Functional Skills Maths Level 2

Complete Study Guide

Every topic explained with worked examples, rules, and practice.

10 Topics | Key Rules | Worked Examples | Practice with Answers

1. Standard Form

Standard form writes numbers as A × 10^n where 1 ≤ A < 10.

Key Rules

```
Rule: Large numbers: move decimal left, positive power. 350,000 = 3.5 × 10^5
Rule: Small numbers: move decimal right, negative power. 0.0042 = 4.2 × 10^-3
Rule: Multiplying: multiply numbers, add powers. (3×10^4)(2×10^3) = 6×10^7
Rule: Dividing: divide numbers, subtract powers. (8×10^5)÷(4×10^2) = 2×10^3
```

Worked Examples

```
Example: Write 0.00056 in standard form → 5.6 × 10^-4 (moved 4 places right)
Example: (4.5×10^3)+(5.5×10^2) = 4500+550 = 5050 = 5.05×10^3
```

Watch out: The first number MUST be between 1 and 10. 45×10^3 is wrong — should be 4.5×10^4.

Practice: Write 7,200,000 in standard form.

Answer: 7.2 × 10^6

Practice: Calculate (6×10^4)×(3×10^2).

Answer: 18×10^6 = 1.8×10^7

2. Algebra & Equations

Use letters for unknowns. Simplify, solve, expand brackets, and factorise.

Key Rules

```
Rule: Simplify: collect like terms. 3x + 5y − x + 2y = 2x + 7y
Rule: Solve: do the same to both sides. Get x on one side.
Rule: Expand single bracket: 3(2x + 4) = 6x + 12
Rule: Expand double brackets (FOIL): (x+3)(x−2) = x² + x − 6
Rule: Factorise: find HCF. 6x + 9 = 3(2x + 3)
```

Worked Examples

```
Example: Solve: 5x − 3 = 2x + 12 → 3x = 15 → x = 5
Example: Expand: 2(3x + 4) − 3(x − 2) = 6x + 8 − 3x + 6 = 3x + 14
```

Watch out: −3(x − 2): negative × negative = positive. −3 × −2 = +6.

Practice: Solve: 4(x + 2) = 3x + 11

Answer: 4x + 8 = 3x + 11, so x = 3

Practice: Expand: (x + 5)(x − 3)

Answer: $x^2 + 2x - 15$

3. Percentages & Compound Interest

Handle increases, decreases, reverse percentages, and compound interest.

Key Rules

```
Rule: Increase: multiply by (1 + rate). 15% increase = × 1.15
Rule: Decrease: multiply by (1 − rate). 20% decrease = × 0.8
Rule: Compound interest: Final = Original × (1 + r)^n
Rule: Reverse %: if £72 is AFTER a 10% increase, original = £72 ÷ 1.1
```

Worked Examples

```
Example: £8,000 at 3.5% for 3 years: £8,000 × 1.035³ = £8,869.74
Example: TV £396 inc 20% VAT. Pre-VAT: £396 ÷ 1.2 = £330
```

Watch out: For reverse %, always DIVIDE by the multiplier. Never subtract from the final amount.

Practice: £5,000 at 4% for 2 years?

Answer: £5,000 × 1.04² = £5,408

Practice: Jacket £68 after 15% off. Original?

Answer: £68 ÷ 0.85 = £80

4. Ratio & Proportion

Compare quantities, share amounts, scale recipes, handle exchange rates.

Key Rules

```
Rule: Share in ratio: total parts → divide → multiply each share
Rule: Scaling: find scale factor. Recipe for 4 → 6: factor = 1.5
Rule: Inverse proportion: workers × time = constant
Rule: Exchange rates: £ → foreign = multiply. Foreign → £ = divide.
```

Worked Examples

```
Example: Share £840 in 3:4:5. Total = 12 parts. One part = £70. Shares: £210, £280, £350
Example: 4 workers take 6 days. 3 workers? Work = 24 worker-days. 24 ÷ 3 = 8 days
```

Practice: €504 to £ at £1 = €1.12

Answer: €504 ÷ 1.12 = £450

Practice: Cement:sand = 1:6. Sand for 4kg cement?

Answer: 6 × 4 = 24 kg

5. Area, Perimeter & Volume

Work with circles, cylinders, cones, trapeziums, and compound shapes.

Key Rules

```
Rule: Circle: Area = πr², Circumference = πd
Rule: Trapezium: Area = ½(a + b) × h
Rule: Cylinder: V = πr²h
Rule: Cone: V = (1/3)πr²h
Rule: Compound shapes: split into simpler shapes, then add/subtract
```

Worked Examples

```
Example: Cylinder r=5cm, h=12cm: V = π × 25 × 12 = 942.5 cm³
Example: Garden 15×10m, pond r=2m. Grass = 150 − π × 4 = 150 − 12.57 = 137.43 m²
```

Watch out: Diameter vs radius! If given diameter, HALVE it first.

Practice: Cone r=3, h=10. Volume?

Answer: (1/3) × π × 9 × 10 = 94.2 cm³

Practice: Trapezium: 8m, 12m, h=5m. Area?

Answer: ½(8+12) × 5 = 50 m²

6. Pythagoras' Theorem

For right-angled triangles: $a^2 + b^2 = c^2$ (c is the hypotenuse).

Key Rules

```
Rule: Finding hypotenuse: c = √(a² + b²)
Rule: Finding shorter side: a = √(c² − b²)
Rule: Common triples: 3, 4, 5  |  5, 12, 13  |  8, 15, 17  |  7, 24, 25
```

Worked Examples

```
Example: Ladder 8m, base 3m from wall: h² = 64 − 9 = 55, h = √55 = 7.42 m
Example: Sides 5 and 12: c² = 25 + 144 = 169, c = 13 cm
```

Watch out: Finding hypotenuse = ADD squares. Finding shorter side = SUBTRACT.

Practice: Pole 15m, ground 20m. Wire length?

Answer: √(225 + 400) = √625 = 25 m

Practice: Rectangle 9 × 12. Diagonal?

Answer: √(81 + 144) = √225 = 15 cm

7. Statistics & Probability

Calculate averages, work with frequency tables, and understand probability.

Key Rules

```
Rule: Mean = total ÷ count. From freq table: Σ(value × freq) ÷ Σfreq
Rule: Median = middle value (ordered). Even count: average of middle two.
Rule: Mode = most common. Range = highest − lowest.
Rule: Probability = favourable ÷ total. Between 0 and 1.
Rule: Expected frequency = probability × number of trials
```

Worked Examples

```
Example: Freq table: 10(×3), 20(×5), 30(×2). Mean = (30+100+60) ÷ 10 = 19
Example: P(even on a fair die) = 3/6 = 0.5. In 120 rolls: 120 × 0.5 = 60 expected
```

Practice: Mean of 4(×5), 7(×8), 10(×2)?

Answer: (20+56+20) ÷ 15 = 6.4

Practice: P(win) = 0.02. 500 tickets. Expected wins?

Answer: 500 × 0.02 = 10

8. Inequalities & Sequences

Solve inequalities like equations. Find patterns in sequences.

Key Rules

```
Rule: Solve like equations. If you × or ÷ by a NEGATIVE, FLIP the inequality sign.
Rule: < does NOT include the value. ≤ DOES include. List integers carefully.
Rule: nth term (arithmetic): find difference d. Formula = dn + (first − d)
```

Worked Examples

```
Example: Solve: 3(x − 2) > 15 → x − 2 > 5 → x > 7
Example: Sequence 4, 9, 14, 19: diff = 5. nth term = 5n + (4 − 5) = 5n − 1
```

Watch out: Dividing by negative FLIPS the sign: −2x > 6 becomes x < −3.

Practice: Solve: 4x + 7 ≤ 31

Answer: 4x ≤ 24, x ≤ 6

Practice: nth term of 3, 8, 13, 18, ...

Answer: Diff = 5. nth = 5n − 2

9. Scale, Conversion & Rates

Convert units, use scale drawings, calculate speed / density / fuel.

Key Rules

```
Rule: Scale: 1:25,000 means 1cm = 25,000cm = 250m = 0.25km
Rule: Speed = distance ÷ time. Distance = speed × time. Time = distance ÷ speed.
Rule: Density = mass ÷ volume
Rule: km/h → m/s: ÷ 3.6.   m/s → km/h: × 3.6
```

Worked Examples

```
Example: Map 1:50,000. 7.4cm apart: 7.4 × 50,000 = 370,000 cm = 3.7 km
Example: 195 miles in 3h 15m: 3.25h. Speed = 195 ÷ 3.25 = 60 mph
```

Watch out: Always convert time to a single unit before calculating speed.

Practice: Map 1:25,000. Actual 4.5 km. Map distance?

Answer: 450,000 ÷ 25,000 = 18 cm

Practice: Density 8.9 g/cm³, volume 45 cm³. Mass?

Answer: 8.9 × 45 = 400.5 g

10. Real-World Multi-Step Problems

Break complex problems into steps. Show all working.

Key Rules

```
Rule: Step 1: Read carefully. What do you need to find?
Rule: Step 2: Write down the numbers and operations needed.
Rule: Step 3: Work through systematically.
Rule: Step 4: Check the answer is sensible.
```

Worked Examples

```
Example: Utility bills: standing charge × days + rate × usage + VAT
Example: Best buy: find price per unit for each option
Example: Tax: income − allowance = taxable. Tax = taxable × rate. Take-home = income − tax.
```

Watch out: Always show working! You get method marks even if the final answer is wrong.

Practice: Builder: £45/hr × 8 hrs + £320 materials + 20% VAT

Answer: 360 + 320 = 680. × 1.2 = £816

Practice: Tank 1,200L. In 15 L/min, out 3 L/min. Fill time?

Answer: Net = 12 L/min. 1,200 ÷ 12 = 100 min