**2.2 – The Zero Exponent Law and Powers of Ten**

**Zero Exponent Law:**  $a^{0}=1$ (where *a* ≠ 0)

We can make sense of the Zero Exponent Law by looking at patterns in decreasing powers of the same base:

|  |  |  |
| --- | --- | --- |
| *Power* | *Repeated Multiplication* | *Standard Form* |
| 35 |  |  |
| 34 |  |  |
| 33 |  |  |
| 32 |  |  |
| 31 |  |  |
|  | N/A |  |

Ex. 1: Evaluate.

1. 40 (b) (-4)0 (c) -40  (d) $ \left(\frac{-3243 × 41}{254}\right)^{0}$

Ex. 2: Complete this table containing powers of ten by following the patterns you see.

|  |  |  |
| --- | --- | --- |
| *Number in Words* | *Standard Form* | *Power* |
| One million | 1 000 000 | 106 |
| One hundred thousand | 100 000 | 105 |
| Ten thousand | 10 000 | 104 |
| One thousand | 1 000 | 103 |
| One hundred | 100 | 102 |
| Ten | 10 | 101 |
| One | 1 |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Powers of ten are important in **scientific notation**, a shorthand way of representing very large or small numbers. A number in scientific notation has the form $m×10^{n}$, where $1\leq m<10$ and the exponent *n* is an integer.

Ex. 3: Represent the following quantities in scientific notation.

1. 10 000 000 000 (b) 3 000 000 (c) 43 000 000

(d) 835 000 (e) 0.000 000 01 (f) 0.000 000 000 432

Ex. 4: Write each quantity in standard form.

1. The population of the world is about $7×10^{9}$
2. The distance from the Sun to the nearest star (Proxima Centauri) is $3.99×10^{13}$ km
3. The diameter of the smallest known virus is $1.8×10^{-5}$ mm
4. The mass of a dust particle is $7.53×10^{-7}$ g