Chapter summary

Algebra

Expanding

$a(b+c) = ab + ac$

$a(b-c) = ab - ac$

e.g. $2(4x+3) = 8x+6$

$-3x(2x-y) = -6x^2 + 3xy$

Simplifying expressions

Add/subtract like terms only. Like terms have the same pronumeral factors.

e.g. $3x$ and $7x$, $2xy$ and $4yx$, not $2x$ and x^2 or $3y$ and $4xy$.

For example,

$3x + 2y - x + 7y = 3x - x + 2y + 7y$

$= 2x + 9y$

Multiply/Divide

$3a \times 2b = 3 \times 2 \times a \times b$

$= 6ab$

$\frac{{}^{1}\cancel{7}xy^{1}}{{}_{2}\cancel{14}y_{1}} = \frac{x}{2}$

Algebraic expressions

$3xy$ $+7x$ $-4y$ $+3$

4 terms

3 is the constant term.

7 is the coefficient of x.

-4 is the coefficient of y.

Adding/subtracting algebraic fractions ★

Find the lowest common denominator and combine.

e.g. $\frac{x}{2} + \frac{2x}{3}$ LCD is 6.

$= \frac{3x}{6} + \frac{4x}{6}$

$= \frac{7x}{6}$

Factorising

This is the opposite of expanding

Factorised form		Expanded form
$2(x+4)$	=	$2x+8$

Look for highest common factor of terms.

e.g. $3ab + 6a$ HCF is $3a$.

$= 3a(b+2)$

$-2x^2 - 6x$ HCF is $-2x$.

$= -2x(x+3)$

Multiplying/dividing algebraic fractions ★

Multiply: Cancel common factors in factorised form and then multiply.

e.g. $\frac{3\cancel{(x+4)}^{1}}{\cancel{2}^{1}} \times \frac{{}^{4}\cancel{8x}}{\cancel{x+4}^{1}}$

$= 12x$

Divide: Multiply by the reciprocal of the fraction following the ÷ sign.

Reciprocal of $\frac{a}{b}$ is $\frac{b}{a}$.

Index form a^m

a is the base.

m is the index/power/exponent.

Index form		Expanded form
5^4	=	$5 \times 5 \times 5 \times 5$

e.g. $3 \times a \times b \times a \times a \times b = 3a^3b^2$

Indices

Scientific notation

Used for very large and small numbers in the form $a \times 10^m$, where $1 \leq a < 10$ or $-10 < a \leq -1$.

$3\,870\,000 = 3.87 \times 10^6$

$0.000\,21 = 2.1 \times 10^{-4}$

Exponential growth and decay ★

For a repeated percentage increase or decrease, the rule can be

$A = A_0\left(1 \pm \frac{r}{100}\right)^n$, where

A_0 is the initial amount

r is % rate

n is the amount of time.

Use '+' for growth and '–' for decay.

Significant Figures

These are counted from left to right from the first non-zero digit

e.g. 213 270 is 2.13×10^5 in scientific notation to 3 significant figures.

$0.000\,429\,1$ is 4.3×10^{-4} in scientific notation to 2 significant figures

Negative indices

$a^{-m} = \frac{1}{a^m}$

e.g. $x^{-3} = \frac{1}{x^3}$

$\frac{1}{a^{-m}} = a^m$

e.g. $\frac{4}{2^{-3}} = 4 \times 2^3 = 32$

Index laws

Law 1: $a^m \times a^n = a^{m+n}$

Law 2: $a^m \div a^n = a^{m-n}$

Law 3: $(a^m)^n = a^{m \times n}$

Law 4: $(ab)^m = a^m \times b^m$

Law 5: $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

Zero power: $a^0 = 1$ when $a \neq 0$.

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Chapter summary

Equations

Solving linear equations that have brackets

- Expand all brackets.
- Collect like terms on each side of the equation.
- Collect terms with a pronumeral to one side (usually the LHS).
- Solve for unknown.

e.g.
$12(x+1)-2(3x-3)=4(x+10)$
$12x+12-6x+6=4x+40$
$6x+18=4x+40$
$2x+18=40$
$2x=22$
$x=11$

Solving linear equations

Solving involves finding the value that makes an equation true.
e.g. $2x+5=9$
$2x=4$ (subtract 5)
$x=2$ (divide by 2)

Equations with fractions

e.g.
$\frac{3x}{4}-2=7$
$\frac{3x}{4}=9$ (first $+2$ to both sides)
$3x=36$ ($\times 4$ both sides)
$x=12$ ($\div 3$ both sides)

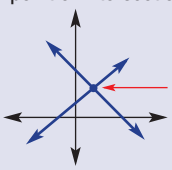
e.g.
$\frac{2x-5}{3}=7$
$2x-5=21$ (first $\times 3$ to both sides)
$2x=26$ ($+5$ to both sides)
$x=13$ ($\div 2$ to both sides)

Solving word problems

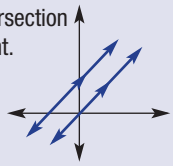
1. Define variable(s).
2. Set up equation(s).
3. Solve equation(s).
4. Check each answer and write in words.

Graphical solutions of simultaneous equations

Graph each line and read off point of intersection.



Parallel lines have no intersection point.

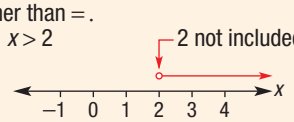


Formulas

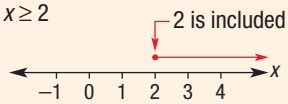
Some common formulas
e.g. $A=\pi r^2$, $C=2\pi r$
An unknown value can be found by substituting values for the other variables.
A formula can be rearranged to make a different variable the subject; i.e. the variable is out the front on its own.
e.g. $E=mc^2$, find m when $E=320$ and $c=4$.
$320=m\times 4^2$ (substitute values)
$320=16m$
$20=m$ (divide both sides by 16)
$m=20$ (Write the answer with m on the left.)

Inequalities

These are represented using $>$, $<$, $\geq$, $\leq$ rather than $=$.
e.g. $x>2$



e.g. $x\geq 2$



Solving inequalities uses the same steps as solving equations, except when multiplying or dividing by a negative number. In this case, the inequality sign must be reversed.
e.g. $4-2x>10$ (-4)
$-2x>6$ $(\div -2)$
$x<-3$ (reverse sign)

Simultaneous equations

Use substitution or elimination to find the solution that satisfies two equations.

Substitution
e.g. $2x+y=12$ [1]
$y=x+3$ [2]

In [1] replace y with [2]:
$2x+(x+3)=12$
$3x+3=12$
$3x=9$
$x=3$
Sub. $x=3$ to find y.
In [2] $y=3+3=6$
Solution is (3, 6).

Elimination
Ensure both equations have a matching pair. Add two equations if matching pair has different sign; subtract if same sign.
e.g. $x+2y=2$ [1]
$2x+3y=5$ [2]
[1] $\times 2$: $2x+4y=4$ [3]
[3] − [2]: $y=-1$
In [1]: $x+2(-1)=2$
$x-2=2$
$x=4$
Solution is (4, −1).

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