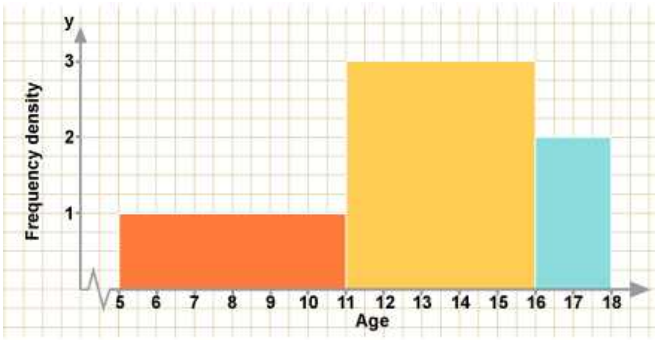
SA DEMOGRAPHICS

The table gives the 2013 population statistics for South Africa.
Complete the table and draw a histogram to represent this data. Remember that for a histogram the area in each column represents the frequency for that class.
Work out the mean age of this population.
What can you say about the other measures of central tendency (median and mode)?
Comment on the distribution.
You can see that almost half the population is under 25 years old. What social, economic and political effect do you think this has on South African society? Is the population of your village or town similar to the national population? How could you find out?

South African Demographic Profile 2013 – Total population 48,810,427				
Age	Class width in years	Frequency as percentage of population	Frequency density as % per year	Frequency in thousands (to nearest 1000)
0 – 14 years		28		13 667
15 – 24 years		21		
25 – 54 years	30	38	38/30 = 1.27	18 548
55 – 64 years		7		
65 – 119 years		6		
				48 810
In 2013 the oldest person in the world was Johanna Mazibuko age119 years living near Johannesburg SA.				

Help

This example may help you to draw the histogram for the SA Demographics data.



This histogram shows the number of children on a school bus. There are no children under 5 years, 6 children aged between 5 and 10 years, and no children over 17 years.
The **area** of the bars in a **histogram** represents the frequency and the **height** is the **frequency density.**
So for the children aged 5 – 10 the **frequency density** (the **height** of the bar**)** is 1 child per year and the **frequency** (the **area** of the bar) is 6 × 1 = 6 children in that age group.

See: 'Histogram' https://aiminghigh.aimssec.ac.za/grades-7-to-10-histogram/ on the AIMING HIGH Teacher Network website.

Extension

Population of UK 2011		
Age group	**Total (million)**	%
0–14	11.100	17.6
15–64	41.704	66.0
65+	10.378	16.4
All ages	63.182	100

Draw a histogram to compare the population distributions for the United Kingdom and South Africa. What do you think are the social and economic implications of the differences between these two distributions?

NOTES FOR TEACHERS

SOLUTION

For the class width, count the ages in each group or subtract as in 54-24 = 30. You must subtract 24 here because nobody who is 24 years or younger is in this group.

For the frequency density as % of population per year, divide the frequency by the number of years in the class width.

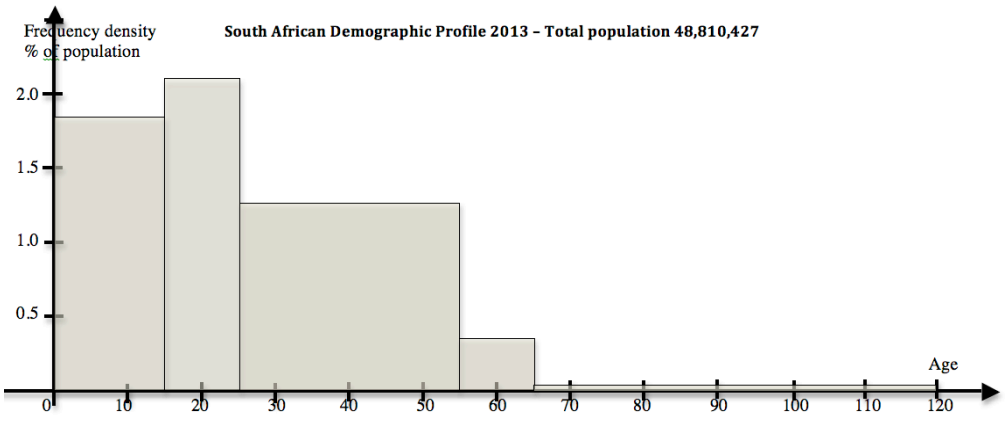
South African Demographic Profile 2013 – Total population 48,810,427					Mid age		
Age	Class width in years	Frequency *f* as percentage of population	Frequency density as % per year	Frequency in thousands (to nearest 1000)	*x*	*fx*	
0 – 14 years	15	28	28/15 = 1.87	0.28x48810=13 667	7.5	210	
15 – 24 years	10	21	21/10 = 2.1	0.21x48810 = 10250	19.5	409.5	
25 – 54 years	54 – 24 = 30	38	38/30 = 1.27	0.38x88810=18 548	39.5	1501	
55 – 64 years	10	7	7/10 = 0.7	0.07x48810 = 3417	59.5	416.7	
65 – 119 years	55	6	6/55 = 0.11	0.06 x 48810 = 2929	82*	492	
		100		48 810		3029.2	

*The data here is biased because of one individual. A truer picture would be to take the oldest class as 65 to 99 years and then the mean age in this interval is 82.

To calculate the mean first work out the mean age *x* in each class interval. Then multiply these mid-ages by the frequency *f* of that class (as a percentage of the whole population) to find *fx* for each class. Then find the total Σfx and divide by the total frequency. In this case as we are using *f* as the percentage of the whole population Σf is 100%.
So the mean age $\Sigma fx/\Sigma f$ = 30.292 or 30 years to the nearest whole number.
The data shows that 49% of the population is under 25 years old. **The median age is about 26** as we can estimate 50% of the population are younger than 26.
The modal class interval is 15 – 24 (greatest frequency density) so we can estimate the modal age as 20 (about the middle of this class interval).

Just plot the ages on the horizontal axis (the independent variable) and the frequency density on the vertical axis (the dependent variable).

Note that the height multiplied by the width of each column (giving the area) represents the frequency for that class.



This data has big social, economic and political significance. Comparison of the numbers of citizens of working age able to contribute to the economy, and the number of dependent children in the population, is one of many reasons for poverty, and explains why the costs of education are a significant part of the national economy. There is likely to be a significant impact on voting in elections due to the numbers of young people who did not experience life before the present government in South Africa came to power.

Diagnostic Assessment This should take about 5–10 minutes.

1. Write the question on the board, say to the class:
   "Put up 1 finger if you think the answer is A, 2 fingers for B, 3 fingers for C and 4 fingers for D".
2. Notice how the learners responded. Ask a learner who gave answer A to explain why he or she gave that answer and DO NOT say whether it is right or wrong but simply thank the learner for giving the answer.
3. Then do the same for answers B, C and D. Try to make sure that learners listen to these reasons and try to decide if their own answer was right or wrong.
4. **Ask the class again to vote for the right answer by putting up 1, 2, 3 or 4 fingers. Notice if there is a change and who gave right and wrong answers.** It is important for learners to explain the reason for their answer otherwise many learners will just make a guess.
5. If the concept is needed for the lesson to follow, explain the right answer or give a remedial task.

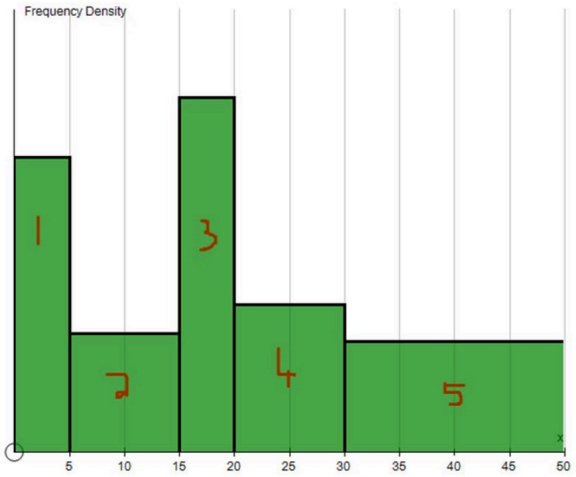
There are 15 people in Group 5. What is the Frequency Density of that group?

A 0.3

B 0.75

C 15

D 30



B. is the correct answer. The frequency density is the frequency (in this case 15) divided by the class width (in this case 20).

Common Misconceptions

A. Learners may have divided 15 by 50 (the extreme value of this class interval).

B. Learners mistakenly think that frequency density is the same as frequency – not so.

D.

https://diagnosticquestions.com

Why do this activity?

This activity involves data from a real life context and may help learners to see that mathematics is important and relevant to the world outside school. It provides practice in reading and interpreting data given in a table and in working out percentages. Learners need to understand how to draw a histogram that has uneven class widths, so this activity should follow work on simpler examples. This activity can be used to re-enforce the understanding of histograms and the idea, fundamental to the application of statistics, that real life situations are modelled by distributions for which the area under the graph represents frequencies, Discussion based on interpretation of this data could be used to build awareness of social and economic issues in society.

Intended learning outcomes

For learners to experience:

1. using real data from national statistics and to interpret that data and discuss its relevance to health, social, economic, cultural, scientific, political and environmental issues.
2. organising and interpreting realistic univariate numerical data in order to determine measures of central tendency.

Generic competences

In doing this activity students will have an opportunity to:

1. **analyse, evaluate, and interpret information** and apply knowledge of school mathematics to a real world situation;
2. **visualize** and develop the skill of interpreting and creating visual images to represent concepts and situations;
3. **develop awareness of some of the complex problems in society** and think flexibly about how those problems might be addressed;
4. **communicate** in writing, speaking and listening to exchange ideas, to analyze, reason and record ideas effectively and to present information and ideas to others.

Suggestions for teaching

Depending on your class, and the availability of calculators, you may choose to make this a whole class lesson or an activity for pairs or groups. For older learners the one-two-four-more teaching strategy works well. First learners should work individually, then the teacher should direct them to work in pairs. Later each pair should compare and check results with another pair. Finally the teacher should lead a class discussion and representatives of the groups could be asked to present their findings.

Younger learners who are still learning about histograms can be asked to complete the columns one at a time with a class discussion to help everyone to understand what to do to before moving on to the next column. First ask them to copy the table and to complete the column for the class width in years. Ask the learners for suggestions as to how to find the class widths building on their knowledge that there is an overnight change in age when they have a birthday. Some may count on their fingers to find the class width, others may write down a list of numbers, others may use a subtraction method. A skilled teacher will help everyone to understand how to find the answers efficiently. Then move on to discuss how to fill in the column for frequency density as a percentage of the population per year, making sure that the learners understand why they are dividing by the class width. Next the learners need to understand how to work out 28% of 48810 and the other percentages and fill in the last column. You may need to give learners some help on how to mark the scales on the axes but always base the help on suggestions from learners.

Finally you can discuss what these figures mean for your society.

Key questions

What is the rule for drawing a histogram?
Are the given class widths the same?
If the data was collected on the day before your 15th birthday which age group would you be in?
If the data was collected on your 15th birthday which age group would you be in?
How are you working out the class width?
How is the frequency density 1.27 calculated from the figures 38 and 30? Can you explain why the calculation is done like that?
How are you going to fit the ages across the page on that axis?
What figures go on the axis up the page?
Good you have drawn the bars. Can you check that the areas of the bars give the frequencies?
Have you labelled your axes and given your graph a title?

Follow up

- Best Representations https://aiminghigh.aimssec.ac.za/grades-6-to-10-best-representation/
- Histogram https://aiminghigh.aimssec.ac.za/grades-7-to-10-histogram/
- Water Crisis 1 (Pictograph): https://aiminghigh.aimssec.ac.za/years-4-8-water-crisis-1/
- Water Crisis 2 (Pie Chart): https://aiminghigh.aimssec.ac.za/years-6-8-water-crisis-2/
- Compare GDPs of the world's top ten economies: https://aiminghigh.aimssec.ac.za/years-9-12-a-richer-world/
- Study UN data on the places where 783 million people did not have safe drinking water in 2012 and why this number is increasing: https://aiminghigh.aimssec.ac.za/years-6-10-drinking-water/
- How much of our planet has good land for farming? https://aiminghigh.aimssec.ac.za/years-10-12-land-and-sea-statistics/

Note: The Grades or School Years specified on the AIMING HIGH Website correspond to Grades 4 to 12 in South Africa and the USA, to Years 4 to 12 in the UK and up to Secondary 5 in East Africa.
Note: The mathematics taught in Year 13 (UK) and Secondary 6 (East Africa) is **not** included in the school curriculum for Grade 12 SA.

	Lower Primary or Foundation Phase Age 5 to 9	**Upper Primary Age 9 to 11**	**Lower Secondary Age 11 to 14**	**Upper Secondary Age 15+**
South Africa	**Grades R and 1 to 3**	**Grades 4 to 6**	**Grades 7 to 9**	**Grades 10 to 12**
USA	**Kindergarten and G1 to 3**	**Grades 4 to 6**	**Grades 7 to 9**	**Grades 10 to 12**
UK	**Reception and Years 1 to 3**	**Years 4 to 6**	**Years 7 to 9**	**Years 10 to 13**
East Africa	**Nursery and Primary 1 to 3**	**Primary 4 to 6**	**Secondary 1 to 3**	**Secondary 4 to 6**