

# KNOWLEDGE CHECK

27

## EXPRESSING AN INCREASE OR DECREASE AS A PERCENTAGE

- a) (No calculator needed.) A school secretary's contract is increased from 80 hours per month to 100 hours. What is the percentage increase? A classroom assistant's contract is reduced from 100 hours to 80 hours per month. What is the percentage decrease?
- b) (Use a calculator.) A primary school uses commercial tests marked out of 50 to assess their Year 5 pupils' progress in various subjects. One year the average scores for science and mathematics were 28.9 and 27.5 respectively. The following year they were 27.6 and 29.5 respectively. What were the percentage changes in the average scores for science and mathematics?
- c) The table shows the percentages of pupils in one particular school achieving the expected standard in Key Stage 2 Mathematics over a period of five years. By how many percentage points have the numbers achieving this standard increased between 2015 and 2019? What was the percentage increase in the number of pupils achieving the expected standard over this period?

Year	2015	2016	2017	2018	2019
%	57	60	59	62	65

## ANSWERS TO KNOWLEDGE CHECK 27

- a) 25%, 20%.
- b) About 4.5% decrease for science, 7.3% increase for mathematics.
- c) 8 percentage points, which is about a 14.0% increase.

## DISCUSSION AND EXPLANATION OF KNOWLEDGE CHECK 27

In this knowledge check we look at problems where we are given the starting value and the finishing value and are required to find the percentage increase or decrease. It is important to remember that the increase or decrease is always expressed as a percentage of the *starting* value.

In example (a) the starting value for the secretary is 80, so the increase (20) is expressed as a proportion of 80. This is  $\frac{1}{4}$  or a 25% increase.

But the starting value for the classroom assistant is 100, so the decrease (again 20) is this time expressed as a proportion of 100. Hence there is a 20% decrease. So, increasing from 80 to 100 is a 25% increase, but going from 100 to 80 is only a 20% decrease.

In example (b), the decrease for science is  $28.9 - 27.6 = 1.3$  points. This must be expressed as a proportion of the starting value, i.e., of 28.9. Using a calculator,  $1.3 \div 28.9 = 0.0449827$ , or about 0.045, which is 4.5%. So the science score has decreased by about 4.5%.

The increase for mathematics is  $29.5 - 27.5 = 2.0$  points. This must be expressed as a proportion of the starting value, i.e., of 27.5. Using a calculator,  $2.0 \div 27.5 = 0.0727273$ , or about 0.073, which is 7.3%. So the mathematics score has increased by about 7.3%.

In example (c) we are again dealing with values that are themselves percentages, so we must be aware of the distinction between the increase expressed in percentage points and the increase expressed as a percentage of the starting value. From 2015 to 2019 there is an increase of 8 percentage points in these figures, from 57 to 65. To express this increase as a percentage of the starting value, we calculate  $8 \div 57 = 0.1403509$ , which is about 0.140 or 14.0%. So there has been about a 14% increase in the proportion of pupils achieving a score of 100. The expected standard or above.

## SUMMARY OF KEY IDEAS

- Remember that an increase or decrease is always expressed as a percentage of the *starting* value (for example, a decrease of 10 from 50 to 40 is a 20% decrease because the 10 is 20% of the 50).
- To find a percentage increase or decrease using a calculator, just divide the increase or decrease by the starting value and read off the decimal answer as a percentage (e.g. if 48 increases by 3, calculate  $3 \div 48 = 0.0625 = 6.25\%$ ).



## FURTHER PRACTICE

- 27.1 The price of a laptop is increased from £1250 to £1400. Without using a calculator, what percentage increase is this? Later the price of £1400 is decreased by the same percentage. Do you expect the price now to be less than £1250, more than £1250 or equal to £1250? Answer this intuitively; then use a calculator to check.
- 27.2 (Use a calculator.) A secondary school's average points score for science and mathematics in the Key Stage 3 statutory tests one year were 31.6 and 32.9 respectively. The following year they were 31.8 and 31.1 respectively. What were the percentage changes in the average points scores for science and mathematics?
- 27.3 The table below shows the percentages of girls in Year 11 in a large secondary school achieving five or more GCSE grades A\*–C (or grades 4–9) over five years. By how many percentage points has this proportion increased from 2014 to 2018. What is the percentage increase in the proportion of girls achieving these grades over this period? In which year from 2015 to 2018 was there the greatest percentage increase from the previous year in the proportion of girls achieving these grades?

Year	2014	2015	2016	2017	2018
%	49.4	50.0	51.5	53.4	54.4