# OCR 05 Ratio, Proportion and Rates of Change (Higher)

1. There are 12 inches in a foot. Write the ratio 3.5 feet : 14 inches in its simplest form.

2. Sam, Jenny and Lily share £54 in the ratio 1 : 2 : 3.
   How much more money does Lily get than Sam?

3. Sam, Jenny and Lily again share £54, but this time in the ratio 2 : 3 : 4.
   What fraction of the money does Jenny get?

4. Jack invests £500 for 5 years in an account paying 3.5% compound interest.
   Calculate the amount in the account at the end of the 5 years.

5. Work out the single multiplier that is equivalent to an increase of 15% followed by a decrease of 20%.

6. Reece buys a new car costing £22 000. If it depreciates by 20% in the first year of ownership, 10% in the second year and then 15% in the third year, work out how much Reece's car will be worth after three years.

7. Which two of the statements below represent a situation where y is inversely proportional to x?

   A: $y = \dfrac{5}{x}$ B: $y = 5x$ C: $y = 5 - x$

   D: $y \propto \sqrt{x}$ E: $y \propto \dfrac{1}{x}$ F: $y \propto x$

8. This graph can be used to convert between New Zealand dollars and pounds.
   Convert 30 New Zealand dollars to pounds.
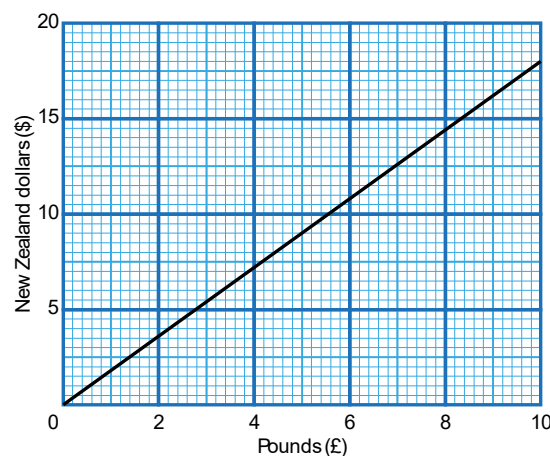
9. Silas drops a ball from a height of 3 m above the floor. The ball bounces on the floor and after each bounce rises to 50% of its previous height. What height will the ball rise to after the 4th bounce?

10. $y \propto \dfrac{1}{x^2}$ and when $x = 3$, $y = \dfrac{5}{6}$. Work out the value of y when $x = 5$, giving your answer as a fraction.

11. A recipe for 12 pancakes uses 110 g flour, 2 eggs, 200 ml milk and 50 g butter. Explain the problem you would face if you tried to convert this recipe to make just 8 pancakes.

12. Which of these graphs could represent $y \propto \sqrt{x}$?

  A   B   C   D
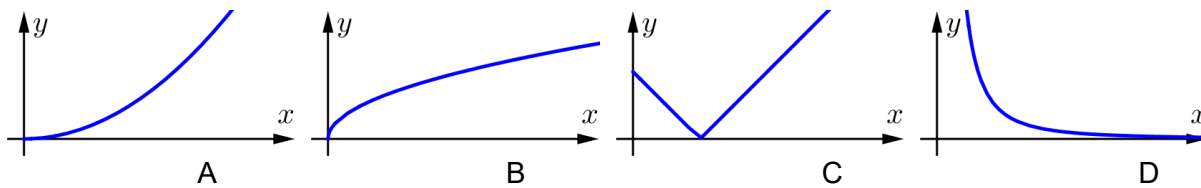
13. Explain why the graph below cannot represent a situation where $y \propto x$.
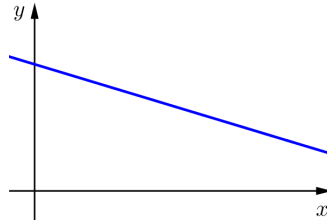
14. Determine if y is inversely proportional to x for the table of values below.

x	2	6	12
y	6	2	1

15. A planning officer is modelling the population of the town of Tessbourne. She uses the model $P = 7600 \times 1.026^{y-2009}$ where P is the size of the population and y is the year. Describe the meaning of the numbers 7600 and 1.026 in the planning officer's model.

16. A company experienced financial difficulties and cut its workers' wages by 20%. When business improved, the company then reinstated the workers original wages. What is the percentage increase from the cut wage back to the original wage?

17. Karine wants to be able to give her son £10 000 on his 18th birthday. When her son is born she makes a one-off payment into an account that pays 3.2% compound interest each year. No withdrawals will be made from this account. What amount does the one-off payment need to be to result in a balance of £10 000 in 18 years' time?

18. The time it takes for a pendulum to make one complete swing (returning to its starting point) is called its period. The period of a pendulum is directly proportional to the square root of its length. A 5 m long pendulum has a period of 4.5 seconds. Work out the period of a 15 m long pendulum.

19. Niki made a fruit salad out of strawberries, grapes and blueberries in the ratio 4 : 9 : 6. Chloe came along and ate 15 grapes from the fruit salad. After she did this, the ratio of fruit became 2 : 3 : 3. How many strawberries are in the fruit salad?

20. Given that $y = kx^n$, find the value of k and n and complete the missing entry in the table.

x	1	2	4
y	5	80	

Answers

1. 42 inches : 14 inches $= 42 : 14 = 3 : 1$

2. There are 6 parts so each part is worth $£54 \div 6 = £9$. Lily gets 2 parts more than Sam, so Lily gets £18 more.

3. Jenny gets 3 parts of the 9 total parts, so she gets $\dfrac{3}{9} = \dfrac{1}{3}$.

4. £593.84

5. $1.15 \times 0.8 = 0.92$ or 92%

6. $£22\,000 \times 0.8 \times 0.9 \times 0.85 = £13\,464$

7. A and E

8. From the graph, $10 is approximately £5.60. Therefore $30 is approximately $3 \times £5.60 = £16.80$.
    Similar arguments could be made by reading, for example, $5 or $15 from the graph.

9. 18.75 cm

10. $y = \dfrac{k}{x^2}$. When $x = 3$, $\dfrac{5}{6} = \dfrac{k}{3^2}$ so $k = 7.5$ and $y = \dfrac{7.5}{x^2}$.
    When $x = 5$, $y = \dfrac{7.5}{5^2} = \dfrac{3}{10}$.

11. To convert the recipe for 12 pancakes into one for 8 pancakes would mean using $\dfrac{2}{3}$ of each ingredient. This would mean using $\dfrac{2}{3} \times 2 = 1\dfrac{1}{3}$ eggs. You cannot easily use $1\dfrac{1}{3}$ of an egg (so you would need to use either 1 or 2).

12. Graph B

13. Graphs of direct proportion cannot have a y-axis intercept that is not zero.
    In most real-world situations, graphs of directly proportional relationships would have a positive gradient.

14. Yes, y is inversely proportional to x as for all values $y = \dfrac{12}{x}$.

15. 7600 is the population in the year 2009.
    1.026 represents a 2.6% population growth each year.

16. 25%

17. $£10\,000 \div 1.032^{18} = £5672.38$

18. $p = k\sqrt{I}$

$4.5 = k\sqrt{5}$

$\dfrac{4.5}{\sqrt{5}} = k \approx 2.01$

$p = \dfrac{4.5}{\sqrt{5}} \times \sqrt{I}$. When $I = 15$, $p = \dfrac{4.5}{\sqrt{5}} \times \sqrt{15} = 7.8$ seconds.

19. The final ratio is 2 : 3 : 3 which is equivalent to 4 : 6 : 6.
Comparing this to the initial ratio of 4 : 9 : 6 we can see that Chloe has eaten "3 parts" of the grapes. Since she ate 15 grapes, each "part" is 5 of each fruit. There were "4 parts" strawberry, so $4 \times 5 = 20$ strawberries.

20. The first pair of values gives $5 = k \times 1^n$. Since $1^n = 1$ for all values of *n* we have $5 = k$ and so $y = 5x^n$. The second pair of values gives $80 = 5 \times 2^n$, so $16 = 2^n$ and $n = 4$. Therefore the relationship is $y = 5x^4$. The missing value is $5 \times 4^4 = 1280$.

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Assessment Objective	Qu.	Topic	R	A	G
AO1	1	Find the ratio of quantities in the form $a : b$ and simplify			
AO1	2	Split a quantity into three parts			
AO1	3	Interpret a ratio as a fraction of a whole			
AO1	4	Calculate with compound interest			
AO1	5	Find the multiplier for a growth and decay situation			
AO1	6	Calculate with repeated percentage change			
AO1	7	Know that if $y = \dfrac{k}{x}$, then y is proportional to x			
AO1	8	Extrapolate with a currency conversion graph			
AO1	9	Calculate with repeated percentage change			
AO1	10	Calculate with formal inverse proportionality notation			
AO2	11	Interpret proportion with real-life quantities			
AO2	12	Interpret graphs with proportion			
AO2	13	Understand the properties of direct proportion			
AO2	14	Determine if y is inversely proportional to x for given values			
AO2	15	Interpret an exponential growth formula			
AO3	16	Calculate with percentage change			
AO3	17	Solve a compound interest problem			
AO3	18	Solve a problem involving a quantity in direct proportion to a root of another quantity			
AO3	19	Solve a ratio problem			
AO3	20	Solve a problem involving a quantity in direct proportion to a power of another quantity			