CCEA

Foundation

Tier

M2

Revision Pack

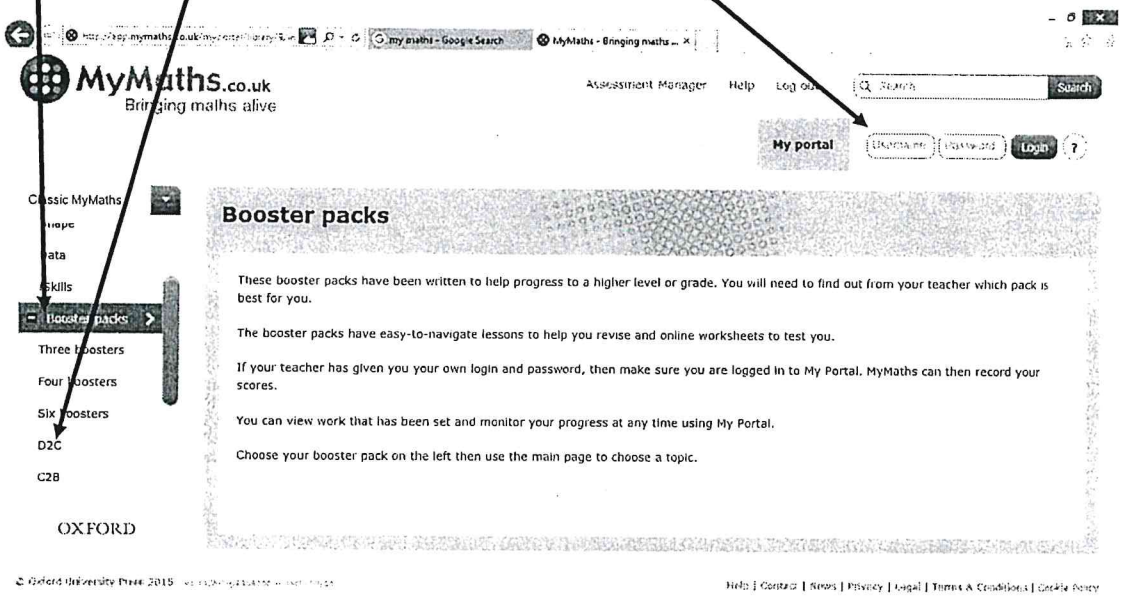
Year 11 and 12 Maths Revision Help for T2

MyMaths Booster Packs

The following is aimed at students aiming for a grade C in T2

1. Log in as usual to MyMaths.co.uk
2. Go to Booster Packs on the Main Menu (left hand side)
3. Click on the D2C Button
4. Under each of the headings listed below, complete the named sections as your revision, then do the 'Revise it' and 'Online Worksheet' at the end of each section. You can tick them off as you complete them on this sheet.

(For the worksheet, if you login with your own username, your teacher will be able to see what you have done as well).



Arithmetic

- Multiply double digits
- Division Chunking
- Negative Numbers
- **Revise It**
- **Online Worksheet**

Numbers and Powers

- Squares and Cubes
- Multiples
- Factors and Primes
- Indices
- HCF
- LCM
- **Revise It**
- **Online Worksheet**

Decimals

- Add and Subtract
- Multiply Two Decimals
- Ordering
- **Revise It**

Measures

- Converting
- **Revise It**
- **Online Worksheet**

Equations

- Solving Equations
- Trial and Improvement
- **Revise It**
- **Online Worksheet**

Expressions

- Simplifying 1
- Simplifying 2
- Single Brackets
- Factorising Linear
- **Revise It**
- **Online Worksheet**

Co-ordinates, Graphs

- Co-ordinates, Midpoints
- Drawing graphs (linear)
- **Revise It**
- **Online Worksheet**

Area and Perimeter

- Parallelogram
- Triangle
- Trapezium
- Circumference of a circle
- Area of circle
- **Revise It**
- **Online Worksheet**

Volume and 3D shapes

- Cuboids
- Prisms
- Cylinders
- **Revise It**
- **Online Worksheet**

Constructions

- Scale drawing
- Map Scales
- Plans and elevations?
- **Revise It**
- **Online Worksheet**

Fractions

- Fractions of Amounts
- Equivalent Fractions
- Comparing Fractions
- Adding Subtracting
- **Revise It**
- **Online Worksheet**

Angles

- Angles and parallel lines
- Interior Exterior
- Bearings
- **Revise It**
- **Online Worksheet**

Sequences, Formulae

- Nth term

Pythagoras'

- The theorem
- **Revise It**
- **Online Worksheet**

Averages

- All averages
- Median from frequency table
- Stem & Leaf
- Mean of a frequency table
- Mean of a frequency table
- **Online Worksheet**

Graphs & Charts

- Pictograms & Charts
- Line graphs & 2way tables
- Reading pie charts
- Drawing pie charts
- 2 way tables
- Grouping data
- Scattergraphs
- **Revise It**
- **Online Worksheet**

Frac Dec Perc

- Fractions to Decimals
- Frac Dec Perc 1
- Frac Dec Perc 2
- Finding Amounts
- Percentage Change
- **Revise It**
- **Online Worksheet**

Calculate volume of a prism.		Know and use Pythagoras' Theorem	
Calculate external and internal angles of regular polygons.		Translate shapes, using a vector.	
Describe the rotation, reflection or enlargement of a shape.		Construct triangles	
Draw the locus of an object.		Construct line and angle bisectors.	
Calculate mean, median, mode and range from data in a diagram.		Describe the correlation of a scatter graph.	
Write and justify appropriate questions for a questionnaire.		Find all of the outcomes of an experiment and write the probability of an event.	

Brownlow Integrated College

PASSPORT

TO GCSE GRADE C IN MATHS

Name: _____

Round to Decimal Places		Add, Subtract Multiply and Divide Decimals.	
Round to significant figures and Estimate answers		Write the prime decomposition of a number.	
Find the HCF and LCM of two numbers		Work with indices.	
Add, subtract, multiply and divide fractions.		Convert between Fractions, Decimals and Percentages.	
Calculate percentage increase or decrease.		Share an amount into a ratio.	
Calculate the Square-root and Cube-root of a number.		Write the Reciprocal of a number.	

Factorise an expression.		Expand brackets, such as 3a(3a + b).	
Set up and solve a linear equation.		Use trial and improvement	
Change the subject of an equation.		Be able to work out the nth term and use it.	
Solve an inequality.		Plot linear graphs and use words like gradient and intercept.	
Plot a quadratic graph.		Calculate surface area of a prism.	
Calculate area and circumference of a circle.		Interpret real-life graphs eg distance time graphs	

CCEA

Foundation

Tier

M2

Number and Algebra

5

Year 11 M2:Foundation Tier

Number and Algebra Overview

Learning Outcomes

You should be able to:

- use index notation and index laws for positive, whole number powers;
- use the concepts and vocabulary of divisor, highest common factor, least (lowest) common multiple and prime factor decomposition;
- add, subtract, multiply and divide decimals of any size;
- round to a specified or appropriate number of significant figures;
- recognise that recurring decimals are exact fractions and that some exact fractions are recurring decimals;
- add, subtract, multiply and divide fractions, including mixed numbers;
- use percentage and repeated proportional change;
- calculate with money and solve problems in a finance context, for example compound interest, insurance, taxation, mortgages and investments;
- simplify and manipulate algebraic expressions by multiplying a single term over a bracket; and
- manipulate algebraic expressions by taking out common factors that are terms.
- set up and solve linear equations in one unknown, including those with the unknown on both sides of the equation and equations of the form:

  $x/4+3=7$;

- find the mid-point and length of a line given in 2D co-ordinates;
- find and interpret gradients and intercepts of linear graphs, for example plot and interpret the graph of the cost of car hire at £40 per day plus a cost of 20p per mile;
- Add and subtract algebraic fraction e.g. 2a/3 + a/4

15 Indices and formulae

Links to:
Middle Student Book
Ch15, pp.242–258

Key Points

Writing Formulae E D

A formula is a general rule that shows the relationship between quantities. These quantities are called variables.

You can use letters for the variables in a formula.

For example $p = hr + b$
where p is the pay, h is the hours worked, r is the rate of pay and b is the bonus.

Substitution E D C

Use the correct order of operations to help you do the calculations when you substitute values into an algebraic expression.

Indices E D C

x^2 is called 'x squared', y^3 is called 'y cubed'.

$t \times t \times t \times t = t^4$. You say '$t$ to the power 4'.

The ^{4} is called the index.

Law of Indices C

To **multiply** powers of the **same** number or variable **add** the indices.

$x^n \times x^m = x^{n+m}$

To **divide** powers of the **same** number or variable **subtract** the indices.

$x^n \div x^m = x^{n-m}$

Powers of 1 and 0 C B

Any number or variable raised to the power 1 is equal to the number or variable itself.

For example: $3^1 = 3$, $x^1 = x$

Any number or variable raised to the power 0 is equal to 1

For example: $3^0 = 1$, $x^0 = 1$

Changing the subject of a formula C B

The subject of a formula only appears once, and only on its own side of the formula.

In the formula $v = u + at$ the variable v is the subject.

You can rearrange a formula to make a different variable the subject. For example, you can rearrange $v = u + at$ as $a = \frac{v - u}{t}$

A power to a power B

To raise a power of a number or variable to a further power, multiply the indices.

$(x^n)^m = x^{nm}$

17 Indices and formulae

G **1** To work out her pay, in pounds, Joan uses the formula:
pay = 7 × hours worked + travel expenses

(a) What is Joan's pay when she works 5 hours, with £10 travel expenses? *(1 mark)*

(b) What is Joan's pay when she works 14 hours, with £15 travel expenses? *(2 marks)*

F **2 (a)** Find the value of $4x + 5y$ when $x = 3$ and $y = 5$. *(2 marks)*

E **(b)** Find the value of $a^3 + b^3$ when $a = 4$ and $b = 3$. *(2 marks)*

E **3** The area (A) of a triangle is calculated using the formula:

$A = \frac{1}{2}bh$

where b = base length and h = height.
What is the area of a triangle with base length 6 cm and height 7 cm? *(2 marks)*

E **4** You are given that $x = 6$, $y = -2$ and $z = 1.5$.
Find the value of $3x + yz$. *(2 marks)*

E **5** Use the formula $a = 7b - 3c$ to work out c when $a = 13$ and $b = 4$. *(3 marks)*

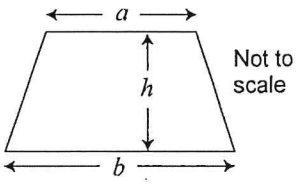
E **6** Simplify:

(a) $p \times p \times p \times p$ *(1 mark)*

D **(b)** $2q \times q \times 7q$ *(1 mark)*

D **7** The area (A) of the trapezium is given by the formula
$A = \frac{1}{2}(a + b)h$.

Use the formula to find b when $A = 15$ cm^2,
$a = 4$ cm and $h = 3$ cm. *(3 marks)*



C **8** Simplify:

(a) $k^6 \div k^4$ *(1 mark)*

(b) $3h^3 \times 6h^4$ *(1 mark)*

C **9** Rearrange $y = 5 + 4x$ to make x the subject. *(2 marks)*

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10 Factors, powers and standard form

Links to:
Middle Student Book
Ch10, pp.158–178

Key Points

Finding multiples E

When you multiply a number by any whole number, you get a multiple of the first number.

Prime numbers E

A prime number is a number with exactly two factors: 1 and the number itself.

Factors and prime factors E

The factors of a number are the numbers that divide into it exactly. A factor that is also a prime number is called a prime factor.

Finding the LCM C

The lowest common multiple (LCM) of two numbers is the smallest number that is a multiple of both numbers.

Lowest common multiple is also known as least common multiple.

Finding the HCF C

The highest common factor (HCF) of two numbers is the largest number that is a factor of both numbers.

Finding and using prime factors C

To find a number's prime factor decomposition

- find any pair of factors of the number
- write them as 'branches' on a tree
- keep dividing the factors until you have only prime numbers at the ends of the branches.

Using squares, cubes and roots E D C

The inverse of squaring is finding the square root ($\sqrt{\ }$). Positive numbers have two square roots: a positive square root and a negative square root.

The inverse of cubing is finding the cube root ($\sqrt[3]{\ }$).

Index notation and roots E B

You can use index notation to simplify repeated multiplication.

The number you are multiplying by itself is called the base. The index tells you how many times the base appears in the multiplication.

Any number to the power 1 is the number itself.

Any number to the power 0 is 1.

A negative power is the reciprocal of the equivalent positive power. The reciprocal of a number means 1 divided by that number.

Using prime factors to find HCFs and LCMs C

To find the HCF

1. Write each number as the product of its prime factors.
2. Find the prime factors that are common to both lists of prime factors numbers.
3. Multiply these to give the HCF.

To find the LCM

1. Write each number as the product of its prime factors.
2. For each prime factor, find the higher power in the two lists of prime factors.
3. Multiply these to give the LCM.

Multiplying and dividing powers C B

To multiply powers of the same number, add the indices.

To divide powers of the same number, subtract the indices.

Using standard form B

A number in standard form is a number between 1 and 10 ($1 \leqslant n < 10$) multiplied by an integer power of 10.

12 Multiples, factors, powers and roots

G 1 Here is a list of numbers:

27 144 36 96 53 15 40 9

(a) Write down the odd numbers between 20 and 60 in the list. *(1 mark)*

(b) Write down the square numbers in the list *(2 marks)*

F AO2 2 Write 145 as the sum of two square numbers. *(2 marks)*

E 3 Here is a list of numbers:

64 16 13 8 23 27 216 3

(a) Write down the cube numbers in the list. *(2 marks)*

(b) Write down the prime numbers in the list *(2 marks)*

E 4 Work out

(a) $5^3 + 10^3$ *(2 marks)*

(b) $4^3 - 3^3 - 2^3 - 1^3$ *(2 marks)*

E 5 Write down:

(a) all the factors of 32. *(2 marks)*

(b) all the prime factors of 32. *(1 mark)*

E 6 Write down the value of:

(a) $\sqrt{121}$ *(1 mark)*

(b) $\sqrt[3]{27}$ *(1 mark)*

C 7 Work out the value of $\sqrt{(5^3 - 5^2)}$. *(2 marks)*

C 8 Write 2520 as a product of prime factors using index notation. *(3 marks)*

C 9 Work out:

(a) the highest common factor (HCF) of 72 and 108. *(3 marks)*

(b) the lowest common multiple (LCM) of 56 and 70. *(3 marks)*

C 10 Write each of these expressions as a single power.

(a) $7^2 \times 7^7 \times 7^4$ *(1 mark)*

(b) $9^9 \div 9^5$ *(1 mark)*

C AO2 11 Phil is setting up a firework display

He sets the fireworks so that a red firework goes off every 5 seconds, a blue firework goes off every 9 seconds and a green firework goes off every 15 seconds.

He starts the firework display with all three fireworks going off at the same time.

How long will it take before all three fireworks go off at the same time again? *(3 marks)*

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13 Decimals

Links to:
Middle Student Book
Ch13, pp.212–222

Key Points

Adding and subtracting decimals F

To add or subtract decimals, set out the calculation in columns by lining up the decimal points, then add or subtract.

Converting decimals to fractions D

You can use place value to convert a decimal to a fraction.

First write the decimal as tenths, hundredths, thousandths, ...

Take the biggest denominator and put it on the bottom of the fraction. Put the decimal digits on the top of the fraction. Remember to give your answer in its simplest form.

Terminating decimals D

Terminating decimals are decimals that come to an end, for example 0.6.

Multiplying decimals D

To multiply decimals

1. ignore the decimal points and multiply the numbers
2. count the decimal places in the calculation
3. put this number of decimal places in the answer.

Dividing decimals D C

To divide a decimal by a whole number, line up the decimal point in the answer and divide in the normal way.

To divide by a decimal, first write the division as a fraction. Convert the denominator to a whole number and create an equivalent fraction. Then divide in the usual way.

Recurring decimals C B

Recurring decimals never end, for example 0.333...

'Recurring dots' are used to make the pattern clear. A dot over one digit shows that this digit recurs. Two dots, at the beginning and end of a sequence of digits, show that the sequence recurs.

15 Decimals

F **1** Work out:

(a) 0.0034 × 1000 *(1 mark)*

(b) 82 ÷ 100 *(1 mark)*

F **2** What has 47.23 been divided by to give 0.04723? *(1 mark)*

E **3** Work out:

(a) 263 + 73.2 *(1 mark)*

(b) 18.31 + 5.4 + 0.27 *(1 mark)*

E **4** Work out:

(a) 6.832 − 2.41 *(1 mark)*

(b) 25.6 − 4.87 *(1 mark)*

D **5** Convert 0.66 to a fraction in its lowest terms. *(1 mark)*

D **6** Work out 16.3 × 4.2. *(2 marks)*

D AO2 **7** Gemma owns a cake company.
To make one batch of fruitcakes she uses 3.6 kg of sultanas.
1 kg of sultanas costs Gemma £2.68.
How much do the sultanas cost for one batch of fruitcakes? *(2 marks)*

C **8** Work out 0.68 ÷ 0.04. *(2 marks)*

C AO2 **9** A dinner lady has made up 22 litres of milkshake.
She is pouring it into glasses that hold 0.4 litres each.
How many glasses can the dinner lady fill with milkshake? *(2 marks)*

C **10** Convert each of these fractions to a decimal.

(a) $\frac{18}{100}$ *(1 mark)*

(b) $\frac{2}{6}$ *(2 marks)*

(*Hint*: one is a recurring decimal, the other is a terminating decimal.)

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3 Number skills 1

G **1** The world record for the longest journey on a tractor is 13 172 miles.

(a) Write this number in words. *(1 mark)*

(b) What is this distance to the nearest hundred miles? *(1 mark)*

G **2** Put these numbers in order of size:

9340 11 129 9732 6405 14 096 *(1 mark)*

G **3** Which two of these fractions are equivalent to $\frac{3}{4}$?

$\frac{9}{12}$ $\frac{10}{14}$ $\frac{11}{15}$ $\frac{12}{16}$ *(2 marks)*

G FS **4** Olivia buys two magazines costing £2.30 each and a chocolate bar costing 45p.

(a) How much does Olivia spend altogether? *(1 mark)*

(b) Olivia pays with £6. How much change does she get? *(2 marks)*

F **5** Write the value of the 8 in these numbers

(a) 374.98 *(1 mark)*

(b) 587 431 *(1 mark)*

F **6** Write the correct sign, < or >, between each pair.

(a) 0.724 0.639 *(1 mark)*

(b) 5.423 5.451 *(1 mark)*

F AO2 **7** Amerie is making soup. She needs 2.2 *l* of chicken stock.
Each stock cube makes 450 m*l*.
Amerie has 5 stock cubes. Does she have enough to make the soup? *(2 marks)*

F AO2 **8** John wins £23 100 on the lottery.
He keeps $\frac{3}{5}$ and splits the rest between his family.
How much money does John give to his family? *(2 marks)*

E **9** Work out 15.04 × 4.7.

(a) Give your answer to one decimal place. *(1 mark)*

(b) Give your answer to one significant figure. *(1 mark)*

D AO3 FS **10** Jessica's house is valued at £105 000.
The house needs a lot of work doing to it and the costs are shown on the right.
If the work is completed, the house will be valued at £135 000.
Is it worth getting the work done or should Jessica sell her house as it is?

Quote for work
Decorating £2200
Roof fixing £7500
New kitchen £10 000
2 new bathrooms @ £3500 each
3 trees pruning @ £150 each

(5 marks)

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11 Number skills 2

G **1** Work out:

(a) 176 + 549 *(2 marks)*

(b) 1440 − 252 *(2 marks)*

(c) 91 ÷ 7 *(1 mark)*

F **2** There are 32 students in Class 10F. The teacher gives each student 12 merits.
How many merits does the teacher give altogether? *(2 marks)*

F **3** The temperatures in five different cities are:
0 °C, −9 °C, 4 °C, −3 °C, −1 °C.

(a) Put these temperatures in order, starting with the coldest. *(2 marks)*

(b) What is the temperature difference between the coldest and warmest city? *(1 mark)*

F FS **4** Hannah is saving up to take her mum to New York for her 50th birthday.
The holiday will cost £1750.
She puts £95 a month into a savings account.
How many months will it take Hannah to save enough for the holiday? *(4 marks)*

F **5 (a)** What is the value of the 7 in the answer to '872 multiplied by 100'? *(1 mark)*

(b) What is the value of the 9 in the answer to '3971 divided by 100'? *(1 mark)*

E **6** Write the number that is:

(a) 40 less than 1460 *(1 mark)*

(b) 5 multiplied by 30 *(1 mark)*

(c) 7 more than −3 *(1 mark)*

(d) 12 divided by −3. *(1 mark)*

E **7** Work out −9 × (−8). *(1 mark)*

D **8** Estimate the value of:

$$\frac{28 \times 236}{64.4}$$

(2 marks)

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13 Decimals

E **1** Work out:

(a) 29.11 + 6.5 + 0.38 *(1 mark)*

(b) 54 + 16.33 + 8.909 *(1 mark)*

E **2** Work out:

(a) 5.482 − 4.16 *(1 mark)*

(b) 25.63 − 4.87 *(1 mark)*

D **3** Convert 0.048 to a fraction in its lowest terms. *(2 marks)*

D **4** Work out 0.307 × 2.6. *(2 marks)*

D AO2 **5** Gemma owns a cake company.
To make one batch of fruitcakes she uses 3.6 kg of sultanas.
1 kg of sultanas costs Gemma £2.68.
How much do the sultanas cost for one batch of fruitcakes? *(2 marks)*

C **6** Work out 0.68 ÷ 0.04. *(2 marks)*

C AO2 **7** Yuan's fish tank holds 72 litres of water.
He fills it up with water from his kettle, which holds 1.6 litres.
How many kettle-fulls does Yuan need to fill his fish tank? *(2 marks)*

C **8** Convert each of these fractions to a decimal.

(a) $\frac{18}{100}$ *(1 mark)*

(b) $\frac{2}{9}$ *(2 marks)*

(*Hint*: one is a recurring decimal, the other is a terminating decimal.)

B AO2 **9** Look at these fractions, which have been converted to recurring decimals.

Set A: $\frac{1}{13} = 0.\dot{0}76923\dot{}$

$\frac{3}{13} = 0.\dot{2}30769\dot{}$

$\frac{4}{13} = 0.\dot{3}07692\dot{}$

Set B: $\frac{2}{13} = 0.\dot{1}53846\dot{}$

$\frac{5}{13} = 0.\dot{3}84615\dot{}$

$\frac{6}{13} = 0.\dot{4}61538\dot{}$

(a) What do you notice about the two sets? *(2 marks)*

(b) Into which set would you put $\frac{11}{13}$? *(1 mark)*

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12 Fractions

Links to:
Middle Student Book
Ch12, pp.198–211

Key Points

Comparing fractions E D

To compare fractions with different denominators, change them into equivalent fractions with the same denominator.

Multiplying fractions E

To multiply fractions, multiply the numerators together and multiply the denominators together.

Before you multiply, cancel common factors if possible.

For example, $\frac{\cancel{4}^{2}}{\cancel{5}_{1}} \times \frac{\cancel{15}^{3}}{\cancel{22}_{11}} = \frac{2}{1} \times \frac{3}{11} = \frac{2 \times 3}{1 \times 11} = \frac{6}{11}$

Adding and subtracting fractions E D

To add or subtract fractions with different denominators, write them as equivalent fractions with the same denominator, then add or subtract the numerators.

For example, $\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6} = \frac{5}{6}$

Adding and subtracting mixed numbers C

You can add or subtract mixed numbers by changing them into improper fractions.

For example, $1\frac{1}{3} + 3\frac{2}{5} = \frac{4}{3} + \frac{17}{5} = \frac{20}{15} + \frac{51}{15} = \frac{71}{15} = 4\frac{11}{15}$

Finding reciprocals C

When two numbers can be multiplied together to give the answer 1, then each number is called the reciprocal of the other.

The reciprocal of a fraction is found by turning the fraction upside down.

The reciprocal of a number is 1 divided by that number.

Multiplying fractions and mixed numbers D C B

To multiply mixed numbers, change them to improper fractions first.

For example, $4\frac{1}{3} \times \frac{2}{5} = \frac{13}{3} \times \frac{2}{5} = \frac{13 \times 2}{3 \times 5} = \frac{26}{15} = 1\frac{11}{15}$

Dividing by a fraction D C B

To divide by a fraction, turn the fraction upside down and multiply.

When the division involves mixed numbers, change them to improper fractions first.

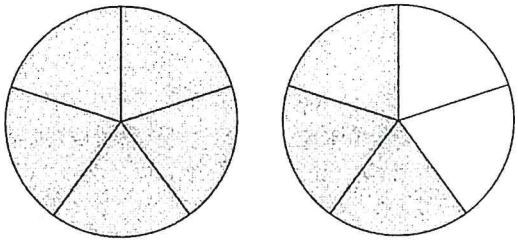
For example, $\frac{3}{4} \div 7 = \frac{3}{4} \div \frac{7}{1} = \frac{3}{4} \times \frac{1}{7} = \frac{3 \times 1}{4 \times 7} = \frac{3}{28}$

14 Fractions

F **1** Write down the fraction shaded in this diagram as:

(a) an improper fraction *(1 mark)*

(b) a mixed number. *(1 mark)*



E **2** Write these fractions in order of size, smallest first.

$\frac{5}{6}$ $\frac{2}{4}$ $\frac{6}{8}$

You must show your working. *(2 marks)*

E AO2 **3** A 400 g tin of beans contains beans, water and salt.

Beans make up $\frac{3}{5}$ of the tin's contents.

What mass in the tin is not beans? *(3 marks)*

E **4** Work out:

$\frac{4}{6} + \frac{2}{12}$ *(2 marks)*

E **5** Work out:

$\frac{21}{24} \times \frac{4}{7}$

Write your answer as a fraction in its lowest terms. *(2 marks)*

D **6** Work out:

$8 \div \frac{2}{5}$ *(2 marks)*

C **7** Find the reciprocal of 0.6.

Give your answer as a mixed number. *(2 marks)*

C AO2 **8** Graham mixes up some mint-green paint for his bathroom.

He mixes $2\frac{1}{5}$ litres of white paint with $1\frac{1}{3}$ litres of green paint and $\frac{1}{2}$ litre of blue paint.

How many litres of mint-green paint has Graham made altogether? *(3 marks)*

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16 Percentages

Links to:
Middle Student Book
Ch16, pp.259–274

Key Points

Credit

When you buy on credit, you usually have to pay a deposit followed by a number of regular payments.

Calculations involving simple interest E

When you put money into a savings account in a bank or building society they pay you interest. If the interest is the same amount each year, it is called simple interest.

VAT D

Value Added Tax (VAT) is added to the price of items and services. Generally it is 17.5% in the UK.

Percentage increase and decrease D

Method A

1 Work out the value of the increase (or decrease).
2 Add to (or subtract from) the original amount.

Method B

1 Add the percentage increase to 100% (or subtract the percentage decrease from 100%).
2 Convert this percentage to a decimal.
3 Multiply it by the original amount.

Percentage profit or loss C

$$\text{Percentage profit (or loss)} = \frac{\text{actual profit (or loss)}}{\text{cost price}} \times 100\%$$

where the actual profit (or loss) is the difference between the cost price and the selling price.

Repeated percentage change C

When you invest money the interest is usually added to the amount of money invested in the first place. The interest that you get is calculated on the amount invested plus the interest already received. This is known as compound interest.

In section 8.1 you learned how to work out repeated percentage change using a calculator. To practise these without a calculator.

1 Work out the interest for the first year.
Add the interest to the amount you started with. This is the amount at the start of the next year.
2 Work out the interest on the new amount.
Add the interest to the amount at the start of that year.
3 Repeat for the number of years needed.

You can also use this method to work out a repeated percentage loss or depreciation. Work out the loss or depreciation each year and subtract it from the value at the start of the year.

Finding the original quantity B

To work out the original quantity when you are given the quantity after a percentage increase or decrease, use one of these methods.

Method A

1 Work out what percentage the figure you are given represents.
2 Divide by this percentage to find 1%.
3 Multiply by 100 to get the 100% figure.

Method B

1 Work out what percentage the figure you are given represents.
2 Divide by 100 to find the multiplier.
3 Divide the original amount by the multiplier.

18 Percentages

E **1** An art gallery is selling a painting for the cash price of £550.
The gallery also lets you buy the painting on credit for a 30% deposit, plus 6 monthly payments of £75.

(a) How much is the deposit? *(2 marks)*

(b) What is the total cost of buying the painting on credit? *(2 marks)*

(c) How much more does it cost to buy on credit rather than paying cash? *(1 mark)*

E **2** William puts £3000 into a savings account.
The interest rate is 2.5% per annum.
Work out the interest after one year. *(2 marks)*
(*Hint*: 2.5% is $\frac{1}{4}$ of 10%.)

D **3** Luisa can type 45 words per minute.
She goes on a course to learn how to touch-type.
By the end of the course, her typing speed has increased by 40%.
How many words per minute can Luisa type now? *(2 marks)*

D **4** An office desk costs £220 + 17.5% VAT.
How much does the desk cost in total? *(2 marks)*

D **5** A television presenter's annual salary was £120 000.
During the recession, he had to take a 6% pay cut.
How much was his annual salary during the recession? *(3 marks)*
(*Hint*: the pay cut is a percentage decrease.)

C **6** Dan bought an antique vase for £16 000.
15 years later he sold it to a collector for £22 400.
What was Dan's percentage profit? *(3 marks)*

C **7** Mindy bought a van for her business three years ago. It cost £15 000.
The value of the van has depreciated by 20% each year since Mindy bought it.
How much is the van worth now? *(3 marks)*

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2 Fractions, decimals and percentages

Links to:
Middle Student Book
Ch2, pp.19–34

Key Points

Finding a fraction of an amount using a calculator

E D

Most scientific calculators have a fraction key that looks like this $a\frac{b}{c}$ or like this $\square/\square$. To find a fraction of an amount, enter the fraction, then multiply by the amount.

Writing one quantity as a fraction of another

D

Make sure both quantities are in the same units, then write the first quantity over the second. Simplify the fraction when possible.

Calculating with fractions using a calculator

E D

To carry out a calculation involving fractions, enter the fractions on your calculator using the fraction key.

Calculating the percentage of an amount

E D

Divide the amount by 100 then multiply by the percentage you want to find.

Writing one quantity as a percentage of another

D C

Write the first quantity as a fraction of the second, then multiply the fraction by 100 to convert it to a percentage.

Percentage increase and decrease

D

To find the amount after a percentage change:

Method A

1 Work out the value of the increase (or decrease).
2 Add to (or subtract from) the original amount.

Method B

1 Add the percentage increase to 100% (or subtract the percentage decrease from 100%).
2 Convert this percentage to a decimal.
3 Multiply it by the original amount.

Retail prices index

D C

An index number compares one number with another. It is a percentage of the base, which is usually 100.

4 Fractions, decimals, percentages and ratio

G 1 In a box of 30 chocolates, 12 have soft centres.
What percentage of the chocolates have soft centres? *(2 marks)*

G 2 Copy and complete this table.

	Fraction	Decimal	Percentage
	$\frac{3}{4}$	0.75	75%
(a)	$\frac{18}{100}$		
(b)		0.8	
(c)			40%

(2 marks) *(2 marks)* *(2 marks)*

G AO3 3 Katie wrote 0.3 = 3%.
Explain why Katie is wrong. *(1 mark)*

F 4 Paul bought a car for £20 000.
Since he bought the car it has gone down in value by 30%.
How much has the car gone down in value?
Do not use a calculator. *(2 marks)*

E 5 Abdul collected 65% of the gold rings in a computer game.
There were 120 gold rings in total.
How many rings did Abdul collect? *(2 marks)*

E 6 An architect makes a model of a bridge he is designing using a ratio of 1 : 75.
The model is 40 cm long.
What will be the length of the real-life bridge when it is built?
Give your answer in metres. *(2 marks)*

D 7 In 2005 a loaf of bread cost £1.04.
Work out the cost of a loaf of bread in July 2009, when the price index was 124.
Take 2005 as the base year of 100. *(2 marks)*

D AO2 8 Abigail completed 70 maths questions.
She got 56 of them correct.
What percentage of questions did Abigail get correct? *(2 marks)*

D AO2 9 A farm grows just potatoes and sugar beet in the ratio 5 : 8.
What fraction of the farm's produce is sugar beet? *(1 mark)*

C AO3 FS 10 A perfume house is making two new fragrances.
Charm contains sandalwood and vanilla in the ratio 4 : 10.
Fascination contains sandalwood and vanilla in the ratio 5 : 12.
Which fragrance, Charm or Fascination, has the higher proportion of sandalwood?
Show workings to support your answer. *(3 marks)*

C 11 Write the ratio 14 : 84 in the form 1 : n. *(1 mark)*

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2 Fractions, decimals and percentages

E **1** Calculate these:

(a) $\frac{5}{8} \times 48$ m*l* *(1 mark)*

(b) $\frac{13}{24} \times 216$ kg *(1 mark)*

(c) $0.112 \times \frac{4}{7}$ *(1 mark)*

E **2** A shop is having a closing down sale. There is 20% off all marked prices.
A blender has a marked price of £39.
How much is the discount on the blender? *(2 marks)*

E **3** Calculate these percentages. Write down your workings.

(a) 18% of £690 *(1 mark)*

(b) 0.15% of 14 000 kg *(1 mark)*

(c) 180% of £35 *(1 mark)*

D AO2 **4** In November, Mo's bus was late 12 times.
What fraction of the days in November was Mo's bus late?
Give your answer in its simplest form. *(1 mark)*

D AO2 **5** Dom added six identical mixed numbers.
He got the answer $11\frac{7}{37}$
What were the mixed numbers that Dom added? *(2 marks)*

D **6** What is 300 g as a percentage of 6 kg? *(1 mark)*

D **7** Monique has £5000 in her savings account.
She uses £2400 of her savings to buy premium bonds.
What percentage of her money is left in her account? *(3 marks)*

D **8** Sandra earns £475 per week. She is given a 3% pay rise.
How much will Sandra earn each week after the pay rise? *(2 marks)*

D AO2 **9** Two shops are selling the same hi-fi in a sale.

(a) Which shop is offering the better deal?
Hint: VAT is charged at 17.5% *(5 marks)*

(b) How much will you save if you buy the hi-fi there? *(1 mark)*

Shop A

Shop B

C **10** Last year a cruise cost £1390 per adult.
The same cruise this year costs £1460 per adult.
What is the percentage increase in the cost per adult?
Give your answer to the nearest whole number. *(3 marks)*

C AO2 **11** A biscuit factory produced 750 000 packets of a particular biscuit in 2008.
This represented an index of 112, using 2004 as the base year with an index of 100.
What was the factory's production of this type of biscuit in 2004? *(2 marks)*

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11 Basic rules of algebra

Links to:
Middle Student Book
Ch11, pp.179–195

Key Points

Collecting like terms **E**

This expression $3a + 6b + 5a$ has three terms: $3a$, $6b$ and $5a$.

Terms that use the same letter are called like terms.

You can simplify algebraic expressions by collecting like terms together.

$3a + 6b + 5a = 3a + 5a + 6b = 8a + 6b$

Multiplying terms **E**

To multiply algebraic terms, you multiply the numbers and then multiply the letters.

$3f \times 4g = 3 \times f \times 4 \times g = 3 \times 4 \times f \times g = 12fg$

Expanding brackets **D**

To expand brackets, you multiply each term inside the bracket by the term outside the bracket.

$3(2a + 7) = 6a + 21$ $\quad$ $x(3x + 5) = 3x^2 + 5x$

Factorising **D**

Factorising an algebraic expression is the opposite of expanding brackets.

$$8t - 10 = 2(4t - 5)$$

factorising

expanding

Start by writing a common factor of both terms outside a bracket.

Then work out the terms inside the bracket.

Expanding two brackets **C** **B**

To expand two brackets, you multiply each term in one bracket by each term in the other bracket.

Method 1 – the grid method

$(x + 2)(x + 5)$

$\times$	x	5
x	x^2	$5x$
2	$2x$	10

Then add the terms together and simplify.

$(x + 2)(x + 5) = x^2 + 5x + 2x + 10 = x^2 + 7x + 10$

Method 2 – FOIL (Firsts, Outers, Inners, Lasts)

$(x + 2)(x + 5)$

Firsts: $x \times x = x^2$

Outers: $x \times 5 = 5x$

Inners: $2 \times x = 2x$

Lasts: $2 \times 5 = 10$

Then add the terms together and simplify.

$(x + 2)(x + 5) = x^2 + 5x + 2x + 10 = x^2 + 7x + 10$

13 Basic rules of algebra

F 1 Pens come in packs of 10.

(a) Write down an expression for the total number of pens in x packs. *(1 mark)*

D **(b)** Pens also come in bumper packs of 15.
Write down an expression for the total number of pens in x packs of 10 and y packs of 15. *(2 marks)*

F 2 Simplify:

(a) $6q + 8q - 7q$ *(1 mark)*

D **(b)** $6m + 4n - 5m + 3n$ *(2 marks)*

D 3 Expand $5(d + 3)$. *(1 mark)*

D 4 Factorise:

(a) $6x + 12$ *(1 mark)*

(b) $b^2 - 5b$ *(1 mark)*

C 5 Expand and simplify $7(3a + 2) - 3(4a - 3)$. *(2 marks)*

C 6 Expand and simplify $(v + 4)^2$. *(2 marks)*

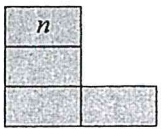
C 7 Show that $(p - 5)(p - 3) + 8p = p^2 + 15$. *(3 marks)*
(*Remember*:
negative × positive = negative
negative × negative = positive.)

C AO2 8 Here is part of a number grid.

1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32

Tony is investigating sets of four numbers that form an L-shape on the grid.
The shaded shape on the grid is called L_5 because it has the number 5 at the top.

(a) This is L_n.



Copy L_n and write expressions in the empty boxes. *(3 marks)*

(b) Find the sum of all the numbers in L_n in terms of n.
Give your answer in its simplest form. *(2 marks)*

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14 Equations and inequalities

Links to:
Middle Student Book
Ch14, pp.223-241

Key Points

Solving two step equations

E D

You will need to use two or more steps to solve some equations.

For example, to solve $2x + 5 = 11$:

$$2x + 5 - 5 = 11 - 5$$
$$2x = 6$$
$$2x \div 2 = 6 \div 2$$
$$x = 3$$

Writing and solving equations

E D

When writing equations decide what your unknown will represent and then write an expression. Turn this into an equation by looking for expressions or numbers that are equal.

Equations with brackets

D C

When you solve equations with brackets expand all the brackets first.

Equations with an unknown on both sides

D C

To solve this type of equation you need to get the unknown on one side of the equals sign only.

For example, $3x - 3 = 2x + 5$.

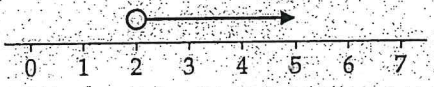
$$3x - 2x - 3 = 2x - 2x + 5$$
$$x - 3 = 5$$

Then solve the equation as normal.

Inequalities

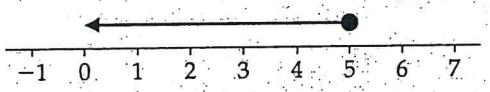
E D C B

$x > 2$ is an inequality. It means that x must be greater than 2. It can be shown on a number line.



The open circle means that the 2 is not included.

$x \leqslant 5$ means that x is less than or equal to 5. The closed circle shows that in this case, the 5 is included in the set of solutions.



You can use the balance method to solve inequalities.

When you multiply or divide both sides of an inequality by a positive number, the inequality sign remains unchanged.

When you multiply or divide both sides of an inequality by a negative number, you need to change the direction of the sign.

Simultaneous equations

B

To solve simultaneous equations you eliminate one of the unknowns using algebraic steps. You should then have a linear equation with one unknown, which you can solve.

16 Equations and inequalities

G 1 Find the value of each missing number.

(a) $\square + 6 = 13$ *(1 mark)*

(b) $\square - 25 = 25$ *(1 mark)*

F 2 Solve:

(a) $x + 7 = 14$ *(2 marks)*

(b) $y - 5 = 3$ *(2 marks)*

E 3 Solve $4f - 6 = -2$. *(2 marks)*

E 4 Show the inequality $x \leq 3$ or $x > 6$ on a number line. *(2 marks)*

E AO2 5 I think of a number.
I divide my number by 5 and then subtract 4.
My answer is 6.
Form an equation and solve it to find the number I was thinking of. *(3 marks)*

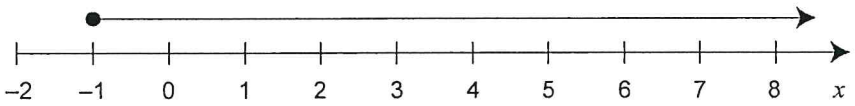
D 6 x is an integer. $-2 < x \leq 4$.
Write down all possible values of x. *(2 marks)*

D 7 Solve the equation $3x + 7 = 17 - x$. *(3 marks)*

C 8 Solve the equation $4x - 1 = 6(x + 2)$. *(3 marks)*

C 9 (a) Solve the inequality $5(3x - 8) < 50$. *(3 marks)*

(b) Write down the inequality shown by the following diagram. *(1 mark)*



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18 Linear graphs

Links to:
Middle Student Book
Ch18, pp.297–321

Key Points

Mid-point of a line segment D C

Mid-point $(x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

where (x_1, y_1) and (x_2, y_2) are the coordinates of the end-points.

Straight-line graphs E D C B

A straight-line graph parallel to the x-axis has equation $y =$ a number.

A straight-line graph parallel to the y-axis has equation $x =$ a number.

Straight-line graphs have equations of the form $y = mx + c$.

The gradient (slope), m, of a straight line measures how steep it is.

Gradient, $m = \frac{\text{change in } y}{\text{change in } x}$

The value of c is the y-intercept.

Conversion graphs E

A conversion graph converts values from one unit to another.

Distance-time graphs E D C

A distance–time graph represents a journey. The x-axis (horizontal) represents the time taken. The y-axis (vertical) represents the distance from the starting point.

The average speed of a journey can be worked out using

Average speed $= \frac{\text{total distance}}{\text{total time}}$

A straight-line graph shows that the rate of change is steady.

A curved graph shows that the rate of change varies.

The steeper the line, the faster the rate of change.

Simultaneous equations B

You can solve a pair of simultaneous equations by drawing their graphs on the same set of axes.

The point on the graph where the two lines intersect (cross) is their solution.

Inequalities B

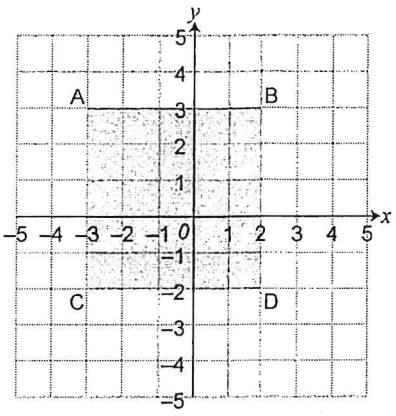
Inequalities can be shown as a shaded region on a graph.

For the inequalities $\leqslant$ and $\geqslant$, the boundary is a solid line.

For the inequalities $<$ and $>$, the boundary is a dashed line.

20 Coordinates and linear graphs

F **1** The square ABCD is drawn on a cm square grid.
The coordinates of A are (−3, 3).
Write the coordinates of B, C and D. *(3 marks)*



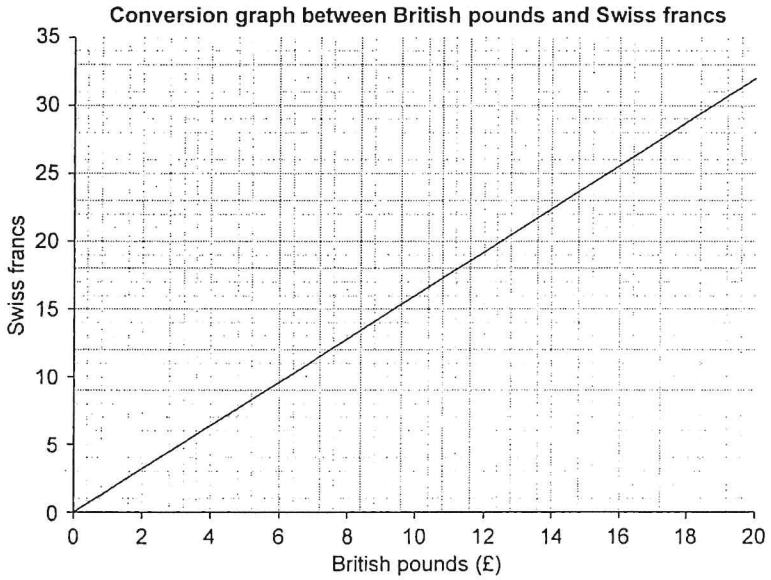
F **2** This is a conversion graph for British pounds and Swiss francs.

(a) Use the graph to convert:

(i) £5 to Swiss francs

(ii) 20 Swiss francs to British pounds. *(2 marks)*

(b) Use the graph to show that 120 Swiss francs is approximately £75. *(1 mark)*



E **3** Hannah takes part in a 13 km race.
The race starts at 9 am. She runs for the first hour and covers 7 km.
She then gets a stitch and only covers 1 km in the next 15 minutes.
Hannah decides to stop and stretch until the stitch goes.
15 minutes later, she starts running again and does the last 5 km in 45 minutes.

(a) Draw a distance–time graph for Hannah's race. *(2 marks)*

(b) How long did Hannah take to complete the race? *(1 mark)*

D AO2 **4** **(a)** Complete the table of values for $y = 2x - 3$. *(1 mark)*

x		−2	−1	0	1	2	3
y	−9		−5			1	

(b) Draw a coordinate grid with the x-axis from −4 to +4 and the y-axis from −12 to 6.
Draw the graph of $y = 2x - 3$. *(1 mark)*

(c) Work out the coordinates of the point where the line $y = 2x - 3$ crosses the line $y = 4$. *(1 mark)*

C AO3 **5** B is the mid-point of the line AC.
A has coordinates (−2, 6). B has coordinates (3, 1).
Work out the coordinates of C. *(2 marks)*

C **6** What are the gradient and y-intercept of the line: $\frac{1}{5}(y + 4) = x$? *(2 marks)*

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