GCSE Mathematics – Unit 18: Fractions, Indices and Standard Form **Name:……**

Topic/Skill	Definition/Tips	Example	Your Turn
Multiplying Fractions	**Multiply** the **numerators** together and **multiply** the **denominators** together. Simplify if you can.	$\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ $\frac{3}{8} \times \frac{2}{9} = \frac{6}{72} = \frac{1}{12}$	 $\frac{5}{7} \times \frac{3}{11} =$
Dividing Fractions	**Multiply by the reciprocal** Keep the first fraction the same Flip the second fraction upside down Change the divide to a multiply Multiply by the reciprocal of the second fraction.	$\frac{1}{2} \div \frac{1}{2} = \frac{1}{2} \times \frac{2}{1} = \frac{2}{2} = 1$ $\frac{3}{4} \div \frac{5}{6} = \frac{3}{4} \times \frac{6}{5} = \frac{18}{20} = \frac{9}{10}$	$\frac{1}{4} \div \frac{1}{4} =$ $\frac{12}{25} \div \frac{4}{5} =$
Multiplication Index Law	When **multiplying** with the same base (number or letter), **add the powers**. $a^m \times a^n = a^{m+n}$ **This only works with the same base number!**	$7^5 \times 7^3 = 7^8$ $3^2 \times 4^2 \; can't \; be \; simplified$ $a^{12} \times a = a^{13}$ $4x^5 \times 2x^8 = 8x^{13}$	Watch out for expressions that can't be simplified: $5^2 \times 5^3 =$ $3x^2 \times 4x^5 =$

Division Index Law	When **dividing** with the same base (number or letter), **subtract the powers**. $a^m \div a^n = a^{m-n}$	$15^7 \div 15^4 = 15^3$ $x^9 \div x^2 = x^7$ $20a^{11} \div 5a^3 = 4a^8$	$15^{17} \div 5^3 =$ $x^9 \div x^2 = x^7$ $20a^{11} \div 5a^3 = 4a^8$
Brackets Index Laws	When raising a power to another power, multiply the powers together. $(a^m)^n = a^{mn}$ If there is a co-efficient inside the bracket then that is raised to the power, not multiplied.	$(y^2)^5 = y^{10}$ $(6^3)^4 = 6^{12}$ $(5x^6)^3 = 125x^{18}$	$(a^3)^4 =$ $(8^2)^5 =$ $(4x^2)^3 =$
Notable Powers	$p = p^1$ $p^0 = 1$	$99999^0 = 1$	$300^1 =$ $42^0 =$
Negative Powers	A negative power performs the reciprocal. $a^{-m} = \frac{1}{a^m}$	$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$	$5^{-3} =$ $x^{-4} =$
Fractional Powers	The **denominator** of a fractional power acts as a 'root'.	$9^{\frac{1}{2}} = \sqrt{9} = 3$	$a^{\frac{1}{4}} =$

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<td>The numerator of a fractional power acts as a normal power.

$a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m$</td>
<td>$27^{\frac{2}{3}} = \left(\sqrt[3]{27}\right)^2 = 3^2 = 9$

$\left(\frac{25}{16}\right)^{\frac{3}{2}} = \left(\frac{\sqrt{25}}{\sqrt{16}}\right)^3 = \left(\frac{5}{4}\right)^3 = \frac{125}{64}$</td>
<td>$64^{\frac{2}{3}} =$

$\left(\frac{9}{36}\right)^{\frac{2}{3}} =$</td>
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<tr>
<td>Standard Form</td>
<td>$A \times 10^b$

$where\ 1 \leq A < 10,\ b = integer$
Remember 10^3 means</td>
<td colspan="2">
<table>
<tr><th>Ordinary Number</th><th>Standard Form</th></tr>
<tr><td>8400</td><td>8.4×10^3</td></tr>
<tr><td>35000</td><td></td></tr>
<tr><td></td><td>7.2×10^7</td></tr>
<tr><td>0.00036</td><td>3.6×10^{-4}</td></tr>
<tr><td>0.0015</td><td></td></tr>
<tr><td></td><td>2.4×10^{-2}</td></tr>
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<td>Multiplying or Dividing with Standard Form</td>
<td>Multiply: Multiply the numbers and add the powers.</td>
<td>$\left(1.2 \times 10^3\right) \times \left(4 \times 10^6\right) = 8.8 \times 10^9$

$\left(4.5 \times 10^5\right) \div \left(3 \times 10^2\right) = 1.5 \times 10^3$</td>
<td>$\left(3.3 \times 10^5\right) \times \left(4 \times 10^2\right) =$

$\left(6.5 \times 10^7\right) \div \left(5 \times 10^2\right) =$</td>
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	Divide: **Divide the numbers** and **subtract the powers**.		
Adding or Subtracting with Standard Form	**Convert** in to **ordinary** numbers, **calculate** and then **convert back** in to standard form If the power is too difficult to convert into an ordinary number, see if you can change one number into the same form as another	$2.7\times10^4 + 4.6\times10^3$ $= 27000 + 4600 = 31600$ $= 3.16\times10^4$ $3.1\times10^{90} + 2.2\times10^{89}$ $= 3.1\times10^{90} + 0.22\times10^{90}$ $= 3.32\times10^{90}$	$3.1\times10^3 + 2.2\times10^5$ $5.2\times10^5 + 5.2\times10^2$