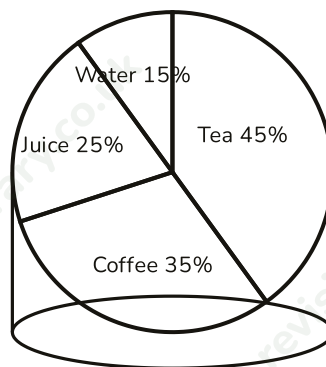
Total Marks

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** A survey of 200 cafe customers found their favourite drink: Tea (80 customers), Coffee (60 customers), Juice (40 customers), Water (20 customers). A magazine draws a 3D pie chart of this data, printing the percentages 45%, 35%, 25% and 15% next to the Tea, Coffee, Juice and Water sectors.

Magazine's 3D pie chart (200 customers)

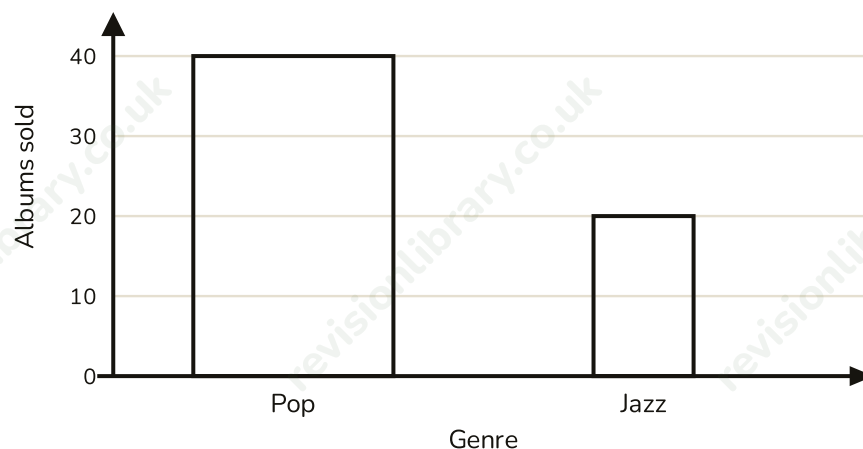


- (a) Work out the correct percentage of customers whose favourite drink was Coffee. (2)
- (b) The magazine's pie chart shows the percentages 45%, 35%, 25% and 15% for Tea, Coffee, Juice and Water. Show that these percentages do not sum to 100%, and state the total they do sum to. (2)
- (c) The magazine's chart is also drawn in 3D with a tilt. Referring to both faults, explain why this pie chart could give a misleading impression of the survey results. (2)

- (d) Suggest two specific corrections the magazine should make before it republishes this pie chart. (2)

(Total for Question 1 is 8 marks)

- 2 A record shop compares sales last month: Pop albums sold 40 copies, Jazz albums sold 20 copies. On a promotional poster, both bars are drawn to the correct heights, but the Pop bar is also drawn twice as wide as the Jazz bar.



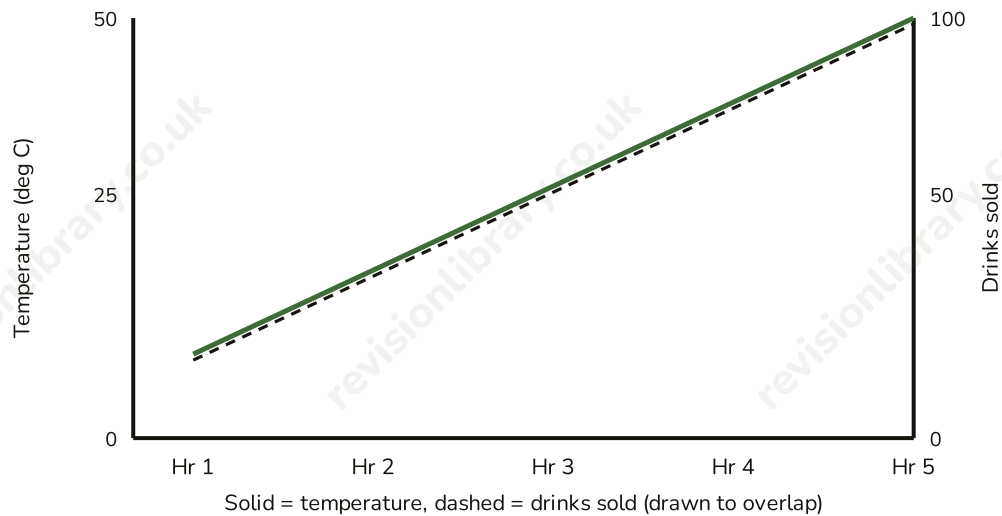
- (a) Write down the ratio of albums sold, Pop to Jazz, in the form $n : 1$. (1)

- (b) The Pop bar is drawn twice as wide as the Jazz bar, as well as twice as tall. Work out the ratio of the areas of the two bars. (2)

- (c) Explain why making the bars different widths, as well as different heights, could mislead a reader even though the heights themselves are drawn correctly. (2)

(Total for Question 2 is 5 marks)

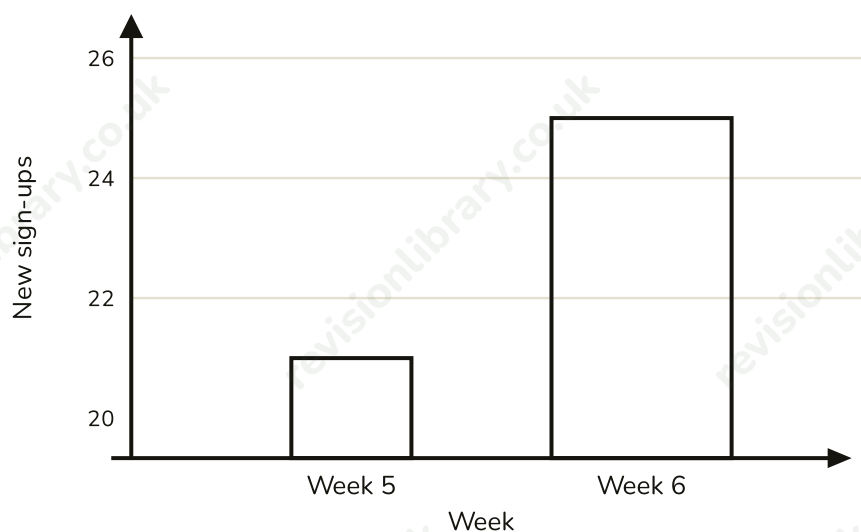
- 3** A wellness blog plots two data sets over five hours: Temperature (degrees C) - 10, 20, 30, 40, 50; Cold drinks sold - 20, 40, 60, 80, 100. The blog uses a left-hand vertical axis from 0 to 50 for temperature and a separate right-hand vertical axis from 0 to 100 for drinks sold. Drawn this way, the two lines lie exactly on top of each other.



- (a) Using the table, work out how many times greater the number of drinks sold is than the temperature value, at the 10 degree reading. (2)
-
- (b) Explain why drawing the two data sets so their lines lie exactly on top of each other, using two different vertical axes, could mislead a reader. (2)
- (c) Suggest a fairer way to present this data so a reader could judge the relationship between temperature and drinks sold without being misled by the matching lines. (2)

(Total for Question 3 is 6 marks)

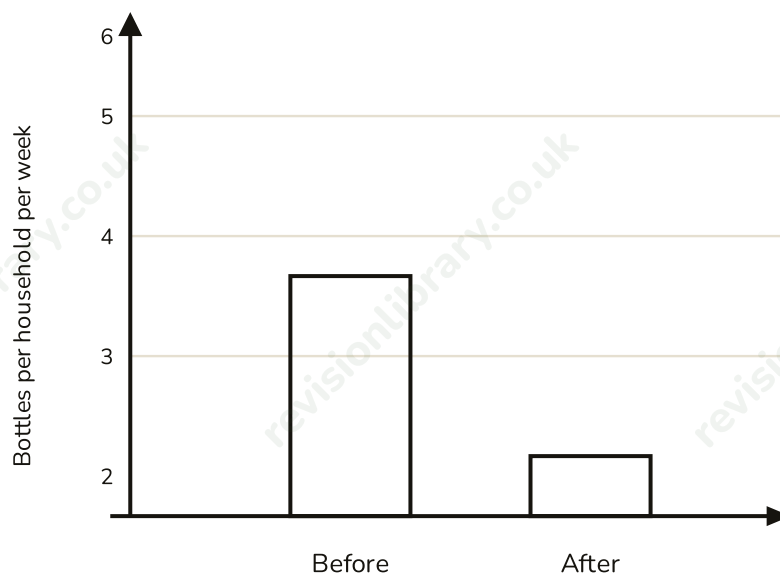
- 4 A gym's full sign-up data for six weeks is: Week 1 = 20, Week 2 = 21, Week 3 = 19, Week 4 = 22, Week 5 = 21, Week 6 = 25. An advert for the gym shows only Weeks 5 and 6, with a vertical axis starting at 20, and the Week 6 bar drawn one and a half times as wide as the Week 5 bar.



- (a) Work out the percentage increase in sign-ups the advert's graph covers, from Week 5 to Week 6. (2)
-
- (b) Work out the percentage increase in sign-ups over the full six weeks shown in the underlying data, from Week 1 to Week 6. (2)
-
- (c) Identify three separate features of how the advert's graph is presented that could make the increase look more dramatic than the roughly 19-25% figures above suggest, and explain the effect of each. Then give an overall conclusion. (4)

(Total for Question 4 is 8 marks)

- 5 A campaign group claims: 'Our graph proves that switching to reusable bottles has cut plastic bottle use in half.' Their bar chart shows 'Plastic bottles used per household per week': Before = 6, After = 3, with the vertical axis starting at 2, and no source or sample size stated anywhere on the chart.



- (a) Work out the true percentage decrease in plastic bottles used, from Before to After. (2)
-
- (b) The claim states the graph 'proves' the reduction. Evaluate this claim, referring to (i) whether the chart's own presentation is fair, and (ii) whether a bar chart like this could ever be enough evidence on its own to 'prove' a cause-and-effect claim about an entire campaign's impact. (3)
-

(Total for Question 5 is 5 marks)

Mark scheme · H25-30min Recognising Misleading Graphs (Higher): 30-minute Pack

Question 1

- (a) **M1** $60/200 \times 100$, oe
- (a) **A1** 30% cao
- **(a) Answer: 30%**
- (b) **M1** $45 + 35 + 25 + 15$, oe
- (b) **A1** 120%, correctly identified as not equal to 100%
- **(b) Answer: 120%**
- (c) **B1** explains that because the percentages sum to 120% rather than 100%, every sector has effectively been labelled with too large a share of the whole, so the chart no longer fairly represents parts of a single complete set of 200 customers
- (c) **B1** explains that the added 3D tilt makes the sector drawn nearest the front of the chart look even bigger than its (already inflated) printed percentage, distorting the comparison between drinks still further
- **(c) Answer: Because the printed percentages add up to 120% instead of 100%, every sector's labelled share is inflated beyond its true proportion of the 200 customers, so the parts no longer fairly represent the whole; on top of this, the 3D tilt makes whichever sector faces the viewer look even larger than its stated percentage, distorting the comparison between drinks further.**
- (d) **B1** recalculate the sector angles/percentages directly from the true frequencies (80, 60, 40, 20 out of 200) so they sum to exactly 100% (360 degrees)
- (d) **B1** redraw the chart as a flat 2D pie chart instead of a 3D one
- **(d) Answer: (1) Recalculate each sector from the true frequencies out of 200, so the percentages sum to exactly 100%. (2) Redraw the pie chart as a flat 2D chart instead of a 3D one.**

Question 2

- (a) **B1** 2 : 1 cao
- **(a) Answer: 2 : 1**
- (b) **M1** $(2 \times 2) : (1 \times 1)$, oe
- (b) **A1** 4 : 1 cao
- **(b) Answer: 4 : 1**
- (c) **B1** identifies that a reader's eye naturally compares the overall size (area) of bars, not just their height
- (c) **B1** explains the extra width makes the Pop bar look four times as big as the Jazz bar, when truly only twice as many albums were sold; every bar in a fair bar chart should be drawn the same width, with only the height varying
- **(c) Answer: A reader naturally judges bars by their overall size, not just their height, so making the Pop bar twice as wide as well as twice as tall makes it look four times as big as the Jazz bar, when really only twice as many albums were sold. In a fair bar chart every bar should be the same width, with only the height showing the value.**

Question 3

- (a) **M1** 20/10, oe
- (a) **A1** 2 (times) cao
- (a) **Answer: 2 times**
- (b) **B1** identifies that the two vertical axes use very different scales and units (temperature in degrees C, drinks sold as a count), chosen deliberately so the lines coincide
- (b) **B1** explains a reader could wrongly think the two quantities are directly linked, matched, or of similar size, without noticing the mismatched scales - drinks sold are actually always twice the temperature value, not literally equal to it
- (b) **Answer: The left axis (0 to 50) and right axis (0 to 100) use completely different scales and units, chosen so the two lines exactly coincide; a reader glancing at the graph could think temperature and drinks sold are closely matched or directly linked in size, without noticing that drinks sold are actually always double the temperature reading in this data set.**
- (c) **B1** valid method, e.g. plot the paired values as a scatter graph of temperature against drinks sold, or clearly label both axes with their true scales so a reader can see they are different
- (c) **B1** explains this fairer method lets the reader judge the true relationship from the paired values, rather than being misled by a coincidental visual match caused by the choice of axes
- (c) **Answer: Plot the data as a scatter graph of temperature against drinks sold (one point per hour), rather than as two separate lines on mismatched axes; this way a reader can judge the true relationship directly from the paired values, instead of being misled by a visual overlap that was only created by choosing two very different axis scales.**

Question 4

- (a) **M1** $(25-21)/21 \times 100$, oe
- (a) **A1** awrt 19.0%
- (a) **Answer: 19.0%**
- (b) **M1** $(25-20)/20 \times 100$, oe
- (b) **A1** 25% cao
- (b) **Answer: 25%**
- (c) **B1** axis truncation: the vertical axis starts at 20, not 0, stretching the modest gap between 21 and 25 to fill most of the height of the chart
- (c) **B1** unequal bar width: the Week 6 bar is drawn one and a half times as wide as the Week 5 bar, adding extra visual area beyond the true height difference
- (c) **B1** cherry-picked window: showing only Weeks 5 and 6 hides that sign-ups were fairly flat over the first four weeks (20, 21, 19, 22), presenting the final small uptick in isolation as if it were the whole story
- (c) **B1** overall conclusion that combining all three features turns a genuinely modest increase of about one-fifth to one-quarter into something that looks like a dramatic surge
- (c) **Answer: (1) The vertical axis starts at 20, not 0, stretching the true gap between 21 and 25 to fill most of the chart. (2) The Week 6 bar is drawn 1.5 times as wide as the Week 5 bar, adding extra visual area on top of the height difference. (3) Showing only Weeks 5 and 6 hides that sign-ups were roughly flat for the first four weeks (20, 21, 19, 22), so the small final rise is shown in isolation as if it were a sudden breakthrough. Together, these three choices turn a genuinely modest 19-25% increase into what looks like a dramatic surge in growth.**

Question 5

- (a) **M1** $(6-3)/6 \times 100$, oe
- (a) **A1** 50% cao
- (a) **Answer: 50%**
- (b) **B1** comments on the presentation: the axis starting at 2 stretches the true (correct) 50% difference further than necessary, and with no source or sample size given, a reader cannot judge how many households, or which households, this data came from
- (b) **B1** comments on proof: even a perfectly fair chart of a small or unspecified sample cannot 'prove' cause and effect for an entire campaign, since other explanations (e.g. fewer people buying bottled drinks generally, seasonal changes, or an unrepresentative sample) could also explain the fall
- (b) **B1** gives a balanced overall conclusion: the 50% figure may well be accurate, but both the chart's presentation and the word 'proves' overstate what a single, unsourced bar chart can honestly establish
- (b) **Answer: The true decrease is a genuine 50%, but the chart's truncated axis (starting at 2) exaggerates this beyond what is needed, and without a stated source or sample size a reader cannot judge how reliable or representative the data is. Even if the chart were drawn perfectly fairly, a single before-and-after bar chart cannot 'prove' that the campaign caused the fall, since other factors could also explain it. The 50% figure may well be true, but the claim of 'proof' overstates what this chart can honestly demonstrate.**