Laws of Indices

Literacy

Explain and illustrate the types of numbers you know that use indices.

RoK (Retention of Knowledge)

Express in Index Form

1) $5 \times 5 \times 5 \times 5$ 2) $8 \times 9 \times 9 \times 9$ 3) $\frac{1}{2 \times 2 \times 2}$

4) $\sqrt{8}$ 5) $\frac{3 \times 3 \times 3 \times 3}{3 \times 3}$ 6) $\frac{5 \times 5 \times 5 \times 7}{5 \times 5 \times 5 \times 5 \times 7 \times 7}$

Skill 1

Simplify

1) $y^5 \times y^2$
2) $p^5 \div p^2$
3) $w^{-4} \times w^7$
4) $q^{-3} \div q^8$
5) $t^{-3} \div t^{-8}$
6) $2h^2 \times 3h^4$
7) $9r^5 \div 3r^2$
8) $4p \times 5p^3$
9) $(x^5)^4$
10) $(2x^3)^2$
11) $(3x)^2 \times (2x)^2$
12) $(2x)^3 \div 8x^0$

Skill 2

Evaluate

1) $5^2 \times 5^3$
2) 4^{-2}
3) 500^0
4) $9^2 \times 3^{-2}$
5) $3^6 \div 3^4$
6) $2^{-2} \times 2^6$
7) $(2^3)^2$
8) $(3.79)^0$
9) 5^{-3}
10) $3^3 \div 3^{-1}$
11) $(3 \times 2^2)^2$
12) $\left(3^{\frac{1}{2}}\right)^2$

Skill 3

Simplify

1) $(t^{-2})^{-4}$
2) $p^{\frac{1}{2}} \times p^{\frac{1}{2}}$
3) $\left(r^{\frac{1}{2}}\right)^4$
4) $(y^5)^{\frac{1}{2}}$
5) $\left(q^{\frac{1}{5}}\right)^5 \times \left(q^{\frac{2}{3}}\right)^3$

Skill 4

Evaluate

1) $9^{\frac{1}{2}}$
2) $125^{\frac{1}{3}}$
3) $27^{\frac{2}{3}}$
4) $100^{-\frac{3}{2}}$
5) $64^{\frac{1}{3}} \times 81^{\frac{1}{2}}$
6) $\left(100^{\frac{1}{2}}\right)^{-4}$

Stretch 1

Solve these equations for x.

1) $5^x = 125$ 2) $2^{-x} = \frac{1}{8}$ 3) $23^x = 1$

4) $3^{2x} = 9$ 5) $10^x = 0.0001$ 6) $5^x + 2^x = 133$

Stretch 2

Consider the function $f(x) = \left(1 - \frac{1}{x}\right)^x$

So $f(1) = \left(1 + \frac{1}{1}\right)^1 = 2$

$f(2) = \left(1 + \frac{1}{2}\right)^2 = 2.25$

a) Find the value of $f(3), f(4)$ and $f(5)$

b) Find the value of $f(10), f(100)$ and $f(1000)$

c) When $\lim_{n \to \infty} \left(1 + \frac{1}{n}\right)^n$ What is the limit of the function, $f(x)$, when x tends to infinity.

Laws of indices Memory

1) $a^n \times a^m = a^{n+m}$

Example: $3^3 \times 3^5 = 3^{3+5} = 3^8$

2) $a^n \div a^m = a^{n-m}$

Example: $7^9 \div 7^4 = 7^{9-4} = 7^5$

3) $(a^n)^m = a^{n \times m}$

Example: $(5^3)^2 = 5^{3 \times 2} = 5^6$

4) $a^{-n} = \frac{1}{a^n}$

Example: $3^4 \div 3^6 = \frac{\cancel{3} \times \cancel{3} \times \cancel{3} \times \cancel{3}}{\cancel{3} \times \cancel{3} \times \cancel{3} \times \cancel{3} \times 3 \times 3} = \frac{1}{3^2} = 3^{-2}$

5) $a^{\frac{1}{n}} = \sqrt[n]{a}$ (means the nth root of a)

Example: $5^{\frac{1}{2}} = \sqrt[2]{5}$ or $5^{\frac{1}{3}} = \sqrt[3]{5}$

6) $a^{\frac{n}{m}} = \sqrt[m]{a^n}$

Example: $7^{\frac{3}{2}} = \sqrt[2]{7^3}$

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