Indices

Exercise 5:

Solution 1:

	Index form	Read as	Product form	Base	Index	Value
1	5^4	5 raised to 4	$5 \times 5 \times 5 \times 5$	5	4	625
2	15^2	15 raised to 2	15×15	15	2	225
3	1^7	1 raised to 7	$1 \times 1 \times 1 \times 1 \times 1 \times 1 \times 1$	1	7	1
4	2^5	2 raised to 5	$2 \times 2 \times 2 \times 2 \times 2$	2	5	32
5	10^3	10 raised to 3	$10 \times 10 \times 10$	10	3	1000

Exercise 6:

Solution 1:

	Exponent	Product form	In words
1.	10^7	$10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10$	7^{th} power of 10
2.	$(-4)^6$	$(-4) \times (-4) \times (-4) \times (-4) \times (-4) \times (-4)$	6^{th} power of (-4)
3.	9^3	$9 \times 9 \times 9$	Cube of 9
4.	m^8	$m \times m \times m \times m \times m \times m \times m \times m$	8^{th} power of m
5.	$(1.4)^2$	$(1.4) \times (1.4)$	Square of (1.4)
6.	$\left(\frac{2}{5}\right)^4$	$\left(\frac{2}{5}\right) \times \left(\frac{2}{5}\right) \times \left(\frac{2}{5}\right) \times \left(\frac{2}{5}\right)$	4^{th} power of $\left(\frac{2}{5}\right)$
7.	$\left(-\frac{3}{4}\right)^5$	$\left(-\frac{3}{4}\right) \times \left(-\frac{3}{4}\right) \times \left(-\frac{3}{4}\right) \times \left(-\frac{3}{4}\right) \times \left(-\frac{3}{4}\right)$	5^{th} power of $\left(-\frac{3}{4}\right)$
8.	$(-1)^3$	$(-1) \times (-1) \times (-1)$	Cube of (-1)
9.	$\left(2\frac{1}{3}\right)^2 = \left(\frac{7}{3}\right)^2$	$\left(\frac{7}{3}\right) \times \left(\frac{7}{3}\right)$	Square of $\left(\frac{7}{3}\right)$
10.	a^3	$a \times a \times a$	Cube of a

Solution 2:

1. $\frac{7}{9} \times \frac{7}{9} \times \frac{7}{9} \times \frac{7}{9} \times \frac{7}{9} = \left(\frac{7}{9}\right)^5$
2. $8 \times 8 \times 8 = 8^3$
3. $m \times m \times m \times m = m^4$
4. $\left(-\frac{5}{7}\right) \times \left(-\frac{5}{7}\right) \times \ldots \times 6 \text{ times } = \left(-\frac{5}{7}\right)^6$
5. $\frac{2}{3} \times \frac{2}{3} \times \ldots \times 9 \text{times} = \left(\frac{2}{3}\right)^9$
6. $a \times a \times a \times a = a^4$
7. $b \times b \times b \times \ldots \times 10 \text{ times} = b^{10}$

Solution 3:

1. $\frac{7}{9} \times \frac{7}{9} \times \frac{7}{9} \times \frac{7}{9} \times \frac{7}{9} = \left(\frac{7}{9}\right)^5$
2. $8 \times 8 \times 8 = 8^3$
3. $m \times m \times m \times m = m^4$
4. $\left(-\frac{5}{7}\right) \times \left(-\frac{5}{7}\right) \times \ldots \times 6 \text{ times } = \left(-\frac{5}{7}\right)^6$
5. $\frac{2}{3} \times \frac{2}{3} \times \ldots \times 9 \text{times} = \left(\frac{2}{3}\right)^9$
6. $a \times a \times a \times a = a^4$
7. $b \times b \times b \times \ldots \times 10 \text{ times} = b^{10}$

Exercise 7:

Solution 1:

1. $11^3 = 11 \times 11 \times 11 = 1331$
2. $(-5)^2 = (-5) \times (-5) = 25$
3. $(-3)^3 = (-3) \times (-3) \times (-3) = (-27)$
4. $10^7 = 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10000000$
5. $2^4 = 2 \times 2 \times 2 \times 2 = 16$
6. $\left(\frac{2}{3}\right)^5 = \left(\frac{2}{3}\right) \times \left(\frac{2}{3}\right) \times \left(\frac{2}{3}\right) \times \left(\frac{2}{3}\right) \times \left(\frac{2}{3}\right) = \frac{32}{243}$
7. $\left(-\frac{1}{5}\right)^4 = \left(-\frac{1}{5}\right) \times \left(-\frac{1}{5}\right) \times \left(-\frac{1}{5}\right) \times \left(-\frac{1}{5}\right) = \left(\frac{1}{625}\right)$
8. $2^8 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 256$
9. $(-1)^8 = (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) = 1$
10. $(-1)^9 = (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) \times (-1) = (-1)$

Solution 2:

1. $(-4)^2 = 64$ is false.
   Correct statement : $(-4)^2 = 16$

2. $2^5 = 128$ is false.
   Correct statement : $2^5 = 32$

3. $(-7)^2 = -49$ is false.
   Correct statement : $(-7)^2 = 49$

4. $\left(-\frac{1}{2}\right)^3 = -\frac{1}{8}$ is true.

5. $3^4 = 81$ is true.

6. $(-5)^4 = -625$ is false.
   Correct statement : $(-5)^4 = 625$

7. $(-1)^{20} = 1$ is true.

8. $(-1)^{15} = -1$ is true.

Exercise 8:

Solution 1:

1. $2^8 \times 2^3 = 2^{8+3}$
2. $\left(\frac{6}{11}\right)^4 \times \left(\frac{6}{11}\right) = \left(\frac{6}{11}\right)^{4+1} = \left(\frac{6}{11}\right)^5$
3. $\left(\frac{4}{5}\right)^{11} \times \left(\frac{4}{5}\right)^2 = \left(\frac{4}{5}\right)^{11+2} = \left(\frac{4}{5}\right)^{13}$
4. $(-3)^{15} \times (-3)^{10} = (-3)^{15+10} = (-3)^{25}$
5. $(5.7)^4 \times (5.7)^2 = (5.7)^{4+2} = (5.7)^6$
6. $m^2 \times m^7 = m^{2+7} = m^9$
7. $\left(\frac{1}{3}\right)^8 \times \left(\frac{1}{3}\right)^6 = \left(\frac{1}{3}\right)^{8+6} = \left(\frac{1}{3}\right)^{14}$
8. $p^4 \times p^4 = p^{4+4} = p^8$

Exercise 9:

Solution 1:

1. $3^{10} \div 3^6 = 3^{10-6}$
2. $7^{19} \div 7^4 = 7^{19-4} = 7^{15}$
3. $\left(\frac{1}{2}\right)^{20} \div \left(\frac{1}{2}\right)^{12} = \left(\frac{1}{2}\right)^{20-12} = \left(\frac{1}{2}\right)^8$
4. $(2.1)^{15} \div (2.1)^{13} = (2.1)^{15-13} = (2.1)^2$
5. $x^{14} \div x^{10} = x^{14-10} = x^4$
6. $x^6 \div x^4 = x^{6-4} = x^2$

Solution 2:

1. $6^4 \div 6^7 = \frac{6^4}{6^7} = \frac{1}{6^{7-4}} = \frac{1}{6^3}$
2. $(-4)^3 \div (-4)^{15} = \frac{(-4)^3}{(-4)^{15}} = \frac{1}{(-4)^{15-3}} = \frac{1}{(-4)^{12}}$
3. $\left(\frac{11}{12}\right)^2 \div \left(\frac{11}{12}\right)^3 = \frac{\left(\frac{11}{12}\right)^2}{\left(\frac{11}{12}\right)^3} = \frac{1}{\left(\frac{11}{12}\right)^{3-2}} = \frac{1}{\left(\frac{11}{12}\right)^1} = \frac{1}{\left(\frac{11}{12}\right)}$
4. $m^{12} \div m^{19} = \frac{m^{12}}{m^{19}} = \frac{1}{m^{19-12}} = \frac{1}{m^7}$
5. $a^2 \div a^9 = \frac{a^2}{a^9} = \frac{1}{a^{9-2}} = \frac{1}{a^7}$

Exercise 10:

Solution 1:

1. $(17)^\circ = 1$
2. $(-11)^\circ = 1$
3. $\left(-\frac{9}{13}\right)^0 = 1$
4. $(ab)^\circ = 1$
5. $\left(\frac{273}{894}\right)^0 = 1$

Exercise 11:

Solution 1:

1. $\left[(-2)^3\right]^4 = (-2)^{3\times4}$
2. $\left[\left(-\frac{12}{13}\right)^2\right]^5 = \left(-\frac{12}{13}\right)^{2\times5} = \left(-\frac{12}{13}\right)^{10}$
3. $(10^5)^6 = 10^{5\times6} = 10^{30}$
4. $\left[\left(\frac{5}{3}\right)^{10}\right]^3 = \left(\frac{5}{3}\right)^{10\times3} = \left(\frac{5}{3}\right)^{30}$
5. $(x^5)^7 = x^{5\times7} = x^{35}$
6. $(m^4)^4 = m^{4\times4} = m^{16}$

Exercise 12:

Solution 1:

1. $(5\times8)^2 = 5^2 \times 8^2$
2. $\left[\left(\frac{3}{7}\right)\times\left(\frac{7}{9}\right)\right]^3 = \left(\frac{3}{7}\right)^3 \times \left(\frac{7}{9}\right)^3$
3. $\left[\left(\frac{-2}{3}\right)\times\left(\frac{-5}{11}\right)\right]^4 = \left(\frac{-2}{3}\right)^4 \times \left(\frac{-5}{11}\right)^4$
4. $(xy)^{10} = x^{10} \times y^{10}$
5. $(pq)^4 = p^4 \times q^4$

Exercise 13:

Solution 1:

1. $\left(\frac{4}{11}\right)^6 = \frac{4^6}{11^6}$
2. $\left(\frac{-5}{17}\right)^3 = \frac{(-5)^3}{17^3}$
3. $\left(\frac{1}{10}\right)^{20} = \frac{1}{10^{20}}$
4. $\left(\frac{a}{b}\right)^2 = \frac{a^2}{b^2}$
5. $\left(\frac{6}{7}\right)^3 = \frac{6^3}{7^3}$
6. $\left(\frac{5}{7}\right)^8 = \frac{5^8}{7^8}$
7. $\left(\frac{x}{y}\right)^7 = \frac{x^7}{y^7}$
8. $\left(\frac{1}{5}\right)^3 = \frac{1^3}{5^3}$

Exercise 14:

Solution 1:

1. $5^{-10} = \frac{1}{5^{10}}$
2. $\left(\frac{1}{8}\right)^{-4} = \frac{1}{\left(\frac{1}{8}\right)^4}$
3. $(-4)^{-2} = \frac{1}{(-4)^2}$
4. $12^{-9} = \frac{1}{12^9}$

Exercise 15:

Solution 1:

1. Volume of the Earth = 11, 00, 00, 00, 00, 000 cubic km (Approx.)

$11,00,00,00,00,000 \text{ cubic km} = 11 \times 1,00,00,00,00,000$

$= 11 \times 10^{11}$

$= 1.1 \times 10^{1} \times 10^{11}$

$= 1.1 \times 10^{1+11}$

$= 1.1 \times 10^{12}$

$\therefore$ Volume of the Earth $= 1.1 \times 10^{12}$ cubic km

2. Distance between the Sun and the Earth = 15, 00, 00, 000 km.

$15,00,00,000 = 15 \times 10^{7} = 1.5 \times 10^{1} \times 10^{7} = 1.5 \times 10^{1+7} = 1.5 \times 10^{8}$

Thus, the distance between the Sun and the Earth $= 1.5 \times 10^{8}$ km.

3. Distance between the Earth and the Moon = 38, 40, 00, 000 m.

$38, 40, 00, 000 = 384 \times 10^{6} = 3.84 \times 10^{2} \times 10^{6} = 3.84 \times 10^{2+6} = 3.84 \times 10^{8}$

Thus, the distance between the Earth and the Moon $= 3.84 \times 10^{8}$ m

4. Diameter of an atom of gold = 0.000000000003 cm.

$$0.000000000003 = \frac{3}{100000000000} = \frac{3}{10^{12}} = 3 \times 10^{-12}$$

Thus, diameter of an atom of gold $= 3 \times 10^{-12}$ cm

5. Diameter of an oxygen atom = 0.00000000000000356 mm.

$$0.00000000000000356 = \frac{356}{100000000000000000} = 356 \times 10^{-16} = 3.65 \times 10^{2} \times 10^{-16}$$

$3.65 \times 10^{2} \times 10^{-16} = 3.65 \times 10^{2+(-16)} = 3.65 \times 10^{-14}$

Thus, diameter of an oxygen molecule $= 3.65 \times 10^{-14}$ mm.