Investigating Multiplying Algebraic Powers

1. Complete the table to simplify these algebraic expressions.

Question	Working	Answer
$a^3 \times a^2$	$a \times a \times a \times a \times a$	a^5
$a^4 \times a^2$	$a \times a \times a \times a \times a \times a$	a^6
$a^2 \times a^6$	$a \times a \times a \times a \times a \times a \times a \times a$	a^8
$a^3 \times a^4$	$a \times a \times a \times a \times a \times a \times a$	a^7
$a^5 \times a^2$	$a \times a \times a \times a \times a \times a \times a$	a^7

2. Can you spot a rule which enables you to simplify the expressions without the need for working?

___When multiplying, we can add the powers_____

_____

3. Use your rule to simplify the following algebraic expressions.

(a) $a^6 \times a^3$ a^9 (b) $x^2 \times x^5$ x^7

(c) $d^3 \times d^6$ d^9 (d) $y^{11} \times y^4$ y^{15}

(e) $a^3 \times b^3$ a^3b^3 (f) $a^4 \times a^1$ a^5

(g) $c^{0.5} \times c^{1.5}$ c^2 (h) $f^9 \times f^{-2}$ f^7

(i) $p^{-1} \times p^5$ p^4 (j) $a^2 \times a^3 \times a^5$ a^{10}

(k) $x^4 \times x^0$ x^4 (l) $b^6 \times b^5 \times b^{-3}$ b^8

4. Now simplify these harder algebraic expressions.

(a) $2a^3 \times a^4$ $2a^7$ (b) $3d^2 \times 2d^3$ $6d^5$

(c) $4x^3 \times 5x^3$ $20x^6$ (d) $2b^9 \times 5b^4$ $10b^{13}$

(e) $3y^4 \times 3y^4$ $9y^8$ (f) $5p^7 \times 3p^{-1}$ $15p^6$

(g) $7x^1 \times 3x^{15}$ $21x^{16}$ (h) $8q^2 \times 5q^{-2}$ $40q^0$

(i) $6p^{2.5} \times 3p^{1.5}$ $18p^4$ (j) $5a^6 \times 2a^5 \times 3a^4$ $30a^{15}$

Investigating Dividing Algebraic Powers

1. Complete the table to simplify these algebraic expressions.

Question	Working	Answer
$a^5 \div a^2$	$\frac{a \times a \times a \times \cancel{a} \times \cancel{a}}{\cancel{a} \times \cancel{a}}$	a^3
$a^4 \div a^2$	$\frac{a \times a \times \cancel{a} \times \cancel{a}}{\cancel{a} \times \cancel{a}}$	a^2
$a^7 \div a^4$	$\frac{a \times a \times a \times \cancel{a} \times \cancel{a} \times \cancel{a} \times \cancel{a}}{\cancel{a} \times \cancel{a} \times \cancel{a} \times \cancel{a}}$	a^3
$a^8 \div a^3$	$\frac{a \times a \times a \times a \times a \times \cancel{a} \times \cancel{a} \times \cancel{a}}{\cancel{a} \times \cancel{a} \times \cancel{a}}$	a^5

2. Can you spot a rule which enables you to simplify the expressions without the need for working?

_____ When dividing, we can subtract the powers _____

_____

3. Use your rule to simplify the following algebraic expressions.

(a) $a^7 \div a^3$ a^4 (b) $x^5 \div x^2$ x^3

(c) $\frac{d^9}{d^3}$ d^6 (d) $\frac{y^{13}}{y^4}$ y^9

(e) $b^3 \div b^3$ b^0 (f) $a^4 \div b^2$ $\frac{a^4}{b^2}$

(g) $c^5 \div c^4$ c^1 (h) $f^{2.5} \div f^{0.5}$ f^2

(i) $p^{-1} \div p^5$ p^{-6} (j) $a^7 \div a^{-2}$ a^9

4. Now simplify these harder algebraic expressions.

(a) $10a^7 \div 5a^4$ $2a^3$ (b) $9d^6 \div 3d^2$ $3d^4$

(c) $\frac{25d^8}{5d^5}$ $5d^3$ (d) $\frac{28y^{11}}{4y^5}$ $7y^6$

(e) $27y^{15} \div 3y^8$ $9y^7$ (f) $10p^{3.5} \div 2p^{0.5}$ $5p^3$

(g) $16x^5 \div 4x^{-1}$ $4x^6$ (h) $40q^2 \div 5q^1$ $8q^1$

Investigating Algebraic Powers Raised to a Power

1. Complete the table to simplify these algebraic expressions.

Question	Working	Answer
$(a^3)^2$	$a^3 \times a^3$	a^6
$(a^5)^2$	$a^5 \times a^5$	a^{10}
$(a^4)^2$	$a^4 \times a^4$	a^8
$(a^2)^3$	$a^2 \times a^2 \times a^2$	a^6
$(a^4)^3$	$a^4 \times a^4 \times a^4$	a^{12}

2. Can you spot a rule which enables you to simplify the expressions without the need for working?

_____When raising a power to another power, we can multiply the powers _____

_____

3. Use your rule to simplify the following algebraic expressions.

(a) $(a^5)^2$ a^{10} (b) $(x^2)^4$ x^8

(c) $(b^3)^6$ b^{18} (d) $(f^7)^2$ f^{14}

(e) $(a^4)^3$ a^{12} (f) $(y^{11})^0$ y^0

(g) $(x^1)^4$ x^4 (h) $(a^{-5})^4$ a^{-20}

(i) $(b^{1.5})^2$ b^3 (j) $(a^{-3})^{-2}$ a^6

4. Now complete the table to simplify these harder algebraic expressions.

Question	Working	Answer
$(2a^5)^2$	$2a^5 \times 2a^5$	$4a^{10}$
$(2a^4)^3$	$2a^4 \times 2a^4 \times 2a^4$	$8a^{12}$
$(3a^5)^3$	$3a^5 \times 3a^5 \times 3a^5$	$27a^{15}$
$(2a^3)^4$	$2a^3 \times 2a^3 \times 2a^3 \times 2a^3$	$16a^{12}$