Student Name

Mathematics Stage 4

DATA CLASSIFICATION AND VISUALISATION

Book 3 Interpret data in graphical representations

Version: 260207

Report mistakes & suggest improvements:
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CONTENTS

OVERVIEW

SYLLABUS CONTENT

MA4-DAT-C-01 classifies and displays data using a variety of graphical representations

Interpret data in graphical representations

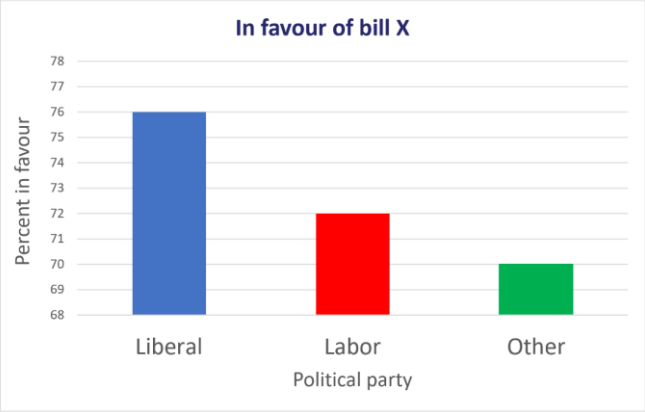
- Identify and interpret data displayed on graphs
- Identify features of graphical representations to draw conclusions
- Interpret patterns in graphical representations to make predictions
- Explain why a given graphical representation can lead to a misinterpretation of data

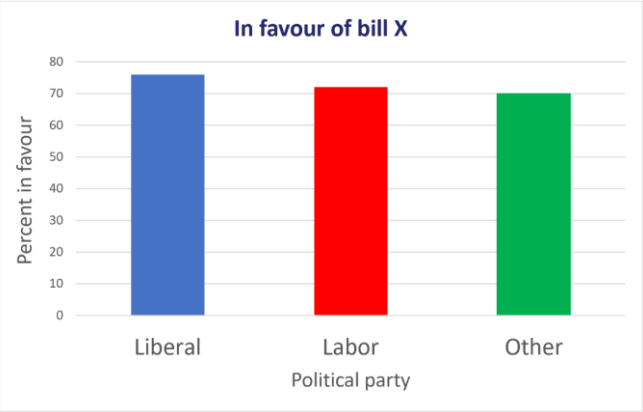
MISLEADING GRAPHS

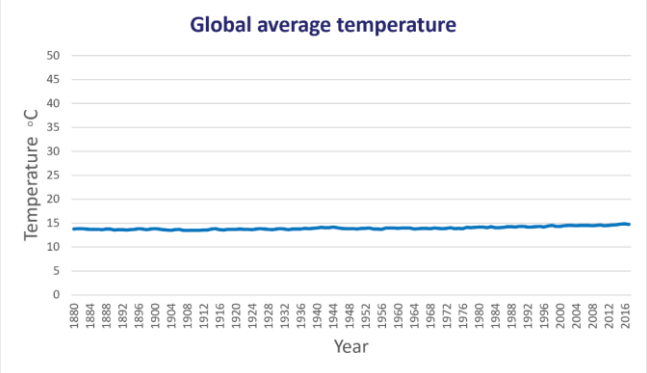
- **Misleading** graphs have the correct data but give a false impression of the data.
- Misleading features include:
  - The scale on the vertical axis does not start at zero.
  - The scale on the vertical axis is irregular or missing entirely.
  - Not all data is shown – the data is cherry picked.
  - An inappropriate graph is used.
  - And more.
- Graphs can be misleading by mistake, or deliberately used to craft a false narrative.

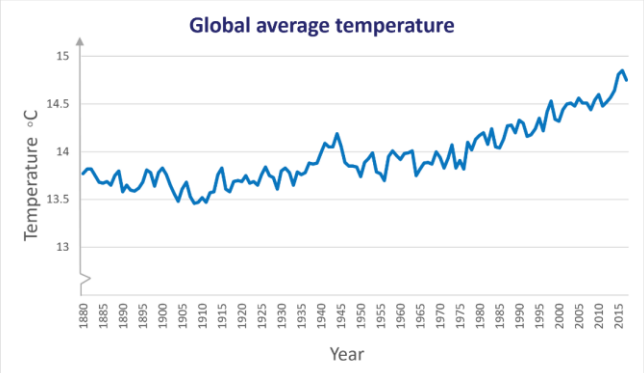
Example Identify and describe misleading features of graphs.

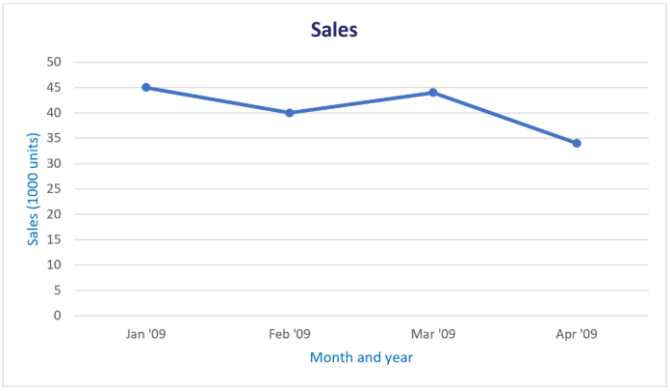
In these examples, the left graph is misleading, the right is the corrected version.
Discuss what makes the left graph misleading.

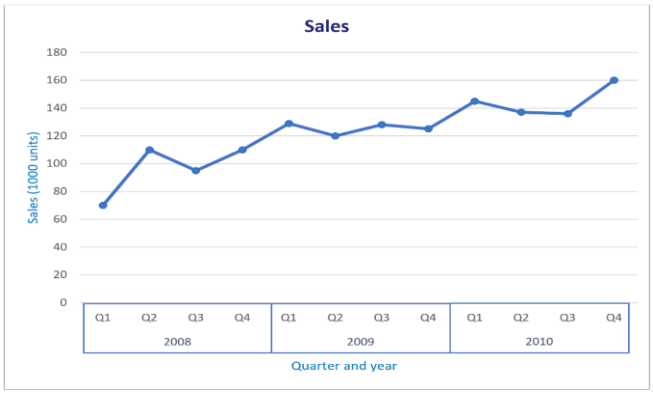


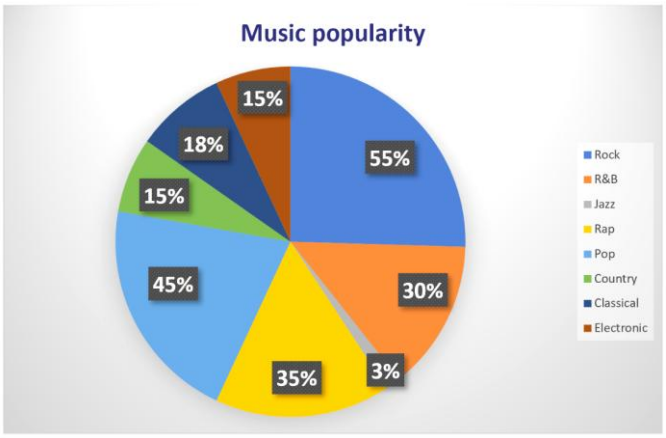


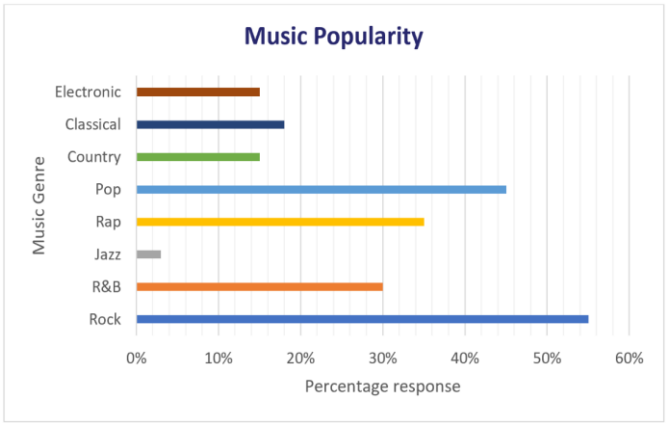


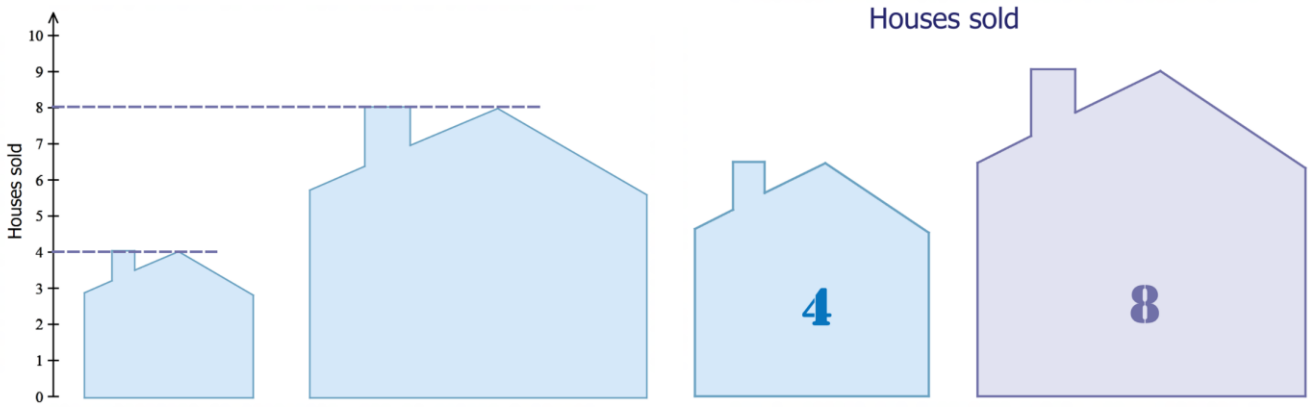



Sales
Sales (1000 units)
50
45
40
35
30
25
20
15
10
5
0
Jan '09
Feb '09
Mar '09
Apr '09
Month and year

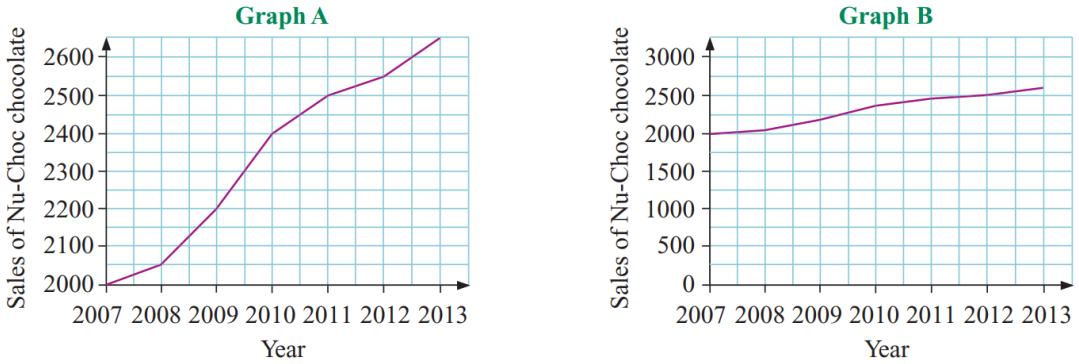

Sales
Sales (1000 units)
180
160
140
120
100
80
60
40
20
0
Q1
Q2
Q3
Q4
2008
2009
2010
Quarter and year


Music popularity
15%
18%
55%
15%
45%
30%
35%
3%
Rock
R&B
Jazz
Rap
Pop
Country
Classical
Electronic


Music Popularity
Music Genre
Electronic
Classical
Country
Pop
Rap
Jazz
R&B
Rock
0%
10%
20%
30%
40%
50%
60%
Percentage response


Houses sold
Houses sold
10
9
8
7
6
5
4
3
2
1
0
4
8

1



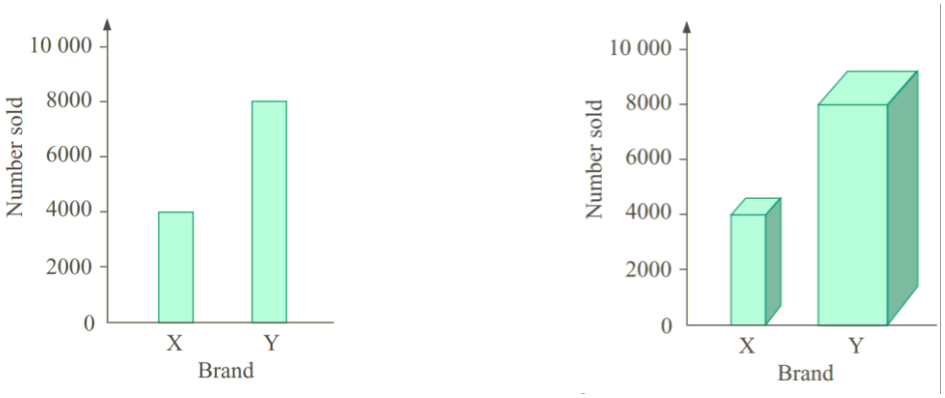
a In graph A, the sales for 2010 appear to be double those of 2009. Is this true?

No

b What aspect of the graph makes it seem so?

The scale. y-axis doesn't start at 0.

2 Look at the two graphs showing sales of two brands of TVs.

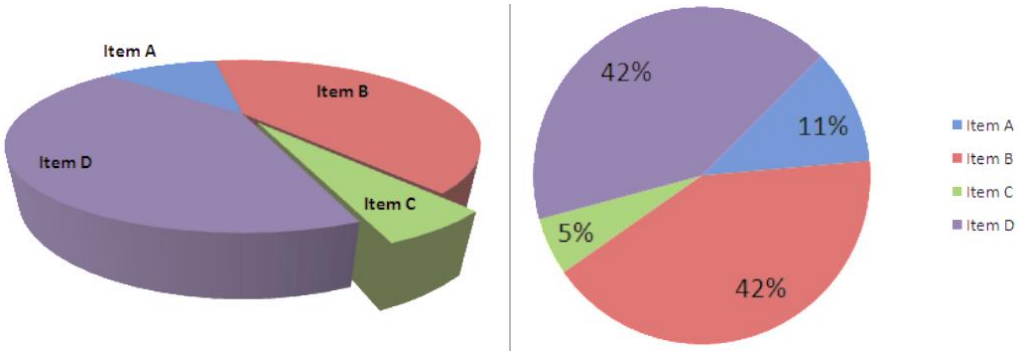


Which graph is misleading, and why?

the 3D graph as you can't tell for sure the height of the column. The width also changes, making the difference look bigger.

3 The two sector graphs show the same information.

Explain why 3D sector graphs are not appropriate (Hint, look at Item C and Item A).



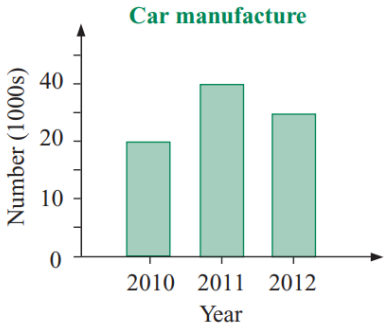
From the perspective of the left graph, the sector that's far away looks much smaller than it is.

4 Describe the misleading or poor features of these graphs.

a

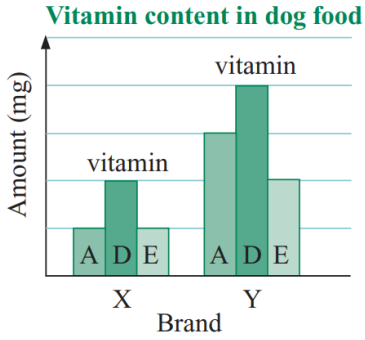
y-axis doesn't start at 0

b



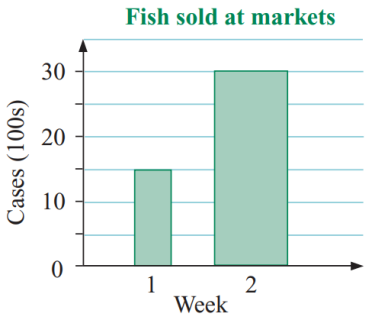
y-axis not increasing in consistent steps

c



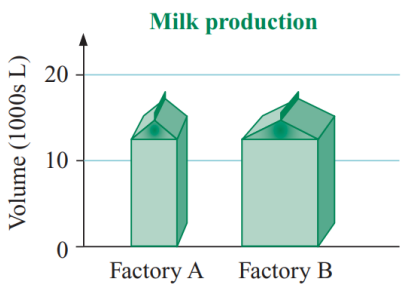
No y-axis scale

d



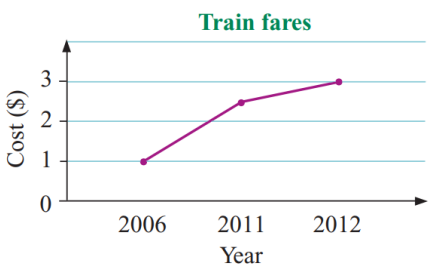
Bars are different wifths

e



Bars different widths.
3D graph, can't tell what the actual height is

f



Year not increasing by a constant amount.

5 The price of the same basket of groceries was compared at 5 supermarkets.

a Explain why the chart is misleading.

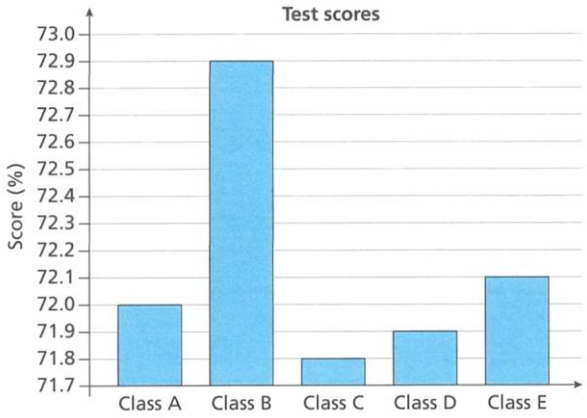
The scale is not appropriate. Hard to see the differences.

b Describe how the chart could be improved

Make y-axis go to 100 instead of 200

6 The average score of 5 classes on a maths test was graphed.

a Faith says, "Class B's average score was significantly higher than any other class." Explain why Faith thinks this.

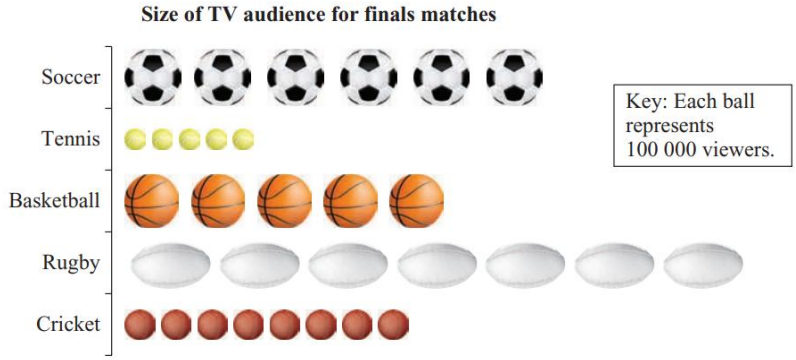


The column is much higher than the others.

b Explain why this chart might be misleading.

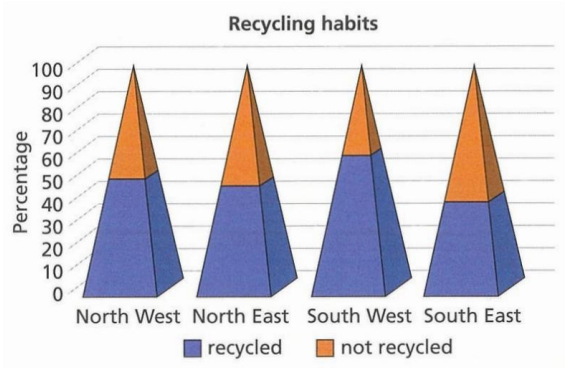
The differences are actually very small

7 Explain what is misleading about this pictogram.



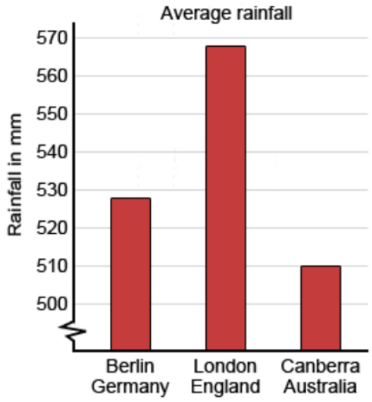
The balls are different widths, you might think rugby is more popular when its cricket that's most popular.

8 The chart shows the recycling habits of four regions.
Explain why the graph is misleading.



The pyramids mean the proportion recycled look larger and the proportion not recycled look smaller

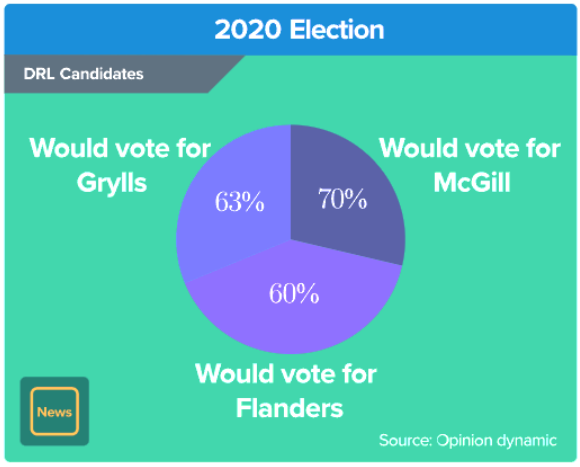
9 This graph shows the average rainfall in three capital cities.
Shelly says: "London's rainfall is around twice that of Berlin, and four times that of Canberra"
Explain why she is incorrect.



London is only 40 mm more than Berlin, not double.

London has around 7.6% more than Berlin

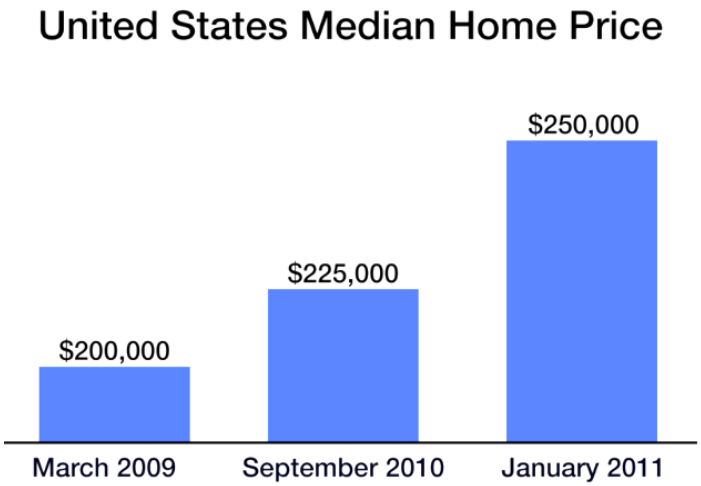
10 A poll before an election asked “who would you vote for” and allowed multiple selections. Explain why this sector graph is incorrect.



The percentages don't sum to 100

11 From the data, what can we conclude about home prices in the US? Select all that apply.

- ☐ The median home price tripled from March 2009 to January 2011.
- ☐ The median home price increased by $50,000 from March 2009 to January 2011.
- ☐ The median home price increased at a constant rate from March 2009 to January 2011.



Explain why each option is correct/incorrect.

Option 1:

Median home price increased by 50 000 from 200 000, which is not tripling

Option 2:

This is correct

Option 3:

The rate of increase is not constant as the dates are not equally spaced.

12 2013 HSC Standard 2 Band 4

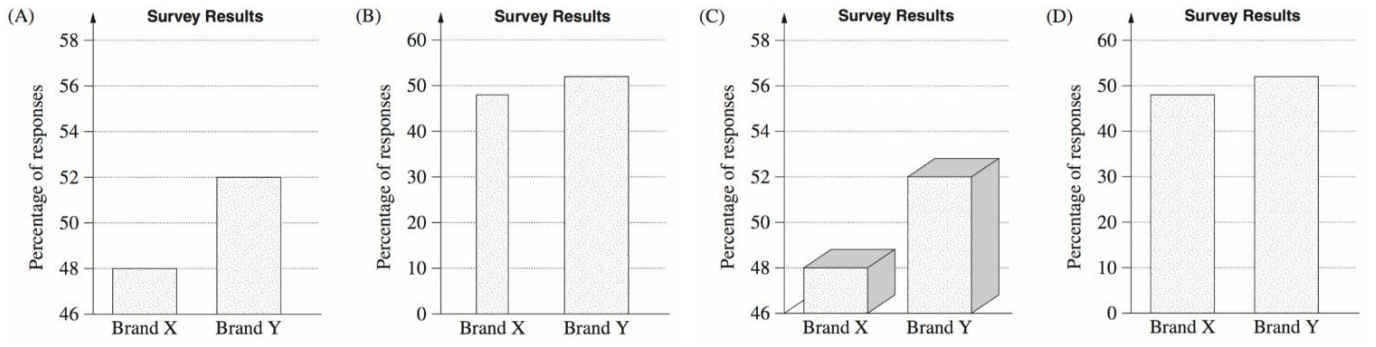
A survey was conducted where people were asked which of two brands of smartphones they preferred. The results were:

48% preferred Brand X

52% preferred Brand Y

A graph displaying the data is to be included in a magazine article. The editor of the magazine wishes to ensure that the graph is not misleading in any way.

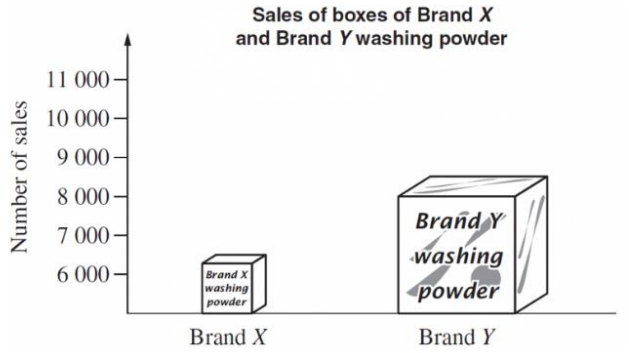
Which graph should the editor choose to include in the article?



D

13 2006 HSC Standard 2 Band 4

List two ways in which this graph is misleading.



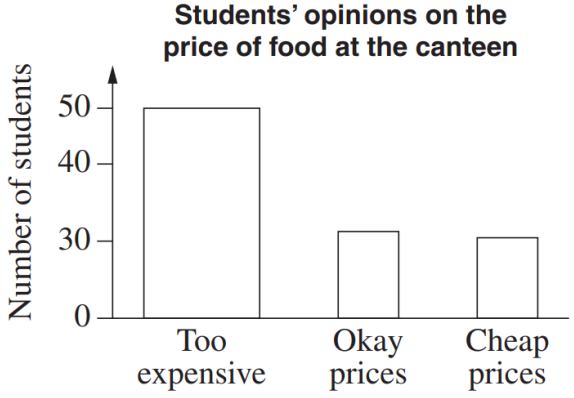
3D graphs make it hard to tell the actual height of the bar.

The different widths make the differences look larger.

The y-axis doesn't start at 0.

14 2022 HSC Standard 1

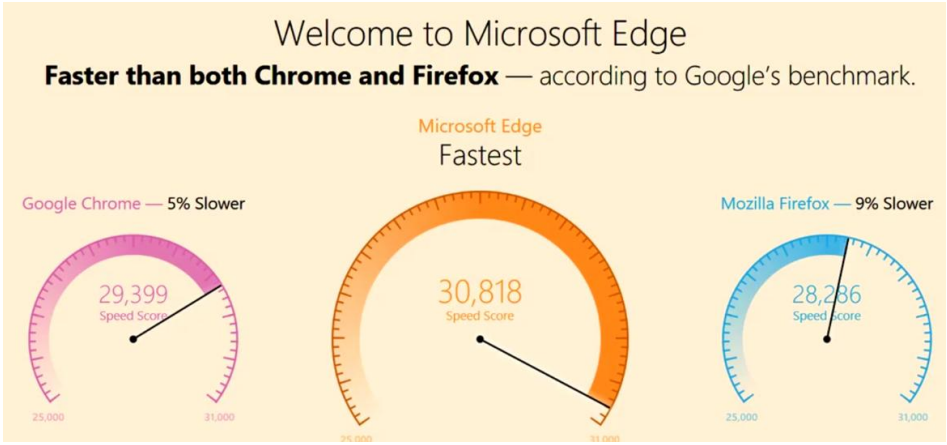
After collecting data, Kim drew the following graph to summarise the opinions related to the price of the food. What TWO features of the graph make it misleading?



The widths of the bars are different

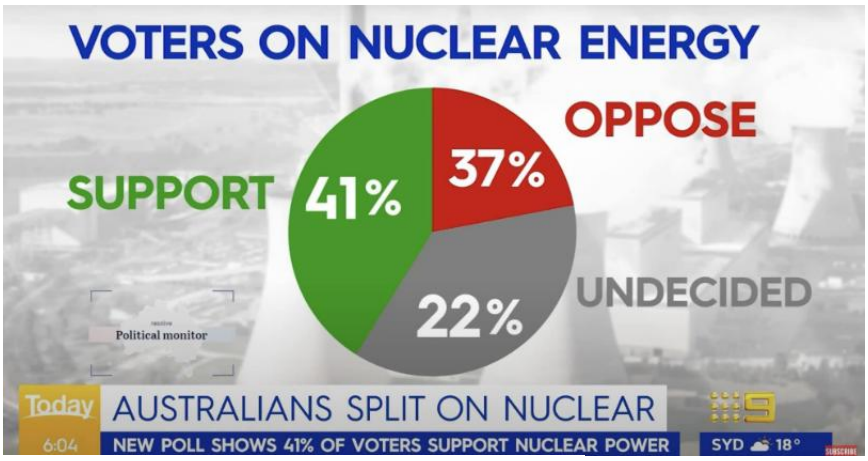
The y axis scale is inconsistent

15 Explain why these graphs are misleading.

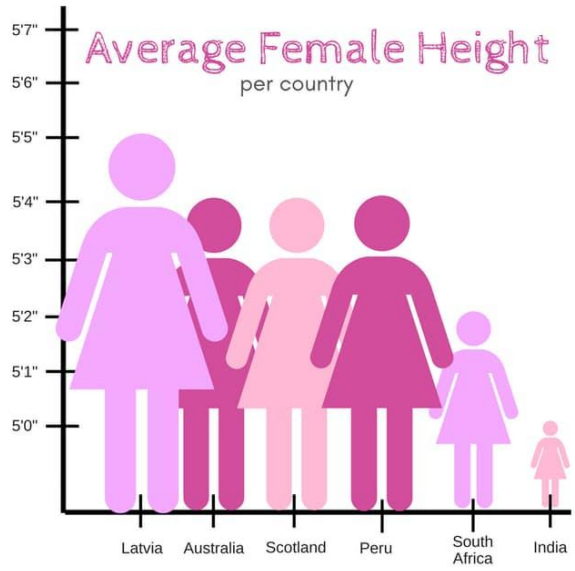


No scale on the speedometers. Differences appear greater than they are.

Dates are not consistent.
Differences look consistent when they're not



Percentages sum to more than 100%



y-axis doesn't start at 0.
Both the width and the height are changing, making differences look larger.

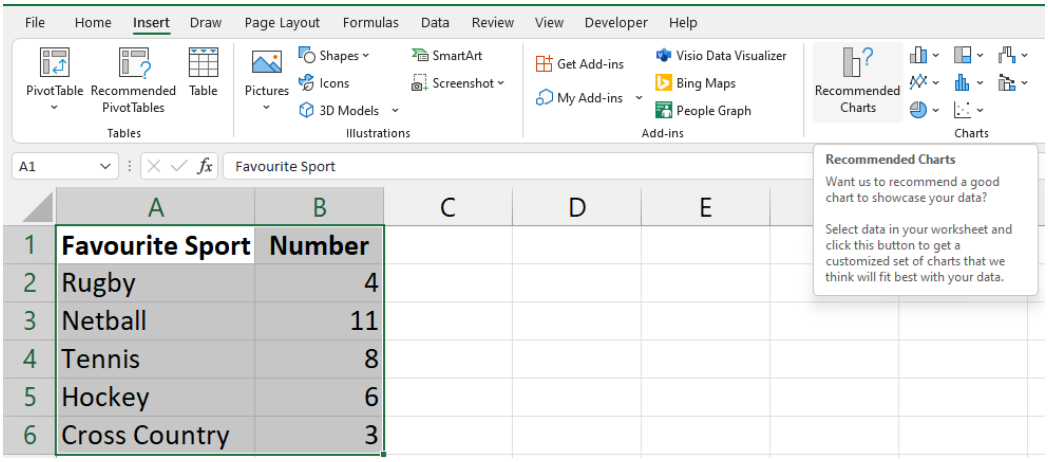
GRAPHING USING SPREADSHEETS

1. Copy the table onto Microsoft Excel

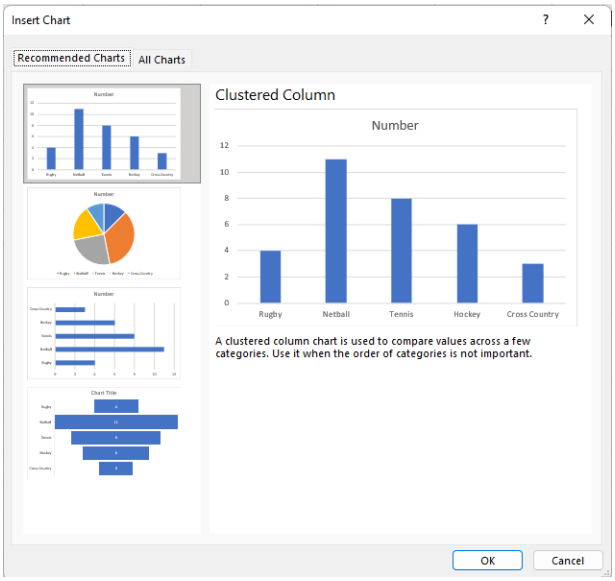
Favourite sport	Number
Rugby	4
Netball	11
Tennis	8
Hockey	6
Cross-country	3

	A	B
1	**Favourite Sport**	**Number**
2	Rugby	4
3	Netball	11
4	Tennis	8
5	Hockey	6
6	Cross Country	3

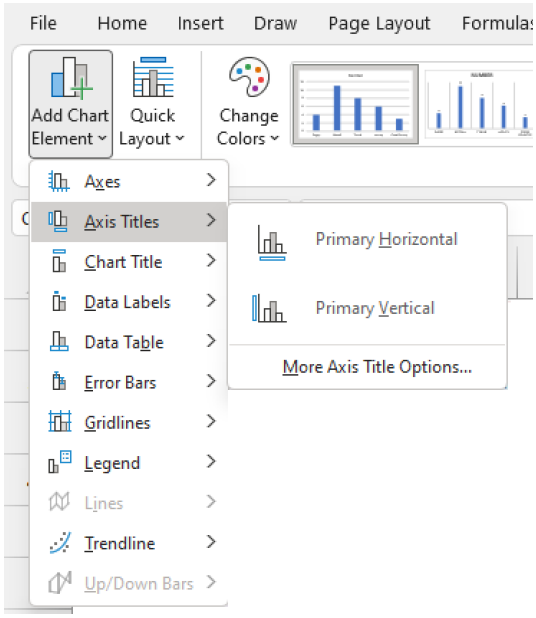
2. Highlight the table, go to **Insert** → **Recommended Charts**



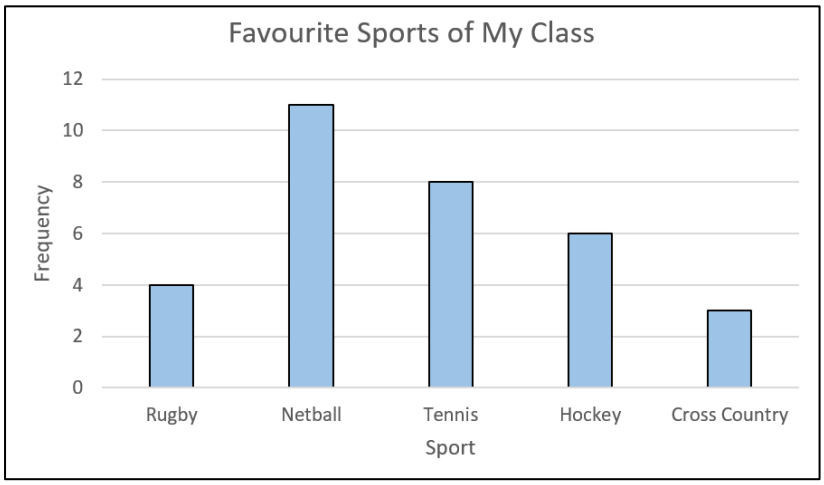
3. Select the most appropriate graph and click “OK”



4. Click on the graph and click on **Chart Design → Add Chart Element → Axis Titles**
   Add the primary horizontal and primary vertical axis titles.



5. Give your chart an appropriate title and axis labels.



Transcribe the data onto Excel or Google Sheets and construct an appropriate graph to display it. Ensure your graphs have appropriate axes, titles, and axis labels. Justify why you chose that type of graph.

1 Eye colour of 25 Year 7 students.

Eye colour	Number of students
Blue	3
Brown	10
Green	2
Hazel	6
Grey	4

Most appropriate graph:

Column graph

Justification:

Categorical data

2 The height of a boy over time.

Age (years)	Height (cm)
8	125
9	132
10	140
11	147
12	150

Most appropriate graph:

Line graph

Justification:

See changes over time

3 Number of boys and girls born at a hospital.

	2000	2001	2002	2003	2004	2005
Number of boys born	40	42	58	45	30	42
Number of girls born	50	40	53	41	26	35

Most appropriate graph and justification:

Line graph with two lines, one for boys and one for girls.

4 The average temperatures in Sydney

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
High	26°C	26°C	25°C	22°C	20°C	17°C	17°C	18°C	21°C	23°C	24°C	26°C
Mid	23°C	23°C	21°C	19°C	16°C	13°C	12°C	14°C	16°C	18°C	20°C	22°C
Low	20°C	20°C	18°C	15°C	12°C	10°C	9°C	10°C	12°C	14°C	17°C	19°C

Most appropriate graph and justification:

Line graph with three lines, high mid low.

5 Australian government spending 2019 (in billions)

Item	Social Security	Health	Education	Defence	COVID-19	Other
Spending	196.1	87	39.9	33.2	55.2	78.3

Most appropriate graph and justification:

Dividing bar chart or pie chart

This is data for 2020. Construct an appropriate graph to compare 2019 and 2020 data.

Item	Social Security	Health	Education	Defence	COVID-19	Other
Spending	205.5	93.8	41.7	34.4	82.5	96.4

Justify why your graph was appropriate.

Two divided bar charts side by side for easy comparison

6 The following data set shows 8N's NAPLAN numeracy bands compared to another year 8 class.

8N	9 9 9 9 8 8 8 8 8 8 8 8 8 7 7 7 7 7 7 7 7
Another Class	7 7 7 7 7 7 7 6 6 6 6 6 6 6 6 6 6 6 6 6 6 5 5 5 5 5 5

Compare the two classes using an appropriate graph.

Bar chart is probably the most appropriate

7 The tables below show average temperatures and precipitation (rain and snow) for two cities.

Average maximum and minimum monthly temperatures in Los Angeles, USA in degrees Celsius (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max	20	21	21	23	23	26	28	29	28	26	23	20
Min	9	9	11	12	14	16	18	18	17	15	11	8

Average maximum and minimum monthly temperatures in Auckland, New Zealand in °C

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max	23	24	23	20	17	15	14	15	16	18	20	22
Min	16	16	15	13	10	8	7	8	9	11	13	14

Average monthly precipitation in Los Angeles, USA in millimetres

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
69	100	62	23	7	2	0	1	6	17	26	59

Average monthly precipitation in Auckland, New Zealand in millimetres

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
74	81	86	93	100	116	126	111	93	80	84	91

a Create a line graph for the maximum daily temperatures in Los Angeles. On the same axes, also graph the minimum monthly temperatures for the same city.

b Describe the trends shown in your graphs and what these trends tell you about Los Angeles.

LA is hot in the middle of the year, so it is in the northern hemisphere

c Now create a new graph to compare the maximum temperatures in Los Angeles to the maximum temperatures in New Zealand.

d Describe what these graphs tell you about the two cities.

They are in different hemispheres.

e Create a new pair of line graphs (on the one set of axes) to compare the monthly precipitation in Los Angeles to that of Auckland. Describe what these graphs tell you about the two cities.

Los Angeles is the drier city.

f Why can you not draw precipitation and temperature graphs on the same set of axes?

The units of measurement are different, one is °C and the other is rainfall in mm