Unit 3 Section 3 : Negative Indices

Using negative indices produces fractions. In this section we practice working with negative indices. From our work in the last section, we see that

$$a^2 \div a^3 \quad = \quad a^{2-3} \quad = \quad a^{-1}$$

but we know that

$$a^2 \div a^3 \quad = \quad \frac{a \times a}{a \times a \times a} \quad = \quad \frac{1}{a}$$, a fraction.

So clearly,

$$a^{-1} \quad = \quad \frac{1}{a}$$

In same way,

$$a^{-2} \quad = \quad \frac{1}{a^2} \quad = \quad \frac{1}{a \times a}$$

$$a^{-3} \quad = \quad \frac{1}{a^3} \quad = \quad \frac{1}{a \times a \times a}$$

and, in general,

$$a^{-n} \quad = \quad \frac{1}{a^n}$$

for positive integer values of n. The three rules at the start of section 3.2 can now be used for any integers m and n, not just for positive values.

Example 1

Calculate, leaving your answers as fractions:

(a) 3^{-2} Show me...

(b) $2^{-1} - 4^{-1}$ Show me...

(c) 5^{-3} Show me...

Example 2

Simplify:

(a) $\frac{6^7}{6^9}$ Show me...

(b) $6^4 \times 6^{-3}$ Show me...

(c) $(10^2)^{-3}$ Show me...

Exercises

Work out the answers to the questions below and fill in the boxes. Click on the Check button to find out whether you have answered correctly. If you are right then ✔ Correct will appear and you should move on to the next question. If ✘ Try again appears then your answer is wrong. Click on ✘ Try again to clear your original answer and have another go. If you can't work out the right answer then click on Tell me ! to see the answer.

Question 1
Write the following numbers as fractions without using any indices:

(a) 4^{-1} $\frac{1}{4}$ ✔ Correct

(b) 2^{-3} $\frac{1}{8}$ ✔ Correct

(c) 10^{-3} $\frac{1}{1000}$ ✔ Correct

(d) 7^{-2} $\frac{1}{49}$ ✔ Correct

(e) 4^{-3} $\frac{1}{64}$ ✔ Correct

(f) 6^{-2} $\frac{1}{36}$ ✔ Correct

Question 2
Fill in the missing numbers:

(a) $\frac{1}{49} = \frac{1}{7^{2}} = 7^{-2}$ ✔ Correct

(b) $\frac{1}{100} = \frac{1}{10^{2}} = 10^{-2}$ ✔ Correct

(c) $\frac{1}{81} = \frac{1}{9^{2}} = 9^{-2}$ ✔ Correct

(d) $1 = 1 =$ ✔ Correct

$\frac{1}{16}$ $\frac{1}{2^{4}}$ 2^{-4}

(e) $\frac{1}{10\,000\,000} = \frac{1}{10^{7}} = 10^{-7}$ Correct

(f) $\frac{1}{1024} = \frac{1}{2^{10}} = 2^{-10}$ Correct

Question 3
Calculate:

(a) $4^{-1} + 3^{-1}$ $\frac{7}{12}$ Correct

(b) $6^{-1} + 2^{-1}$ $\frac{8}{12}$ Correct

(c) $5^{-1} - 10^{-1}$ $\frac{5}{50}$ Correct

(d) $10^{-2} - 10^{-3}$ $\frac{9}{1000}$ Correct

(e) $4^{-1} - 10^{-1}$ $\frac{6}{40}$ Correct

(f) $6^{-1} + 7^{-1}$ $\frac{13}{42}$ Correct

Question 4
Simplify the following expressions giving your answers in the form of a number to a power:

(a) $4^{7} \times 4^{-6}$ 4^{1} Correct

(b) $5^{7} \times 5^{-3}$ 5^{4} Correct

(c) $\frac{7^{4}}{7^{-6}}$ 7^{10} Correct

(d) $(3^{2})^{-4}$ 3^{-8} Correct

(e) $(6^{-2})^{-3}$ 6^{6} Correct

(f) $8^{4} \times 8^{-9}$ 8^{-5} Correct

(g) $\frac{7^{2}}{7^{-2}}$ 7^{4} Correct

(h) $\frac{8^{9}}{8^{-9}}$ 8^{18} Correct

Question 5
Fill in the missing numbers:

(a) $\frac{1}{9} = 3^{-2}$ ✔ Correct

(b) $\frac{1}{100} = 10^{-2}$ ✔ Correct

(c) $\frac{1}{125} = 5^{-3}$ ✔ Correct

(d) $\frac{5}{5^4} = 5^{-3}$ ✔ Correct

(e) $\frac{6^2}{6^3} = 6^{-1}$ ✔ Correct

(f) $\frac{2^2}{2^{10}} = 2^{-8}$ ✔ Correct

Question 6
Simplify the following expressions:

(a) $\frac{x^8}{x^3}$ x^{5} ✔ Correct

(b) $\frac{x^7}{x^9}$ x^{-2} ✔ Correct

(c) $\frac{x^4}{x^8}$ x^{-4} ✔ Correct

(d) $(x^6)^{-4}$ x^{-24} ✔ Correct

(e) $\left(\frac{1}{x^2}\right)^4$ x^{-8} ✔ Correct

(f) $(x^{-8})^3$ x^{-24} ✔ Correct

Question 7
Complete the following statements:

(a) $0.1 = 10^{-1}$ ✔ Correct

(b) $0.25 = 2^{-2}$ ✔ Correct

(c) $0.0001 = 10^{-4}$ ✔ Correct

(d) $0.2 = 5^{-1}$ ✔ Correct

(e) $0.001 = 10^{-3}$ ✔ Correct

(f)

$0.02 = 50^{-1}$ ✔ Correct

Question 8
Fill in the missing numbers:

(a) $\frac{x^4}{x^{2}} = x^2$ ✔ Correct

(b) $x^6 \times x^{-4} = x^2$ ✔ Correct

(c) $x^9 \times x^{-7} = x^2$ ✔ Correct

(d) $\frac{x^7}{x^{9}} = x^{-2}$ ✔ Correct

(e) $\frac{x^3}{x^{-1}} = x^4$ ✔ Correct

(f) $(x^3)^{-2} = x^{-6}$ ✔ Correct

Question 9
Fill in the missing numbers:

(a) $\frac{1}{8} = 2^{-3}$ ✔ Correct

(b) $\frac{1}{25} = 5^{-2}$ ✔ Correct

(c) $\frac{1}{81} = 9^{-2}$ ✔ Correct

(d) $\frac{1}{10\,000} = 10^{-4}$ ✔ Correct

Question 10

If $a = b^3$ and $b = \frac{1}{c^2}$, express a as a power of c,

without having any fractions in your final answer.

$a =$ c^{-6} ✔ Correct

You have now completed Unit 3 Section 3

Your overall score for this section is 100%

Correct Answers
You answered 55 questions correctly out of the 55 questions in this section.

Incorrect Answers

There were 0 questions where you used the *Tell Me* button.

There were 0 questions with wrong answers.

There were 0 questions you didn't attempt.

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