Exercise walk-through

2.2.1
Formula Rearrangement

AQA · GCSE · Mathematics

Solving equations

- **Linear equations.** Collect the letters on one side and the numbers on the other. **Worked example 8.** $7x - 22 = 4x + 29$.
- Subtract $4x$: $3x - 22 = 29$.
- Add 22: $3x = 51$, so $x = 17$.
- **Quadratic equations by factorising.** Make one side zero and factorise.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Sequences

- A sequence is a list of numbers that follows a rule.
- A term-to-term rule says how to get the next term; a position-to-term rule, the **nth term** , gives any term from its position n.
- You should know the square numbers (1, 4, 9, 16, ...), cube numbers (1, 8, 27, ...), triangular numbers (1, 3, 6, 10, ...) and Fibonacci-type sequences, where each term is the sum of the two before.
- **Arithmetic sequences.** An **arithmetic progression** adds the same number each time.

Sources for this lesson

- AQA, *GCSE Mathematics (8300) specification*, subject content section 3.2 (Algebra).
- Muhammad ibn Musa al-Khwarizmi, *The Compendious Book on Calculation by Completion and Balancing* (Baghdad, about 820), the problem $x^2 + 10x = 39$.
- AQA, *GCSE Mathematics* Higher Papers 1 and 3 (June 2024), the linear-equation and **identity** questions.

Exercise 2.1

2.1 Make x the subject of $y = 3x + 2$. [2]



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2.1

- subtract 2 from both sides: $y - 2 = 3x$
- divide by 3: $\boldsymbol{x = \dfrac{y - 2}{3}}$

Exercise 2.2

2.2 Make a the subject of $v = u + at$. [2]



2.3 Make r the subject of $C = 2\pi r$. [1]



2.4 Make h the subject of $V = \frac{1}{3}\pi r^2 h$. [2]



2.5 Make r the subject of $A = \pi r^2$. [2]



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2.2

- subtract u: $v - u = at$

Full solution on next slide

Full solution 2.2

2.2

- subtract u: $v - u = at$
- divide by t: $\boldsymbol{a = \dfrac{v - u}{t}}$

2.3

- divide both sides by 2π: $\boldsymbol{r = \dfrac{C}{2\pi}}$

2.4

- multiply by 3: $3V = \pi r^2 h$
- divide by πr^2: $\boldsymbol{h = \dfrac{3V}{\pi r^2}}$

2.5

- divide by π: $r^2 = \dfrac{A}{\pi}$
- square-root: $\boldsymbol{r = \sqrt{\dfrac{A}{\pi}}}$

Exercise 3.1 (a)

3.1 The formula $F = \dfrac{9C}{5} + 32$ converts degrees Celsius, C, to degrees Fahrenheit, F.

(a) Make C the subject of the formula. [2]



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(a) Make C the subject of the formula. [2]



(a)

- subtract 32: $F - 32 = \dfrac{9C}{5}$
- multiply by 5, then divide by 9: $\boldsymbol{C = \dfrac{5(F - 32)}{9}}$

Exercise 3.1 (b)

3.1 The formula $F = \dfrac{9C}{5} + 32$ converts degrees Celsius, C, to degrees Fahrenheit, F.

(b) Work out C when $F = 77$. [1]

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(b)

- $C = \dfrac{5(F - 32)}{9} = \dfrac{5 \times (77 - 32)}{9} = \dfrac{5 \times 45}{9} = \mathbf{25}$

Setup for exercise 3.2

3.2 Zara makes t the subject of $s = ut + 5$ and writes $t = s - 5 - u$. Explain her mistake and write the correct formula. [2]



3.3 Make u the subject of $v^2 = u^2 + 2as$. [2]



Exercise 3.2

3.4 *(H)* Make x the subject of $px - q = rx + 7$. [3]



3.5 *(H)* Make a the subject of $\dfrac{a+2}{a} = b$. [3]



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3.2

- ut means $u \times t$, so she must **divide** by u, not subtract it
- $s - 5 = ut$, so $\boldsymbol{t = \dfrac{s-5}{\quad}}$

Full solution on next slide

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Full solution 3.2 (1/2)

3.2

- ut means $u \times t$, so she must **divide** by u, not subtract it
- $s - 5 = ut$, so $\boldsymbol{t = \dfrac{s-5}{u}}$

3.3

- subtract $2as$: $u^2 = v^2 - 2as$
- square-root: $\boldsymbol{u = \sqrt{v^2 - 2as}}$

Full solution 3.2 (2/2)

3.4

- collect the x-terms on the left and the rest on the right: $px - rx = 7 + q$
- factorise: $x(p - r) = 7 + q$
- $\boldsymbol{x = \dfrac{q + 7}{p - r}}$

3.5

- multiply both sides by a: $a + 2 = ab$
- collect the a-terms: $2 = ab - a = a(b - 1)$
- $\boldsymbol{a = \dfrac{2}{b - 1}}$