

Exercise walk-through

# 2.1.2

## Algebra Language

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AQA · GCSE · Mathematics

## 141. Graphical gradients and area estimates · Higher

### Graphical gradients and area estimates · Higher

For a distance curve  $d=t^2$ , the chord from (1,1) to (3,9) has gradient  $(9-1)/(3-1)=4$ . A tangent at (2,4) passes through (1,0) and (3,8), giving gradient 4 without calculus. A velocity-time trapezium with endpoint velocities 2 and 6 m/s over 3 s has area  $(2+6) \times 3/2 = 12$  m. Smaller strips can improve a curved-area estimate; curvature affects over/underestimation. A cost-versus-quantity tangent through (2,12) and (6,28) gives a local rate  $(28-12)/(6-2)=4$  yuan per extra item, linking graph slope to a financial interpretation.

## 183. Reasoning and check

### Reasoning and check

For  $F(x) = (x^2 - 9)/(x - 3)$ , factor  $x^2 - 9 = (x - 3)(x + 3)$ . Thus  $F(x) = x + 3$  for  $x \neq 3$ ;  $F(5) = 8$ , but  $F(3)$  is undefined, not 6. For addition,  $1/(x - 1) + 2/(x + 1) = [(x + 1) + 2(x - 1)]/[(x - 1)(x + 1)] = (3x - 1)/(x^2 - 1)$ , with  $x \neq \pm 1$ . At  $x = 3$ , both forms give 1. For subtraction, the numerator is  $(x + 1) - 2(x - 1) = 3 - x$ , so the minus sign acts on both terms. Multiplication  $[(x - 1)/(x + 2)] \times [(x + 2)/(x + 1)]$  gives  $(x - 1)/(x + 1)$ , but the original excludes  $x = -2$  and  $x = -1$ . Division  $[(x^2 - 1)/(x^2 + 3x + 2)] \div [(x - 1)/(x + 2)]$  gives 1, yet  $x = -2, -1, 1$  are excluded:  $x = 1$  makes the divisor zero. Finally  $F(x) = 6$  reduces to  $x + 3 = 6$ .

## 186. Reasoning and check

### Reasoning and check

AQA A4 Higher includes algebraic fractions and valid cancellation. The equation example checks whether a candidate is inside the original domain. Explain each factor cancellation, retain original restrictions and check every equation candidate. These operations extend the existing manipulation example into a complete worked arithmetic sequence.

## Exercises 2.1·2.3

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**2.1** (Foundation) Find  $4+3d$  when  $d=5$ .

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**2.2** (Foundation) Find  $a^2b$  for  $a=-2, b=3$ .

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**2.3** (Foundation) Find  $(3/4)x$  for  $x=8$ .

**3** Exam-style questions

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## Exercises 2.1·2.3

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**2.1** (Foundation) Find  $4+3d$  when  $d=5$ .

**2.1** Substitute:  $4+15=19$ .

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**2.2** (Foundation) Find  $a^2b$  for  $a=-2, b=3$ .

**2.2** Square  $-2$  in brackets to get  $4$ ; multiply by  $3$ .

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**2.3** (Foundation) Find  $(\frac{3}{4})x$  for  $x=8$ .

## 3 Exam-style questions

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**2.3**  $8/4 \times 3 = 6$ .

## Exercise 3.1

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**3.1** Decide whether this claim is true. Justify with a concrete calculation or counterexample: In the expression  $3x^2$ , the coefficient of  $x^2$  is 2.

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**3.1** False. The coefficient multiplying  $x^2$  is 3; the exponent is 2. At  $x=2$  the term is  $3 \times 4 = 12$ .

Local review guidance: show the chosen method; give the checked result; explain the condition or failed shortcut. This is authored classroom guidance.