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Simplifying expressions

A LEVEL LINKS
Scheme of work: 1a. Algebraic expressions – basic algebraic manipulation, indices and surds

Key points

- $a^m \times a^n = a^{m+n}$
- $\frac{a^m}{a^n} = a^{m-n}$
- $(a^m)^n = a^{mn}$
- $a^0 = 1$
- $a^{\frac{1}{n}} = \sqrt[n]{a}$ i.e. the nth root of a
- $a^{\frac{m}{n}} = \sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m$
- $a^{-m} = \frac{1}{a^m}$
- The square root of a number produces two solutions, e.g. $\sqrt{16} = \pm 4$.

Example 1 Simplify $\frac{x^5}{x^2}$

$\frac{x^5}{x^2} = x^3$	use the rule $\frac{a^m}{a^n} = a^{m-n}$ to give $\frac{x^5}{x^2} = x^{5-2} = x^3$

Example 2 Simplify $6x^6 \times 3x^4$

$6x^6 \times 3x^4 = 18x^2$	$6 \times 3 = 18$ and then use the rule $a^m \times a^n = a^{m+n}$ to give $x^6 \times x^4 = x^{6+4} = x^{10}$

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Example 3 Simplify $(x^4)^2 \times 3x^5$

$(x^4)^2 \times 3x^5 = 3x^{13}$	$3 \times 1 = 3$ and then use the rule $(a^m)^n = a^{mn}$ following by to give $a^m \times a^n = a^{m+n}$ $(x^4)^2 \times x^5 = x^{4\times 2} \times x^5$ $= x^8 \times x^5$ $= x^{8+5}$ $= x^{13}$

Practice questions

1. (a) Simplify $a^4 \times a^5$

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(b) Simplify $\dfrac{45e^6 f^8}{5ef^2}$

.....

(c) Write down the value of $9^{\frac{1}{2}}$

.....

2. (a) Simplify $x^7 \times x^3$

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(b) Simplify $(m^4)^3$

.....

(c) Simplify $\dfrac{36af^8}{12a^5 f^2}$

.....

3. (a) Simplify $(p^3)^2$

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(b) Simplify $\dfrac{t^8}{t^3}$

.....

4. Simplify $(3x^2y^4)^3$

.....

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Answers

1. (a) a^9

(b) $9e^5f^6$

(c) 3

2. (a) x^{10}

(b) m^{12}

(c) $3a^{-4}f^6$

3. (a) p^6

(b) t^5

4. $27x^6y^{12}$