

25/4/19

 Kumar,
 Date: / /
 Page:

Chapter - 2.

Exponent & Powers.

a^m — Power or Exponent
 $\downarrow$
 Base

Laws of Exponents

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

Law 2: $a^m \div a^n = \frac{a^m}{a^n} = a^{m-n}$

Law 3: $(a^m)^n = a^{mn}$

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

Law 5: $\sqrt[n]{a^m} = (a^m)^{\frac{1}{n}} = (a)^{m/n}$

Law 6: $a^0 = 1$

Law 7: $a^m \times b^m = (a \times b)^m$

Law 8: $a^m \div b^m = \left(\frac{a}{b}\right)^m$



Scientific Notation or Standard Form

Ex. 1 1250000000

$= 1.25 \times 10^{10}$

0.0000000432

4.32×10^{-7}

Warm up Exercise

1. Using the laws of exponents, write the simplest form.

a. $2^4 \times 2^5 \times 2^3 \times 2$

$= 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$= 2^{13}$ Ans.

b. $48 \div 43$

$= 48 - 3$

$= 45$ Ans.

c. $(\frac{7}{3})^2$

$= \frac{7 \times 7}{3 \times 3}$

$= \frac{49}{9}$ Ans.

d. $3^4 \times 5^2$

$= (5 \times 3)^2 = 15^2$ Ans.

e. $123 \div 63$

$= (\frac{123}{63})^3$

$= \frac{2^3}{2^3}$ Ans.

f. $(-38)^8$

$= \frac{1}{38} = 38$ Ans.

g. $\frac{2^3 \times 6^3 \times 10^2}{4^2 \times 3^2 \times 5}$

$= 2^6 \times 3 \times 5$

h. $\frac{2^5 \times 1^3 \times 15^4 \times 24}{2^2 \times 14^2 \times 5}$

$= 2^3 \times 1 \times 2^2 \times 3^4 \times 5^3$

i. $\frac{625 \times 32 \times 729 \times 12^0}{20^2 \times 3^3}$

$= 5^2 \times 2 \times 3^3$

2 Express in standard form

a. $12,345,500$
 1.23455×10^7

b. 5465.43
 5.46543×10^3

c. $14,393$
 1.4393×10^4

d. $10,000,000$
 1×10^7

3. Compare the numbers $23,400,000,000$ and $2,32,00,00,000$.

$$2.34 \times 10^8 < 23.2 \times 10^2$$

$$23.2 \times 10^2 > 2.34 \times 10^8$$

$$2,32,00,00,000 < 23,40,00,000$$

Day this!

Page no. 27

1 Evaluate:

a. 4^{-3}

$$= \frac{1}{4^3}$$

$$= \frac{1}{4 \times 4 \times 4} = \frac{1}{64}$$

b. 12^{-2}

$$= \frac{1}{12^2}$$

$$= \frac{1}{12 \times 12} = \frac{1}{144}$$

c. 10^{-4}

$$= \frac{1}{10^4}$$

$$= \frac{1}{10 \times 10 \times 10 \times 10} = \frac{1}{10000}$$

2. Write the values in exponential form

a. $\frac{1}{36} = 6^{-2} = 6^{-2}$

b. $\frac{1}{243} = \frac{1}{3^5} = 3^{-5}$



$$c. \frac{1}{1000}$$

$$= \frac{1}{10^3} = 10^{-3}$$

3. Write the values with positive exponent

$$a. \left(\frac{1}{3}\right)^{-2} = \left(\frac{3}{1}\right)^2$$

$$b. \left(\frac{8}{9}\right)^{-4} = \left(\frac{9}{8}\right)^4$$

$$c. \left(\frac{10}{13}\right)^{-3} = \left(\frac{13}{10}\right)^3$$

Try this! pg no - 28

1. Write the reciprocal with positive exponents.

$$a. 5^{-4} = \frac{1}{5^4} = 5^4 \text{ Ans}$$

$$b. \left(-\frac{3}{5}\right)^{-2} = \left(-\frac{5}{3}\right)^2 \text{ Ans}$$

$$c. \left(\frac{2}{3}\right)^6 = \left(\frac{3}{2}\right)^6 \text{ Ans}$$

$$d. \left(\frac{1}{3}\right)^{-3} = \left(\frac{3}{1}\right)^3 \text{ Ans}$$

$$e. \left(-\frac{23}{13}\right)^4 = \left(-\frac{13}{23}\right)^4 \text{ Ans}$$

2. Write the multiplicative inverse with negative exponents

$$a. \left(\frac{3}{7}\right)^2 = \left(\frac{7}{3}\right)^{-2} = \left(\frac{3}{7}\right)^{-12}$$

$$b. \left(-\frac{6}{11}\right)^{-5} = \left(\frac{11}{6}\right)^{-5}$$

$$c. \left(\frac{4}{9}\right)^{-3} = \left(\frac{9}{4}\right)^{-3}$$

$$d. \left(-\frac{5}{12}\right)^{-4} = \left(-\frac{12}{5}\right)^{-4}$$

$$e. \left(\frac{8}{-17}\right)^{-7} = \left(-\frac{8}{17}\right)^{-7}$$

Day 11 Pg no-30

1. Using the laws of exponents, simplify

a. $\left(\frac{2}{3}\right)^{-4} \times \left(\frac{2}{3}\right)^{-3}$

$= \left(\frac{2}{3}\right)^{-4+(-3)}$

$= \left(\frac{2}{3}\right)^{-7}$

b. $\left(\frac{3}{4}\right)^{-3} \times \left(\frac{3}{4}\right)^{-5}$

$= \left(\frac{3}{4}\right)^{-3+(-5)}$

$= \left(\frac{3}{4}\right)^{-8}$

$= \left(\frac{3}{4}\right)^{-8}$

c. $\left[\left(\frac{2}{7}\right)^{-2}\right]^{-3}$

$= \left(\frac{2}{7}\right)^{-2 \times (-3)}$

$= \left(\frac{2}{7}\right)^6$

d. $\left[\left(-\frac{9}{11}\right)^5\right]^2$

$= \left(-\frac{9}{11}\right)^{5 \times 2}$

e. $\left(\frac{3}{8}\right)^2 \times \left(\frac{3}{8}\right)^{-3} \times \left(\frac{3}{8}\right)^4$

$= \left(\frac{3}{8}\right)^{2+(-3)+4}$

$= \left(\frac{3}{8}\right)^3$

2. Write the following in p form

a. $(2)^{-4}$

$= \frac{1}{2^4}$

$= \frac{1}{16}$

b. $\left(-\frac{3}{5}\right)^{-2}$

$= \left(\frac{5}{3}\right)^2$

$= \frac{25}{9}$

$$c. \left(\frac{2}{4}\right)^{-2} \times \left(\frac{8}{9}\right)^{-1}$$

$$= \left(\frac{1}{2}\right)^2 \times \left(\frac{9}{8}\right)$$

$$= \frac{1 \times 9}{2 \times 2} \times \frac{9}{8} = \frac{81}{32} \text{ ans}$$

$$d. (3^{-1} - 4^{-1})^{-1}$$

$$= \left(\frac{1}{3} - \frac{1}{4}\right)^{-1}$$

$$= \left(\frac{4-3}{12}\right)^{-1}$$

$$= \left(\frac{1}{12}\right)^{-1}$$

$$= \frac{12}{1} \text{ ans}$$

$$e. \left[\left(\frac{7}{8}\right)^2\right]^{-\frac{1}{2}}$$

$$= \left(\frac{7^2}{8}\right)^{-\frac{1}{2}}$$

$$= \left(\frac{7}{8}\right)^{1 \times -\frac{1}{2}}$$

$$= \left(\frac{7}{8}\right)^{-1}$$

$$= \frac{8}{7} \text{ ans}$$

$$f. \left(\frac{-1}{3}\right)^{-2}$$

$$= \frac{-1 \times 3}{1 \times 1} = -3 \text{ ans}$$

$$g. \left(\frac{2}{3}\right)^{-1} \div \left(\frac{1}{2}\right)^2$$

$$= \left(\frac{3}{2}\right)^1 \div \left(\frac{1}{2}\right)^2$$

$$= \frac{3}{2} \div \frac{1}{4}$$

$$= \frac{3}{2} \times \frac{4}{1}$$

$$= 6 \text{ ans}$$

3. Express as rational no. with positive exponent.

$$a. (2^{-1} \times 2^{-9}) \times \left(-\frac{2}{3}\right)^5$$

$$= (2^{-1+(-9)}) \times \left(\frac{2}{3}\right)^5$$

$$= \frac{1}{2} \times \left(\frac{2}{3}\right)^5$$

$$= \frac{1}{2} \times \frac{2 \times 2 \times 2 \times 2 \times 2}{3 \times 3 \times 3 \times 3 \times 3}$$

$$= \frac{1 \times 2 \times 2 \times 2 \times 2}{2 \times 3 \times 3 \times 3 \times 3} = \frac{16}{243} \text{ ans}$$

$$\begin{aligned}
 &= \left(\frac{9}{2}\right)^{-2} \div \left(\frac{2}{9}\right)^{-3} \times \left(\frac{9}{2}\right)^{-4} \\
 &= \left(\frac{9}{2}\right)^2 \div \left(\frac{9}{2}\right)^3 \times \left(\frac{9}{2}\right)^4 \\
 &= \frac{9^2}{2^2} \times \frac{2^3}{9^3} \times \frac{9^4}{2^4} \\
 &= \left(\frac{9}{2}\right)^{2-3+4} = \left(\frac{9}{2}\right)^3 \text{ where}
 \end{aligned}$$

$$c. \left(\frac{25}{13}\right)^{-22} \times \left(\frac{5}{13}\right)^{-22}$$

$$= \left(\frac{12}{25}\right)^{22} \times \left(\frac{5}{6}\right)^{22}$$

$$= \frac{12^{22}}{25^{22}} \times \frac{5^{22}}{6^{22}} \text{ where}$$

$$= \left(\frac{2}{5}\right)^{22} \text{ where}$$

4. Using suitable examples to verify
where m is an integer

$$= \left(-\frac{3}{5}\right)^4 \times \left(\frac{2}{3}\right)^{-4}$$

$$= \left(-\frac{5}{3}\right)^4 \times \left(\frac{3}{2}\right)^4$$

$$= \left(-\frac{5}{3} \times \frac{3}{2}\right)^4$$

$$\begin{aligned}
 &= \left[\left(\frac{-5 \times 7}{3 \times 2}\right)\right]^4 = \left(\frac{3 \times 2}{-5 \times 7}\right)^{-4} = \left(\frac{-3 \times 2}{5 \times 7}\right)^{-4} \\
 &= \left(\frac{-3 \times 2}{5 \times 7}\right)^{-4} \text{ where}
 \end{aligned}$$

Justify this! pg no-31

1. simplify.

$$a. \left[\left(\frac{1}{2}\right)^2 + \left(\frac{4}{3}\right)^{-2}\right] \div (2)^{-5}$$

$$= \left[\frac{1 \times 1}{2 \times 2} + \left(\frac{5}{4}\right)^2\right] \div \frac{1}{2^5}$$

$$= \left[\frac{1 \times 4}{4} + \frac{25}{16}\right] \div \frac{1}{2^5}$$

$$= \frac{4+25}{16} \div \frac{1}{2^5}$$

$$= \frac{29}{16} \times 2^5$$

$$= \frac{29}{16} \times 2 \times 2 \times 2 \times 2 \times 2$$

$$= \frac{29}{58} \text{ where}$$

$$= \left(\frac{29}{58}\right)^4 \times \left(\frac{2}{5}\right)^{-4}$$



$$= 2^{-11-(-5)} \times 3^{-5-(-14)}$$

$$= 2^{-11+5} \times 3^{-5+14}$$

$$= 2^{-6} \times 3^9$$

Ans

d.

$$\left(\frac{3}{8}\right)^{-8} \times \left(\frac{6}{4}\right)^{-5} \div \left(\frac{16}{24}\right)^{-3}$$

$$= \left(\frac{8}{3}\right)^8 \times \left(\frac{4}{6}\right)^5 \div \left(\frac{24}{16}\right)^3$$

$$= \frac{\left(\frac{2^3}{3}\right)^8 \times \left(\frac{2^2}{3}\right)^5}{\left(\frac{3}{2}\right)^3} = \frac{2^{24}}{3^8} \times \frac{2^{10}}{3^5 \times 2^5} \div \frac{2^{12}}{2^3 \times 3^3}$$

$$= \frac{2^{24} \times 2^{10} \div 10 \div 12}{3^8 \div -5 + 3 \times 2^{5+3}}$$

$$= \frac{2^{24} \times 2^8}{3^{11-5} \times 2^8}$$

$$= \frac{2^{32}}{3^6 \times 2^8}$$

$$= \frac{2^{24}}{3^6}$$

Ans

e.

$$\left[\left(\frac{2}{3}\right)^{-8}\right]^{-2} \times \left[\left(\frac{4}{27}\right)^{-4}\right]^{-3}^{-1}$$

$$= \left(\frac{3}{2}\right)^{-8 \times -2} \times \left[\left(\frac{4}{27}\right)^{-4 \times -3}\right]^{-1}$$

$$= \left(\frac{3}{2}\right)^{-16} \times \left[\left(\frac{4}{27}\right)^{-12}\right]^{-1}$$

$$= \left(\frac{2}{3}\right)^{-16} \times \left(\frac{4}{27}\right)^{-12 \times -1}$$

$$= \left(\frac{2}{3}\right)^{-16} \times \left(\frac{2^2}{3^3}\right)^{-12}$$

$$= \frac{2^{16}}{3^{32}} \times \frac{3^{36}}{2^{24}}$$

$$= \frac{3(36-32)}{2(24-16)}$$

$$\frac{2^4}{12} = \frac{3^4}{2^8}$$

Ans

d.

$$\left(\frac{4}{15}\right)^{-5} \times \left(\frac{25}{8}\right)^{-8} \div \left(\frac{5}{18}\right)^{-6}$$

$$= \left(\frac{15}{4}\right)^5 \times \left(\frac{8}{25}\right)^8 \div \left(\frac{18}{5}\right)^6$$

$$= \frac{(5 \times 3)^5}{(2 \times 2)^5} \times \frac{(2 \times 2 \times 2)^8}{(5 \times 5)^8} \div \frac{(3 \times 3 \times 2)^6}{5^6}$$

$$\frac{5^5 \times 3^5}{(2^2)^5} \times \frac{(2^2)^8}{5^6} \div \frac{(3^2 \times 2)^6}{5^6}$$

$$\frac{3^5 \times 5^5}{2^{10}} \times \frac{2^{16}}{5^{16}} \div \frac{5^6}{3^{12} \times 2^6}$$

$$\frac{3^5 \times 5^5 \times 2^{24} \times 5^6}{2^{10} \times 5^{16} \times 3^{12} \times 2^6}$$

$$\frac{3^5 \times 5^5 \times 6 \times 3^{12}}{2^{10+6} \times 5^{16} \times 3^{12}}$$

$$\frac{3^5 \times 5^{11} \times 2^{29}}{3^{12} \times 5^{16} \times 2^{16}}$$

$$\frac{1 \times 1 \times 2^{24-16}}{3^{12-5} \times 5^{16-11} \times 1}$$

$$\frac{1 \times 2^8}{3^7 \times 5^5}$$

$$2^8 \times 3^{-7} \times 5^{-5}$$

3. Solve for m: $\left(\frac{5}{9}\right)^{-7} \div \left(\frac{5}{9}\right)^{-2} = \left(\frac{5}{9}\right)^{2m-3}$

$$\left(\frac{5}{9}\right)^{-7-(-2)} = \left(\frac{5}{9}\right)^{2m-3}$$

$$\left(\frac{5}{9}\right)^{-7+2} = \left(\frac{5}{9}\right)^{2m-3}$$

$$\left(\frac{5}{9}\right)^{-5} = \left(\frac{5}{9}\right)^{2m-3}$$

$$-5 = 2m-3$$

$$-5+3 = 2m$$

$$-2 = 2m$$

$$m = -1$$

$$m = -1$$

4. By what number should $\left(-\frac{1}{2}\right)^{-1}$ be divided so that quotient is $\left(-\frac{4}{7}\right)^{-1}$?
Let the number be divided = x

$$\left(-\frac{1}{2}\right)^{-1} \div x = \left(-\frac{4}{7}\right)^{-1}$$

$$\left(-\frac{2}{1}\right)^1 \times \frac{1}{x} = \left(-\frac{7}{4}\right)^1$$

$$\left(-\frac{2}{1} \times \frac{1}{x}\right) = -\frac{7}{4}$$

$$x = -\frac{2}{4} \div \left(-\frac{2}{1}\right)$$

$$x = -\frac{2}{4} \times \left(-\frac{1}{2}\right)$$

$$x = \frac{2}{8}$$

$$x = \frac{1}{4}$$

$$x = \left(-\frac{2}{3}\right)^1$$

Ans

Exercise 2.1

1. Write the inequalities with positive integral exponents

$$a. \left(\frac{9}{48}\right)^{-13} = \left(\frac{38}{9}\right)^{13}$$

$$b. \left(\frac{35}{18}\right)^{-10} = \left(\frac{18}{35}\right)^{10}$$

$$c. 3^{-5} = \frac{1}{3^5}$$

2. Use the multiplicative inverse with negative integral exponents

$$a. \left(\frac{67}{76}\right)^{-22} = \left(\frac{76}{67}\right)^{22}$$

$$b. \left(\frac{-11}{23}\right)^{-16} = \left(\frac{-23}{11}\right)^{16}$$

$$c. \left(\frac{-197}{3}\right)^{56} = \left(\frac{-3}{197}\right)^{-56}$$

$$d. \left(\frac{14}{9}\right)^{10} = \left(\frac{9}{14}\right)^{-10}$$

3. Simplify

$$a. \begin{aligned} & (-12)^5 \times (-12)^{-12} \\ &= (-12)^{5-12} = (-12)^{-7} \\ &= \frac{1}{(-12)^7} \end{aligned}$$

$$b. \begin{aligned} & (-15)^{-24} \div (-15)^{-16} \\ &= \frac{(-15)^{-24}}{(-15)^{-16}} = (-15)^{-24+16} \\ &= (-15)^{-8} = \frac{1}{(-15)^8} \end{aligned}$$

$$c. \begin{aligned} & (5)^{-6} \times (13)^{-6} \\ &= (5 \times 13)^{-6} = (65)^{-6} \end{aligned}$$

$$d. \begin{aligned} & \left(\frac{1}{2}\right)^{-12} \div \left(\frac{-3}{5}\right)^{-12} \\ &= \left(\frac{1}{2}\right)^{-12} \times \left(\frac{5}{-3}\right)^{12} \\ &= \left(\frac{5}{-6}\right)^{12} \end{aligned}$$

$$e. \begin{aligned} & [(-8)^3]^{-2} \\ &= (-8)^{3 \times -2} \\ &= (-8)^{-6} = \frac{1}{(-8)^6} \end{aligned}$$

$$f. \left[\left(-\frac{5}{8} \right)^2 \right]^{-1}$$



$$= \left(-\frac{5}{8}\right)^{2 \times 4 \times -1}$$

$$= \left(-\frac{5}{8}\right)^{-8}$$

$$= \left(\frac{8}{5}\right)^8$$

$$9. (-17)^{-13} \times (-17)^{-22}$$

$$= (-17)^{-13 + (-22)}$$

$$= (-17)^{-35}$$

$$h. (-18)^{-19} \div (-18)^{-12}$$

$$= (-18)^{-19 - (-12)}$$

$$= (-18)^{-7}$$

$$= (-9)^{-12} \times (3)^{-12}$$

$$= (27)^{-12}$$

$$j. \left(\frac{6}{7}\right)^{-17} \div \left(-\frac{5}{11}\right)^{-17}$$

$$= \left(\frac{6}{7}\right)^{-17} \times \left(\frac{11}{5}\right)^{-17}$$

$$= \left(\frac{66}{35}\right)^{-17}$$

$$k. [(-6)^{-15}]^2$$

$$= (-6)^{-15 \times 2}$$

$$= (-6)^{-10}$$

$$= (6)^{-10}$$

$$1. [4^2 4^{-2}]^3$$

$$= (4 \times 4^{-2})^3$$

$$= 4^{-12}$$

4. Express as rational number with positive exponents

$$a. \left(\frac{2}{3}\right)^{-8} \times \left(\frac{2}{3}\right)^{-12}$$

$$\left(\frac{2}{3}\right)^{-8} \times \left(\frac{2}{3}\right)^{-12} = \left(\frac{2}{3}\right)^{-8 + (-12)} = \left(\frac{2}{3}\right)^{-20}$$

$$b. \left(-\frac{2}{3}\right)^{-28} \div \left(-\frac{2}{5}\right)^{-15}$$

$$= -2 \left(\frac{5}{2}\right)^{-28} \div \left(\frac{5}{2}\right)^{-15}$$

$$= \left(\frac{5}{2}\right)^{-18 - (-15)}$$

$$= \left(\frac{5}{2}\right)^{-3}$$

$$c. \left(\frac{4}{7}\right)^{-11} \times \left(\frac{3}{8}\right)^{-11}$$

$$= \left(\frac{4}{7}\right)^{-11} \times \left(\frac{8}{3}\right)^{-11}$$

$$= \left(\frac{32}{21}\right)^{-11}$$

$$= \left(\frac{21}{32}\right)^{11}$$

$$d. \frac{-3-5}{-8-8}$$

$$= \left(\frac{8}{8}\right)^5$$

$$e) \left[\left(\frac{5}{-7}\right)^{-4}\right]^3$$

$$= \left[\left(\frac{7}{5}\right)^4\right]^3$$

$$= \left(\frac{7}{5}\right)^{4 \times 3}$$

$$= \left(\frac{7}{5}\right)^{12}$$

$$d) \left[2\left(-\frac{2}{3}\right)^2\right]^3$$

$$= \left[\left(\frac{2}{3}\right)^2\right]^3$$

$$= \left(\frac{2}{3}\right)^{2 \times 3}$$

$$= \left(\frac{2}{3}\right)^6$$

5. Express as R.no with negative exponents

$$a) \left(\frac{3}{8}\right)^{-7} \times \left(\frac{3}{8}\right)^{-23}$$

$$= \left(\frac{3}{8}\right)^{-7+(-23)}$$

$$= \left(\frac{3}{8}\right)^{-7-23}$$

$$= \left(\frac{3}{8}\right)^{-30}$$

$$b) \left(\frac{4}{9}\right)^{-14} \div \left(\frac{4}{9}\right)^{-18}$$

$$= \left(\frac{4}{9}\right)^{-14-(-18)}$$

$$= \left(\frac{4}{9}\right)^{-14+18}$$

$$= \left(\frac{4}{9}\right)^{-4}$$

$$c) \left(\frac{3}{13}\right)^{-15} \times \left(\frac{4}{7}\right)^{-15}$$

$$= \left(\frac{3}{13}\right)^{-15} \times \left(\frac{4}{7}\right)^{-15}$$

$$= \left(\frac{12}{91}\right)^{-15}$$

$$d. \frac{-4-11}{-12-11}$$

$$\left(\frac{7}{12}\right)^{-11}$$

$$e) \left[\left(\frac{3}{9}\right)^5\right]^{-13}$$



$$= \left(\frac{2}{5}\right)^{5 \times -13}$$

$$= \left(\frac{2}{5}\right)^{-15}$$

$$d. \left[\left(\left(\frac{9}{2} \right)^2 \right)^{-3} \right]^4$$

$$= \left(\frac{9}{2} \right)^{2 \times -3 \times 4}$$

$$= \left(\frac{9}{2} \right)^{-24}$$

$$= \left(\frac{2}{9} \right)^{24}$$

$$6. a. (-1)^{543267} \text{ is equal to.}$$

$$i) -1 \quad ii) 1 \quad iii) 0 \quad iv) \text{None of the}$$

$$b. (-1)^{564238} \text{ is equal to}$$

$$i) 1 \quad ii) -1 \quad iii) 0 \quad iv) \text{None of the}$$

7. Express as rational numbers in the form $\frac{p}{q}$.

$$a. 6^{-3}$$

$$= \frac{1}{6^3}$$

$$b. (-5)^{-2}$$

$$= \frac{1}{5^2} = \frac{1}{25}$$

$$= \frac{1}{216}$$

$$c. \left(\frac{2}{5} \right)^{-3}$$

$$= \left(\frac{5}{2} \right)^3$$

$$= \frac{125}{8}$$

$$d. \left(\frac{-1}{3} \right)^{-2}$$

$$= \left(\frac{3}{-1} \right)^2$$

$$= 9$$

$$= \frac{9}{1}$$

$$e. \left(\frac{3}{4} \right)^{-3}$$

$$= \left(\frac{4}{3} \right)^3$$

$$= \frac{64}{27}$$

$$d) 2^{-2} \times 5^{-2}$$

$$= \frac{1}{2^2 \times 5^2}$$

$$= \frac{1}{100}$$

8. Simplify as rational numbers in the form $\frac{p}{q}$.



Shot on Y83 Pro
vivo dual camera

a. $\left(\frac{3}{5}\right)^{-4} \div \left(\frac{6}{20}\right)^{-3}$

$= \left(\frac{3}{5}\right)^{-4} \times \left(\frac{20}{6}\right)^{-4+(-3)}$

$= \left(\frac{3}{5}\right)^{-4} \times \left(\frac{10}{3}\right)^{-4-3}$

$= \left(\frac{3}{5}\right)^{-4} \times \left(\frac{3}{10}\right)^{-7}$

$= \frac{3^4}{5^4} \times \frac{10^7}{3^7} = \frac{6}{50}$

b) $\left(\frac{3}{8}\right)^{-2} \times \left(\frac{16}{27}\right)^{-2}$

$= \left(\frac{8}{3}\right)^2 \times \left(\frac{27}{16}\right)^2$

$= \left(\frac{4}{3}\right)^2 \times \left(\frac{27}{16}\right)^2$

$= \left(\frac{16}{9}\right)^2$

c. $\left(\frac{9}{3}\right)^{-5} \times \left(\frac{9}{4}\right)^{-4} \div \left(\frac{2}{3}\right)^2$

$= \left(\frac{3}{1}\right)^{-5} \times \left(\frac{4}{9}\right)^{-4} \times \left(\frac{3}{2}\right)^2$

$= \left(\frac{3}{1}\right)^{-5} \times \left(\frac{4}{9}\right)^{-4} \times \left(\frac{3}{2}\right)^2$

$= \left(\frac{3}{1}\right)^{-5} \times \left(\frac{4}{9}\right)^{-4} \times \left(\frac{3}{2}\right)^2$

$= \left(\frac{3}{1}\right)^{-5} \times \left(\frac{4}{9}\right)^{-4} \times \left(\frac{3}{2}\right)^2$

$\left(\frac{3}{2}\right)^5 \times \left(\frac{4}{9}\right)^4 \div \left(\frac{2}{3}\right)^2$

$= \frac{3^5}{2^5} \times \frac{4^4}{9^4} \times \frac{3^2}{2^2}$

$= \frac{3^5}{2^5} \times \frac{4^4}{9^4} \times \frac{3^2}{2^2}$

a. $\left(\frac{3}{4}\right)^{-2} \div \left(\frac{64}{27}\right)^{-2} \times \left(\frac{3}{4}\right)^2$

$= \left(\frac{4}{3}\right)^2 \div \left(\frac{27}{64}\right)^2 \times \left(\frac{3}{4}\right)^2$

$= \frac{4^2}{3^2} \times \frac{64^2}{27^2} \times \frac{3^2}{4^2}$

$= \frac{4096}{729}$

10. By what should $\left(\frac{3}{5}\right)^{-3}$ be divided to get $\left(\frac{5}{3}\right)^{-4}$?

$\left(\frac{5}{3}\right)^{-4} \times \left[\left(\frac{5}{3}\right)^2\right]^{-3}$

$= \left(\frac{5}{3}\right)^{-4} \times \left[\left(\frac{5}{3}\right)^6\right]$

$= \left(\frac{5}{3}\right)^{-4+6}$

$= \left(\frac{5}{3}\right)^2$

Q. By what power of $\left(\frac{3}{4}\right)^{-5}$ be divided to get $\left(\frac{3}{4}\right)^{-2}$

$$\left(\frac{3}{4}\right)^{-5} \times \left(\frac{3}{4}\right)^{-2} = \left(\frac{3}{4}\right)^{-7}$$

$$\left(\frac{3}{4}\right)^{-5} \times \left(\frac{3}{4}\right)^{-2} = \left(\frac{3}{4}\right)^{-7}$$

$$\left(\frac{3}{4}\right)^{-5} \times \left(\frac{3}{4}\right)^{-2} = \left(\frac{3}{4}\right)^{-7}$$

Q. $\left(\frac{3}{4}\right)^{-5} \times \left(\frac{3}{4}\right)^{-2}$

$$\left(\frac{3}{4}\right)^{-5} \times \left(\frac{3}{4}\right)^{-2} = \left(\frac{3}{4}\right)^{-7}$$

$$\left(\frac{3}{4}\right)^{-5} \times \left(\frac{3}{4}\right)^{-2} = \left(\frac{3}{4}\right)^{-7}$$

$$\left(\frac{3}{4}\right)^{-5} \times \left(\frac{3}{4}\right)^{-2} = \left(\frac{3}{4}\right)^{-7}$$

Q. $\left(\frac{3}{4}\right)^{-5} \times \left(\frac{3}{4}\right)^{-2}$

$$\left(\frac{3}{4}\right)^{-5} \times \left(\frac{3}{4}\right)^{-2} = \left(\frac{3}{4}\right)^{-7}$$

Q. $\left(\frac{5}{6}\right)^{-8} \div \left(\frac{5}{6}\right)^{-3}$

$$\left(\frac{5}{6}\right)^{-8} \div \left(\frac{5}{6}\right)^{-3} = \left(\frac{5}{6}\right)^{-5}$$

$$\left(\frac{5}{6}\right)^{-8} \div \left(\frac{5}{6}\right)^{-3} = \left(\frac{5}{6}\right)^{-5}$$

$$\left(\frac{5}{6}\right)^{-8} \div \left(\frac{5}{6}\right)^{-3} = \left(\frac{5}{6}\right)^{-5}$$

11. Evaluate

$$(8 \times 8^0) + [5 \times (-9)^{0.31}] + [2 \times (-9)^{0.22}] + (9 \times 9^0)$$

$$= (8 \times 1) + [5 \times (-1)] + [2 \times 1] + (9 \times 1)$$

$$= 8 - 5 + 2 + 9$$

$$= 14$$

Q. $\frac{2-3 \times 4-2}{4-3}$

$$\frac{2-3 \times 4-2}{4-3} = \frac{2-12-2}{1} = -12$$

Q. $\frac{2^5 \times 2^3}{2^2 \times 2^4}$

$$\frac{2^5 \times 2^3}{2^2 \times 2^4} = \frac{2^8}{2^6} = 2^2 = 4$$

Q. $\frac{2^5 \times 2^3}{2^2 \times 2^4}$

$$\frac{2^5 \times 2^3}{2^2 \times 2^4} = \frac{2^8}{2^6} = 2^2 = 4$$

$$c) \begin{pmatrix} 2 \\ 11 \end{pmatrix}^{-9} \times \begin{pmatrix} 11 \\ 2 \end{pmatrix}^{-12}$$

$$= \begin{pmatrix} 11 \\ 2 \end{pmatrix}^9 \times \begin{pmatrix} 2 \\ 11 \end{pmatrix}^{-12}$$

$$= \begin{pmatrix} 11 \\ 2 \end{pmatrix}^{9+(-12)}$$

$$= \begin{pmatrix} 11 \\ 2 \end{pmatrix}^{-3}$$

$$= \begin{pmatrix} 11 \\ 2 \end{pmatrix}^{-3} = \begin{pmatrix} 2 \\ 11 \end{pmatrix}^3 \text{ Ans.}$$

$$d) (4-2+3-2)^{-2} \times \begin{pmatrix} 6 \\ 25 \end{pmatrix}^{-4}$$

$$= \left[\begin{pmatrix} 1 \\ 4 \end{pmatrix}^2 + \begin{pmatrix} 1 \\ 3 \end{pmatrix}^2 \right]^{-2} \times \begin{pmatrix} 6 \\ 25 \end{pmatrix}^{-4}$$

$$= \left[\frac{1}{16} + \frac{1}{9} \right]^{-2} \times \begin{pmatrix} 6 \\ 25 \end{pmatrix}^{-4}$$

$$= \left[\frac{9+16}{144} \right]^{-2} \times \begin{pmatrix} 6 \\ 25 \end{pmatrix}^{-4}$$

$$= \left[\frac{25}{144} \right]^{-2} \times \begin{pmatrix} 6 \\ 25 \end{pmatrix}^{-4}$$

$$= \left(\frac{144}{25} \right)^2 \times \begin{pmatrix} 25 \\ 6 \end{pmatrix}^4$$

$$= \frac{144}{25} \times \frac{144}{25} \times \frac{25}{6} \times \frac{25}{6} \times \frac{25}{6} \times \frac{25}{6}$$

$$= 10000$$

$$= (10)^4$$

$$e) \frac{3-3}{6-2} \times \frac{5-6}{15-3} \times \frac{2-4}{8-2}$$

$$= \frac{0}{4} \times \frac{-1}{12} \times \frac{-2}{6}$$

$$= 0 \times \frac{1}{72}$$

$$= 0$$

$$= 0$$

$$f) (5-1-4-1) \times \begin{pmatrix} 14 \\ 13 \end{pmatrix}^{-1}$$

$$= \left[\frac{1}{5} - \frac{1}{4} \right] \times \begin{pmatrix} 15 \\ 14 \end{pmatrix}$$

$$= \frac{4-5}{20} \times \frac{15}{14}$$

$$= \frac{-1}{20} \times \frac{15}{14}$$

$$= \frac{-15}{280}$$

$$= \frac{-3}{56}$$

$$g) (2-1+3-1) \div \begin{pmatrix} 24 \\ 15 \end{pmatrix}^{-2}$$

$$= \left[\frac{1}{2} + \frac{1}{3} \right] \div \begin{pmatrix} 15 \\ 24 \end{pmatrix}^2$$

$$= \left[\frac{3+2}{6} \right] \div \begin{pmatrix} 15 \\ 24 \end{pmatrix}^2$$

$$= \frac{5}{6} \div \begin{pmatrix} 15 \\ 24 \end{pmatrix}^2$$

$$\left(\frac{5}{3}\right)^{3+x-2} = \left(\frac{5}{3}\right)^3$$

Comparing the exponent

$$\begin{aligned} 1+x &= 3 \\ x &= 3-1 \\ x &= 2 \quad \text{Ans.} \end{aligned}$$

$$b. x = \left(\frac{3}{5}\right)^{-4} \times \left(\frac{10}{4}\right)^{-2}$$

$$= \left(\frac{3}{5}\right)^{-4} \times \left(\frac{5}{2}\right)^2$$

$$= \left(\frac{3}{5}\right)^{-4+2} = \left(\frac{3}{5}\right)^{-2}$$

$$= \left(\frac{5}{3}\right)^2 \quad \text{Ans.}$$

$$c. \left(\frac{3}{8}\right)^{-8} \times \left(\frac{3}{8}\right)^{-3} \div \left(\frac{3}{8}\right)^{-5} = \left(\frac{3}{8}\right)^3$$

$$\left(\frac{3}{8}\right)^{-8+(-3)-(-5)} = \left(\frac{3}{8}\right)^{3x-24}$$

$$\left(\frac{3}{8}\right)^{-8-3+5} = \left(\frac{3}{8}\right)^{3x-24}$$

$$\left(\frac{3}{8}\right)^{-11+5} = \left(\frac{3}{8}\right)^{3x-24}$$

$$\left(\frac{3}{8}\right)^{-6} = \left(\frac{3}{8}\right)^{3x-24}$$

d.

$$\left(\frac{3}{2}\right)^x \times \left(\frac{3}{2}\right)^5 \div \left(\frac{3}{2}\right)^4 = \left(\frac{3}{2}\right)^2$$

$$\left(\frac{3}{2}\right)^5 \div \left(\frac{3}{2}\right)^4 = \left(\frac{3}{2}\right)^{x-2-4}$$

$$\left(\frac{3}{2}\right)^1 = \left(\frac{3}{2}\right)^{-6x}$$

Comparing the exponent

$$5 = -6x$$

$$x = -6-5$$

$$x = 11 \quad \text{Ans.}$$

e)

$$x = \left(\frac{3}{7}\right)^{-6} \times \left(\frac{3}{7}\right)^{-3}$$

$$x = \left(\frac{3}{7}\right)^{-6} \times \left(\frac{3}{7}\right)^3$$

$$x = \left(\frac{3}{7}\right)^{-6+3}$$

Comparing the exponent

$$\begin{aligned} -6 &= 3x-24 \\ -6+24 &= 3x \end{aligned}$$

$$18 = 3x$$

$$x = 6 \quad \text{Ans.}$$

$$\left(\frac{2}{3}\right)^{-3} = \left(\frac{3}{2}\right)^3$$

$$\begin{aligned} d) \left(\frac{6}{11}\right)^{-12} &= \left(\frac{11}{6}\right)^{-4} \times \left(\frac{6}{11}\right)^{-2} = \left(\frac{6}{11}\right)^{4x-18} \\ &= \left(\frac{6}{11}\right)^{-12-(4)+(-2)} = \left(\frac{6}{11}\right)^{4x-18} \\ &= \left(\frac{6}{11}\right)^{-12+4-2} = \left(\frac{6}{11}\right)^{4x-18} \\ &= \left(\frac{6}{11}\right)^{-10} = \left(\frac{6}{11}\right)^{4x-18} \end{aligned}$$

Comparing the Exponent $\rightarrow$

$$4x = 18 - 10$$

$$4x = 8$$

$$x = \frac{8}{4} = 2$$

$$x = 2 \text{ Ans.}$$

~~Exponent~~

Say this pg no. 32

a1. Write in expanded form.

a2. 24.72

$$= 2 \times 10^1 + 4 \times 10^0 + 7 \times 10^{-1} + 2 \times 10^{-2}$$

b. 10.027

$$= 1 \times 10^1 + \frac{0}{10} + \frac{2}{100} + \frac{7}{1000}$$

$$= 1 \times 10^1 + 2 \times 10^{-2} + 7 \times 10^{-3}$$

c. 4978.207

$$= 4 \times 10^3 + 9 \times 10^2 + 7 \times 10^1 + 8 \times 10^0 +$$

$$\frac{2}{10} + \frac{7}{1000}$$

$$= 4 \times 10^3 + 9 \times 10^2 + 7 \times 10^1 + 8 \times 10^0 + 2 \times 10^{-1} + 7 \times 10^{-3}$$

d. Write in decimal form.

$$a. 1 \times 10^1 + 2 \times 10^0 + 4 \times 10^{-1} + 7 \times 10^{-2}$$

$$= 10 + 2 \times 1 + \frac{4}{10} + \frac{7}{100}$$

$$= 10 + 2 + 0.4 + 0.07$$

$$= 12.47 \text{ Ans.}$$

$$6. 3 \times 10^1 + 2 \times 10^{-3} + 3 \times 10^{-4}$$

$$= \frac{30}{1000} + \frac{2}{1000} + \frac{3}{10000}$$

$$= \frac{30}{1000} + \frac{2}{1000} + \frac{0.0003}{1000}$$

$$= 30.0023 \text{ Ans.}$$

$$c. 1 \times 10^{-1} + 3 \times 10^{-3} + 1 \times 10^{-4}$$

$$= \frac{1}{10} + \frac{3}{1000} + \frac{1}{10000}$$

$$= 0.1 + 0.003 + 0.0001$$

$$= 0.10031$$

Thus pg no-33

1. Express in standard form.

$$a. 0.0000009$$

$$= 9 \times 10^{-7}$$

$$b. 0.000000456$$

$$= 4.56 \times 10^{-6}$$

$$c. 1234500000$$

$$= 1.2345 \times 10^9$$

$$= \frac{12345}{1000000000}$$

$$d. 3765.43$$

$$= \frac{376543}{1000} = 3.76543 \times 10^3$$

$$e. 12.222$$

$$= \frac{12222}{10} = 1.2222 \times 10^1$$

2. Express the following numbers in usual form.

$$a. 2.97 \times 10^{-5}$$

$$\Rightarrow 0.0000297$$

$$b. 378 \times 10^7$$

$$\Rightarrow 378000000$$

$$c. 30003 \times 10^9$$

$$\Rightarrow 30003000000$$

$$d. 1.234 \times 10^{-3}$$

$$\Rightarrow 0.001234$$

$$e. 4.4000 \times 10^{-4}$$

$$\Rightarrow 0.00044$$

Thus pg no-34



4. Evaluate

$$a. 5.965 \times 10^{15} + 39.46 \times 10^{13}$$

$$= 5.965 \times 10^{15} + 39.46 \times 10^{13} \times 10^{15}$$

$$= 5.965 \times 10^{15} + 39460 \times 10^{15}$$

$$= (5965 + 39460)$$

$$= 39465.965 \times 10^{15} \text{ km}$$

$$b. 6.28 \times 10^{-10} - 9.99 \times 10^{-12}$$

$$= 6.28 \times 10^{-10} - 9.99 \times 10^{-12} \times 10^{-10}$$

$$= 6.28 \times 10^{-10} - 0.0999 \times 10^{-10}$$

$$= (6.28 - 0.0999) \times 10^{-10}$$

$$= 6.1801 \times 10^{-10}$$

3. The Radius

$$\text{Radius of Saturn} = 6.02 \times 10^7 \text{ m} = 60.2 \times 10^6$$

$$\text{Radius of Earth} = 6.3 \times 10^6 \text{ m} = 6.3 \times 10^6$$

$\Rightarrow$ Radius of Saturn is greater than the radius of Earth.

3. The Mass

$$= 5.68 \times 10^1 \times 10^{25} = 5.68 \times 10^{25}$$

$$= 568 \times 10^{25} \text{ kg} = 568 \times 10^{25}$$

$$= (568 + 868) \times 10^{25}$$

$$= 4812 \times 10^{25}$$

Exercise 2.2

1. Write in decimal form.

$$a. 7 \times 10^1 + 3 \times 10^0 + 3 \times 10^{-2} + 8 \times 10^{-3}$$

$$= 70 + 3 \times 1 + \frac{3}{100} + \frac{8}{1000}$$

$$= 70 + 3 + 0.03 + 0.008$$

$$= 73.038$$

$$b. 8 \times 10^2 + 1 \times 10^0 + 3 \times 10^{-2} + 4 \times 10^{-5}$$

$$= 800 + 1 \times 1 + \frac{3}{100} + \frac{4}{1000}$$

$$= 801 + 0.03 + 0.004$$

$$= 801.034$$

$$c. 2 \times 10^1 + 5 \times 10^{-2} + 7 \times 10^{-3}$$

$$= 20 + \frac{5}{100} + \frac{7}{1000}$$

$$= 20 + 0.05 + 0.007$$

$$= 20.057$$

$$d. 3 \times 10^2 + 6 \times 10^0 + 2 \times 10^{-1} + 6 \times 10^{-2}$$

$$= 300 + 6 \times 1 + \frac{2}{10} + \frac{6}{100}$$

$$= 306 + 0.2 + 0.006$$

$$= 306.206$$

8. Write in standard form.

a. 0.00005656

$\rightarrow 5.656 \times 10^{-5}$

b. 0.000000019800

$\rightarrow 1.98 \times 10^{-8}$

c. 0.000008754

$\rightarrow 8.754 \times 10^{-6}$

d. 0.0000521

$\rightarrow 5.21 \times 10^{-5}$

3. Write in usual form.

a. 7.02103×10^{-9}

$\rightarrow 0.0000000702103$

b. 4080.561×10^{-8}

$\rightarrow 0.00004080561$

c. 34.01023×10^{-8}

$\rightarrow 0.000003401023$

d. $9880.02301 \times 10^{-2}$

$\rightarrow 98.8002301$

4-a) The radius distance. — form

Distance = $(1.5)^2 \times (108)^2 \text{ km}$
 $= 2.25 \times 1016 \text{ km}$

b. The distance — form

Distance = $3.8 \times 10^5 \text{ km}$
 $= 3.8 \times 10^5$
 $= (3.8) \times 10^5$
 $= 3.8 \times 10^5 \text{ km}$

5. The mass — comparison

Mass of Earth = 5.9×10^{24} (592.6×10^{22})
 Mass of Moon = 7.4×10^{22} (5.92×10^{24})

Ans (B) The Earth is 80 times heavier than the moon

6. The time — time

Ans: In time taken by light = 3×10^{-5}
 time taken by sound = 2.9×10^{-5}

Ans: (D) The speed of light is 10^8 times the speed of sound

1. *Quadratische Gleichungen*

$$\begin{aligned} & (3.4 \times 10^3) + (1.4 \times 10^4) \\ & 3.4 \times 10^3 + 1.4 \times 10^4 = 1.74 \times 10^4 \\ & 3.4 \times 10^3 + 1.4 \times 10^4 = 1.74 \times 10^4 \\ & (1.4 \times 10^4) + (3.4 \times 10^3) \\ & 1.4 \times 10^4 + 3.4 \times 10^3 = 1.74 \times 10^4 \end{aligned}$$

$$\begin{aligned} & (1.5 \times 10^{-6}) + (9.4 \times 10^{-10}) \\ & 1.5 \times 10^{-6} + 9.4 \times 10^{-10} = 1.50094 \times 10^{-6} \\ & 1.5 \times 10^{-6} + 9.4 \times 10^{-10} = 1.50094 \times 10^{-6} \\ & (1.5 \times 10^{-6}) + (9.4 \times 10^{-10}) \\ & 1.5 \times 10^{-6} + 9.4 \times 10^{-10} = 1.50094 \times 10^{-6} \end{aligned}$$

$$\begin{aligned} & (8.8 \times 10^8) + (1.9 \times 10^6) \\ & 8.8 \times 10^8 + 1.9 \times 10^6 = 8.819 \times 10^8 \\ & 8.8 \times 10^8 + 1.9 \times 10^6 = 8.819 \times 10^8 \\ & (8.8 \times 10^8) + (1.9 \times 10^6) \\ & 8.8 \times 10^8 + 1.9 \times 10^6 = 8.819 \times 10^8 \end{aligned}$$

$$\begin{aligned} & (2.1 \times 10^{-12}) + (4.7 \times 10^{-14}) \\ & 2.1 \times 10^{-12} + 4.7 \times 10^{-14} = 2.147 \times 10^{-12} \\ & 2.1 \times 10^{-12} + 4.7 \times 10^{-14} = 2.147 \times 10^{-12} \\ & (2.1 \times 10^{-12}) + (4.7 \times 10^{-14}) \\ & 2.1 \times 10^{-12} + 4.7 \times 10^{-14} = 2.147 \times 10^{-12} \end{aligned}$$