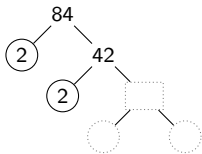


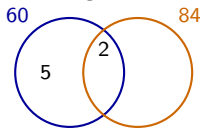
Algebraic Fractions: Starters

Starter 1: Prime Factors & HCF

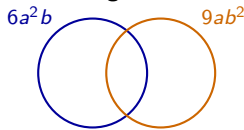
Factor tree



Venn diagram A



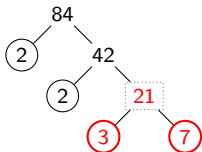
Venn diagram B



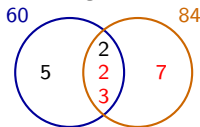
1. Simplify $\sqrt{20}$.
2. Work out 2^{-1} and $9^{\frac{1}{2}}$.
3. Complete the factor tree. Write 84 as a product of prime factors in index form.
4. $60 = 2^2 \times 3 \times 5$. Complete Venn diagram A for 60 and 84, then find the HCF and the LCM of 60 and 84.
5. Simplify $\frac{60}{84}$ by dividing by the HCF. Which numbers in Venn diagram A are not in the HCF?
6. Simplify $\frac{x^5}{x^2}$ by writing out the xs and cancelling.
7. (Challenge) Complete Venn diagram B for $6a^2b$ and $9ab^2$. Use it to simplify $\frac{6a^2b}{9ab^2}$.

Starter 1: Prime Factors & HCF

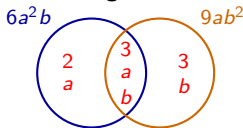
Factor tree



Venn diagram A



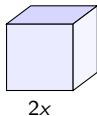
Venn diagram B



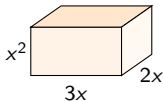
1. Simplify $\sqrt{20}$.
 $\sqrt{4 \times 5} = 2\sqrt{5}$
2. Work out 2^{-1} and $9^{\frac{1}{2}}$.
 $\frac{1}{2}$ and 3
3. Complete the factor tree. Write 84 as a product of prime factors in index form. $84 = 2^2 \times 3 \times 7$
4. $60 = 2^2 \times 3 \times 5$. Complete Venn diagram A for 60 and 84, then find the HCF and the LCM of 60 and 84. $\text{HCF} = 12$; $\text{LCM} = 2^2 \times 3 \times 5 \times 7 = 420$
5. Simplify $\frac{60}{84}$ by dividing by the HCF. Which numbers in Venn diagram A are not in the HCF?
 $\frac{5}{7}$: the 5 and the 7, which are not shared
6. Simplify $\frac{x^5}{x^2}$ by writing out the xs and cancelling.
 x^2 cancels from the top and the bottom, leaving $x^3 = x^{5-2}$
7. (Challenge) Complete Venn diagram B for $6a^2b$ and $9ab^2$. Use it to simplify $\frac{6a^2b}{9ab^2}$. The HCF is $3ab$, so $\frac{6a^2b}{9ab^2} = \frac{2a}{3b}$

Starter 2: Index Laws

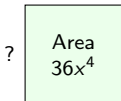
Cube



Cuboid



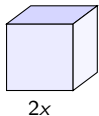
Square



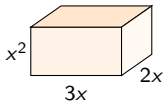
1. Write 72 as a product of prime factors in index form.
2. Simplify $\sqrt{8} + \sqrt{18}$.
3. Simplify $x^4 \times x^3$ and $y^8 \div y^2$.
4. Write 2^{-3} and x^{-2} as fractions.
5. Find the volume of the cube. Is it $2x^3$ or $8x^3$?
6. Find the volume of the cuboid.
7. The square has area $36x^4$, so its side length is $(36x^4)^{\frac{1}{2}}$. Simplify this.
8. (Extension) Complete the working.
$$8^{-\frac{2}{3}} = \frac{1}{8^{\frac{2}{3}}} = \frac{1}{(\sqrt[3]{8})^2} = \frac{1}{\square^2} = \square$$
9. (Challenge) Divide the volume of the cube by the volume of the cuboid. Write the answer as a fraction in its simplest form.

Starter 2: Index Laws

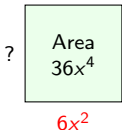
Cube



Cuboid



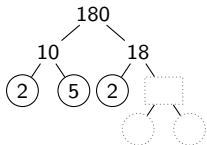
Square



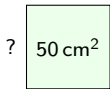
1. Write 72 as a product of prime factors in index form.
 $72 = 2^3 \times 3^2$
2. Simplify $\sqrt{8} + \sqrt{18}$.
 $2\sqrt{2} + 3\sqrt{2} = 5\sqrt{2}$
3. Simplify $x^4 \times x^3$ and $y^8 \div y^2$. x^7 and y^6
4. Write 2^{-3} and x^{-2} as fractions. $\frac{1}{8}$ and $\frac{1}{x^2}$
5. Find the volume of the cube. Is it $2x^3$ or $8x^3$?
 $(2x)^3 = 2^3 x^3 = 8x^3$
6. Find the volume of the cuboid.
 $3x \times 2x \times x^2 = 6x^4$
7. The square has area $36x^4$, so its side length is $(36x^4)^{\frac{1}{2}}$. Simplify this. $36^{\frac{1}{2}} \times x^{4 \times \frac{1}{2}} = 6x^2$
8. (Extension) Complete the working.
$$8^{-\frac{2}{3}} = \frac{1}{8^{\frac{2}{3}}} = \frac{1}{(\sqrt[3]{8})^2} = \frac{1}{2^2} = \frac{1}{4}$$
9. (Challenge) Divide the volume of the cube by the volume of the cuboid. Write the answer as a fraction in its simplest form. $\frac{8x^3}{6x^4} = \frac{4}{3x}$

Starter 3: Surds & Single Brackets

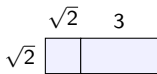
Factor tree



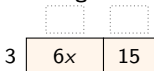
Square



Rectangle A



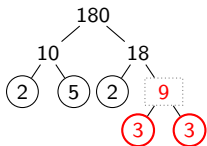
Rectangle B



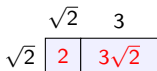
- Find the HCF of 18 and 24.
- Work out $16^{\frac{1}{2}}$ and $16^{-\frac{1}{2}}$.
- Complete the factor tree. Write 180 as a product of prime factors in index form.
- Use the prime factors to simplify $\sqrt{180}$.
- The square has area 50 cm^2 . Find its side length as a simplified surd, and its perimeter.
- Complete rectangle A to expand $\sqrt{2}(\sqrt{2} + 3)$.
- Complete rectangle B to factorise $6x + 15$. Then simplify $\frac{6x + 15}{3}$.
- (Challenge) Sam says $\frac{6 + \sqrt{18}}{3} = 2 + \sqrt{18}$. Explain Sam's mistake, then simplify it correctly.

Starter 3: Surds & Single Brackets

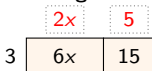
Factor tree



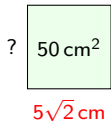
Rectangle A



Rectangle B



Square



- Find the HCF of 18 and 24. **6**
- Work out $16^{\frac{1}{2}}$ and $16^{-\frac{1}{2}}$. **4 and $\frac{1}{4}$**
- Complete the factor tree. Write 180 as a product of prime factors in index form.
 $180 = 2^2 \times 3^2 \times 5$
- Use the prime factors to simplify $\sqrt{180}$.
 $\sqrt{2^2 \times 3^2 \times 5} = 2 \times 3 \times \sqrt{5} = 6\sqrt{5}$
- The square has area 50 cm^2 . Find its side length as a simplified surd, and its perimeter.
 $\sqrt{50} = 5\sqrt{2} \text{ cm}$; $4 \times 5\sqrt{2} = 20\sqrt{2} \text{ cm}$
- Complete rectangle A to expand $\sqrt{2}(\sqrt{2} + 3)$.
 $2 + 3\sqrt{2}$
- Complete rectangle B to factorise $6x + 15$. Then simplify $\frac{6x + 15}{3}$. **$3(2x + 5)$; $2x + 5$, not $2x + 15$**
- (Challenge) Sam says $\frac{6 + \sqrt{18}}{3} = 2 + \sqrt{18}$. Explain Sam's mistake, then simplify it correctly.
Divide both terms by 3: $2 + \frac{3\sqrt{2}}{3} = 2 + \sqrt{2}$

Starter 4: Double Brackets

Grid A

	x	5
x	x^2	
2		

Grid B

	x	
x	x^2	
		12

Area = $x^2 + 7x + 12$

- Is 3^{-2} equal to -9 , -6 or $\frac{1}{9}$?
- Simplify $\sqrt{50} - \sqrt{8}$. Is it $\sqrt{42}$?
- Complete grid A to expand $(x + 2)(x + 5)$.
- Write 12 as a product of prime factors, then list its factor pairs. Which pair adds to 7?
- Complete grid B to factorise $x^2 + 7x + 12$.
- A rectangle has area $x^2 + 7x + 12$ and width $x + 3$. Find its length. Use this to simplify $\frac{x^2 + 7x + 12}{x + 3}$.
- Factorise $x^2 - 9$. Use the difference of two squares to expand $(3 + \sqrt{2})(3 - \sqrt{2})$.
- (Challenge) $391 = 20^2 - 3^2$. Use this to write 391 as a product of prime factors.

Starter 4: Double Brackets

Grid A

	x	5
x	x^2	$5x$
2	$2x$	10

Grid B

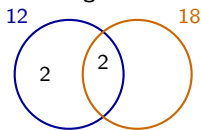
	x	4
x	x^2	$4x$
3	$3x$	12

Area = $x^2 + 7x + 12$

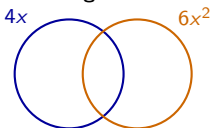
- Is 3^{-2} equal to -9 , -6 or $\frac{1}{9}$? $\frac{1}{3^2} = \frac{1}{9}$
- Simplify $\sqrt{50} - \sqrt{8}$. Is it $\sqrt{42}$? **No:**
 $5\sqrt{2} - 2\sqrt{2} = 3\sqrt{2}$
- Complete grid A to expand $(x + 2)(x + 5)$.
 $x^2 + 7x + 10$
- Write 12 as a product of prime factors, then list its factor pairs. Which pair adds to 7? $2^2 \times 3$;
 $1 \times 12, 2 \times 6, 3 \times 4; 3 + 4 = 7$
- Complete grid B to factorise $x^2 + 7x + 12$.
 $(x + 3)(x + 4)$, in either order
- A rectangle has area $x^2 + 7x + 12$ and width $x + 3$. Find its length. Use this to simplify $\frac{x^2 + 7x + 12}{x + 3}$.
 $\frac{(x + 3)(x + 4)}{x + 3} = x + 4$
- Factorise $x^2 - 9$. Use the difference of two squares to expand $(3 + \sqrt{2})(3 - \sqrt{2})$. $(x + 3)(x - 3)$;
 $9 - 2 = 7$
- (Challenge) $391 = 20^2 - 3^2$. Use this to write 391 as a product of prime factors.
 $(20 + 3)(20 - 3) = 23 \times 17$, both prime

Starter 5: LCM & Fractions

Venn diagram A



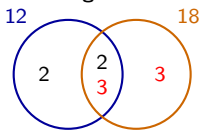
Venn diagram B



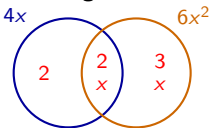
1. Simplify $a^3 \times a^{-1}$.
2. Work out $\sqrt{8} \times \sqrt{2}$.
3. $12 = 2^2 \times 3$ and $18 = 2 \times 3^2$. Complete Venn diagram A, then find the HCF and the LCM of 12 and 18.
4. Complete: $\frac{5}{12} + \frac{7}{18} = \frac{\boxed{}}{36} + \frac{\boxed{}}{36} = \frac{\boxed{}}{36}$
5. Write $\frac{x}{12} - \frac{x}{18}$ as a single fraction.
6. Work out $\frac{3}{4} \times \frac{8}{9}$. Then simplify $\frac{3x}{4} \div \frac{9x}{10}$.
7. $4x = 2 \times 2 \times x$ and $6x^2 = 2 \times 3 \times x \times x$. Complete Venn diagram B, then find the LCM of $4x$ and $6x^2$.
8. (Challenge) Write $\frac{5}{4x} + \frac{1}{6x^2}$ as a single fraction.

Starter 5: LCM & Fractions

Venn diagram A



Venn diagram B



1. Simplify $a^3 \times a^{-1}$.
 $a^{3+(-1)} = a^2$
2. Work out $\sqrt{8} \times \sqrt{2}$.
 $\sqrt{16} = 4$
3. $12 = 2^2 \times 3$ and $18 = 2 \times 3^2$. Complete Venn diagram A, then find the HCF and the LCM of 12 and 18. **HCF = 6; LCM = $2^2 \times 3^2 = 36$**
4. Complete: $\frac{5}{12} + \frac{7}{18} = \frac{15}{36} + \frac{14}{36} = \frac{29}{36}$
5. Write $\frac{x}{12} - \frac{x}{18}$ as a single fraction.
 $\frac{3x}{36} - \frac{2x}{36} = \frac{x}{36}$
6. Work out $\frac{3}{4} \times \frac{8}{9}$. Then simplify $\frac{3x}{4} \div \frac{9x}{10}$.
 $\frac{24}{36} = \frac{2}{3}$; $\frac{3x}{4} \times \frac{10}{9x} = \frac{30x}{36x} = \frac{5}{6}$
7. $4x = 2 \times 2 \times x$ and $6x^2 = 2 \times 3 \times x \times x$.
Complete Venn diagram B, then find the LCM of $4x$ and $6x^2$. **$2 \times 2 \times 3 \times x \times x = 12x^2$**
8. (Challenge) Write $\frac{5}{4x} + \frac{1}{6x^2}$ as a single fraction.
 $\frac{15x}{12x^2} + \frac{2}{12x^2} = \frac{15x+2}{12x^2}$