

2.1 Expressions, indices and formulae

Name: _____ Class: _____ Date: _____

Total: 24 marks

KEY WORDS identity • equation

Expressions, indices and formulae

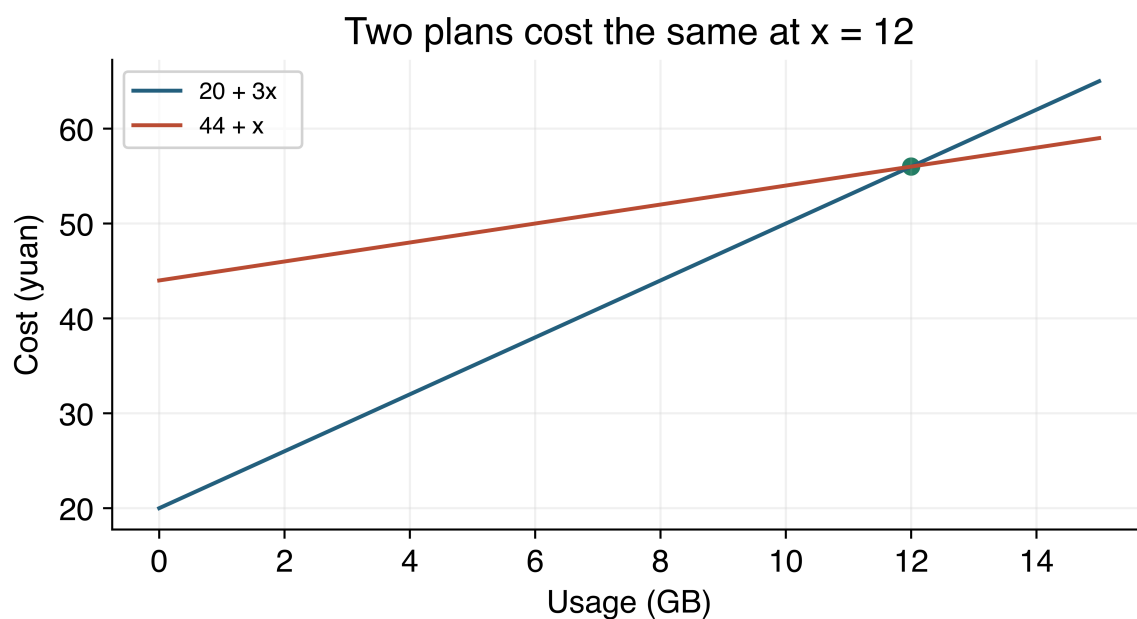
Objective

Use symbols and index laws (integer, fractional, negative and zero powers), substitute, expand and factorise expressions, and change the subject of formulae including subject-twice and power cases (objectives Foundation 2.1–2.3 and Higher 2.1–2.3).

1 Key knowledge and worked examples

Index laws. Same base: multiply adds the indices, divide subtracts them, powers multiply them: $x^m \times x^n = x^{m+n}$, $x^m \div x^n = x^{m-n}$, $(x^m)^n = x^{mn}$. Special values: $x^0 = 1$, $x^{-n} = 1/x^n$, $x^{1/2} = \sqrt{x}$. An equation in one base becomes an equation in indices only.

Changing the subject. Apply the same operation to both sides until the letter stands alone. Powers need rooting: $V = \frac{4}{3}\pi r^3 \Rightarrow r = \sqrt[3]{\frac{3V}{4\pi}}$. Subject twice: collect first. From $4a + 3 = 5(a - r)$, expanding gives $4a + 3 = 5a - 5r$, so $a = 5r + 3$. Check by substituting numbers into both forms.



Original native-lesson illustration; labels belong to its worked example.

2 Practice

2.1 Simplify $x^5 \times x^{-2} \div x^0$, giving your answer as a single power. [2]

2.2 Evaluate $27^{1/3} \times 4^{1/2}$ [2]

2.3 Expand and simplify $(x + 8)(x - 5)$ [2]

2.4 Factorise fully $x^2 + 10x + 24$ [2]

2.5 Make t the subject of $v = u + at$ [2]

2.6 Expand and simplify $(x + 2)(x + 3)(x - 1)$ [3]

3 Exam-style questions

3.1 (*Edexcel 4MA1 2HR June 2024 Q7, adapted.*) Given that $\frac{3^{n-2} \times 3^{n+5}}{3^{3n+10}} = 1$, find the value of n . [2]

3.2 (*Original.*) Make r the subject of $V = \frac{4}{3}\pi r^3$ [3]

3.3 (*Original.*) Make l the subject of $T = 2\pi\sqrt{\frac{l}{g}}$ [3]

3.4 (*Original.*) The three angles of a triangle are a° , $(a + 10)^\circ$ and $(a + 20)^\circ$. Set up and solve an equation to find a . [3]

Solutions

2.1 $x^{5+(-2)-0} = x^3$ (dividing by $x^0 = 1$ changes nothing).

2.2 $\sqrt[3]{27} \times \sqrt{4} = 3 \times 2 = 6$.

2.3 $x^2 + 3x - 40$.

2.4 $(x + 6)(x + 4)$.

2.5 $at = v - u$, so $t = \frac{v - u}{a}$.

2.6 $(x^2 + 5x + 6)(x - 1) = x^3 + 4x^2 + x - 6$.

3.1 One base, so indices combine: $(n - 2) + (n + 5) - (3n + 10) = 0$, giving $-n - 7 = 0$ and $n = -7$.

3.2 Multiply by 3: $3V = 4\pi r^3$; divide by 4π : $r^3 = \frac{3V}{4\pi}$; cube root: $r = \sqrt[3]{\frac{3V}{4\pi}}$.

3.3 Square both sides: $T^2 = \frac{4\pi^2 l}{g}$, so $l = \frac{gT^2}{4\pi^2}$.

3.4 Angles sum to 180° : $3a + 30 = 180$, so $a = 50$ (angles 50° , 60° , 70° – check: sum 180° ✓).

Local review guidance: index arithmetic on the exponents only, never on the bases; subjects isolated with correct power handling; checks by substitution into the original form. This is authored classroom guidance.