SHARP

Worksheet 5 Memorandum: Exponents

Grade 9 Mathematics

1. a) $ababaabaa = a^6b^3$ b) $5.5.5.5.xxx.yyyxyx = 5^4x^5y^4$

   c) $abcadbdcab = a^3b^3c^2d^2$ d) $xxxyyyxyxyx2.2.2.3.3.3.2 = 2^43^3x^6\,y^5$

   e) $7.7.2.2.2.2.x.x.x.x.x = 2^47^2x^5$ f) $11.11.\frac{aaaa}{bbb} = 11^2\,a^4b^{-3}$

   g) $cbc^2b^3c^4 = c^7b^4$ h) $ccccbbbbbcbabaabcc = a^3b^8c^7$

   i) $\frac{xxxxxx}{yyyy} = x^6y^{-4}$ j) $ggggghhhghghgh7.7.7 = \ 7^3g^7h^6$

   k) $\frac{mmmmmm}{5.5.5.5.5} = 5^{-5}m^6$ l) $nnpppqqqrr = n^2p^3q^3r^2$

2. a) $2^5x^3 = 2.2.2.2.2xxx$ b) $5^2 \times 7^4 \times a^8 = 5.5.7.7.7.7aaaaaaaa$

   c) $3^3 \times x^2 \times y^4 = 3.3.3xxyyyy$ d) $10^4xy^2z^3 = 10.10.10.10xyyzzz$

   e) $(3^2x^3y)^3 = 3^6x^9y^3 = 3.3.3.3.3.3xxxxxxxxxyyy$

   f) $\frac{1}{a^4} = \frac{1}{aaaa}$ g) $6^{-3}a^3b^4 = \frac{aaabbbb}{6.6.6}$

   h) $(2^4a^9b^7)^0 = 1$ i) $4^3b^4x^3y^2 = 4.4.4bbbbxxxyy$

3. Write the following numbers in scientific notation

   a) 290 000 $= 2.9 \times 10^5$ b) 0.00000931 $= 9.31 \times 10^{-6}$

   c) 90 400 $= 9.04 \times 10^4$ d) 7 180 $= 7.18 \times 10^3$

   e) 0.000000675 $= 6.75 \times 10^{-7}$ f) 0.00549 $= 5.49 \times 10^{-3}$

   g) 0.0894 $= 8.94 \times 10^{-2}$ h) 0.00228 $= 2.28 \times 10^{-3}$

   i) 681 000 000 6.81×10^8

4. Write these scientific notation numbers into normal format:

a) 1.95×10^4 = 19 500

b) 5.53×10^{-2} = 0.0553

c) 5.14×10^{-4} = 0.000514

d) 4.93×10^7 = 49 300 000

e) 5.26×10^{-6} = 0.00000526

f) 6.97×10^3 = 6 970

g) 7.04×10^{-7} = 0.000000704

h) 1.97×10^{10} = 19 700 000 000

i) 4.08×10 = 40.8

5. Simplify the following, write the final answer with positive exponents

a) $(a^2b)^3 \times \frac{a^4b}{(ab^3)^{-1}}$

$= \frac{a^6b^3}{1} \times \frac{a^4b}{a^{-1}b^{-3}}$

$= \frac{a^{10}b^4}{a^{-1}b^{-3}}$

$= a^{11}b^7$

b) $(ab^3)^0$

$= 1$

c) $\frac{x^5y^{-3}}{(x^2y^2)^2} \times \left(\frac{1}{xy^2}\right)^{-1}$

$= \frac{x^5y^{-3}}{x^4y^4} \times \frac{xy^2}{1}$

$= \frac{x^6y^{-1}}{x^4y^4}$

$= \frac{x^2}{y^5}$

d) $\frac{8m^2n}{9m^{-3}n^2} \div \frac{16m^3n^{-1}}{3m^4n}$

$= \frac{8m^2n}{9m^{-3}n^2} \times \frac{3m^4n}{16m^3n^{-1}}$

$= \frac{8 \times 3\, m^6n^2}{9 \times 16n}$

$= \frac{m^6n}{2 \times 3}$

$= \frac{m^6n}{6}$

e) $\frac{ab^2c}{(abc^2)^2} \times \frac{(a^{-2}b^3c)^{-1}}{a^0b^4}$

$= \frac{ab^2c}{a^2b^2c^4} \times \frac{a^2b^{-3}c^{-1}}{b^4}$

$= \frac{a^3b^{-1}}{a^2b^6c^4}$

$= \frac{a}{b^7c^4}$

f) $2^3a^3b^4 \times 3^2a^{-2}b^2$

$= 8 \times 9\, ab^6$

$= 72ab^6$

g) $\frac{p^3q^2}{p^{-2}q^3} \times \frac{16p^3q^3}{(2p^{-1}q^2)^3}$

$= \frac{p^3q^2}{p^{-2}q^3} \times \frac{16p^3q^3}{8p^{-3}q^6}$

$= \frac{16\,p^6q^5}{8p^{-5}q^9}$

$= \frac{2p^{11}}{q^4}$

h) $\left(\frac{m^3n}{mn^2}\right)^{-1} + \frac{m^3n^2}{n}$

$= \frac{mn^2}{m^3n} + \frac{m^3n^2}{n}$

$= \frac{n}{m^2} + m^3$

i) $\left(\frac{x}{y} + \frac{y^2}{x^2}\right)^{-1}$

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

$= \frac{x^2y}{x^3+y^3}$

6. a) $3^x = 27$

$3^x = 3^3$

$\therefore x = 3$

b) $x^4 = 16$

$x^4 = 2^4$

$\therefore x = 2$

c) $5^x = 125$

$5^x = 5^3$

$\therefore x = 3$

d) $4^{x-2} = 1$

$4^{x-2} = 4^0$

$x - 2 = 0$

$\therefore x = 2$

e) $5^4 = x$

$\therefore x = 625$

f) $x^3 = 729$

$x^3 = 9^3$

$\therefore x = 9$

g) $3 \times 2^x = 96$

$2^x = \frac{96}{3}$

$2^x = 32$

$2^x = 2^5$

$\therefore x = 5$

h) $10^x = 0.0001$

$10^x = 10^{-4}$

$\therefore x = -4$

i) $8^3 = x$

$\therefore x = 512$

j) $x^7 = 16\,384$

$x^7 = 4^7$

$\therefore x = 4$

k) $\frac{3^x}{7} = 34\frac{5}{7}$

$3^x = 243$

$3^x = 3^5$

$\therefore x = 5$

l) $8^x = 2^3$

$8^x = 8^1$

$\therefore x = 1$

m) $3^{x-3} = 9$

$3^{x-3} = 3^2$

$x - 3 = 2$

$\therefore x = 5$

n) $8^x = \frac{1}{2}$

$2^{3x} = 2^{-1}$

$3x = -1$

$x = -\frac{1}{3}$

o) $7^{x+2} = \frac{1}{343}$

$7^{x+2} = 7^{-3}$

$x + 2 = -3$

$x = -5$

7. $2^x = 16$

$2^x = 2^4$

$\therefore x = 4$ $\therefore$ It takes 4 x 3 = 12 years for your money to grow to 16 times its original value

8. a) $x^2 = 64$

$\therefore x^2 = 8^2$

$\therefore x = 8cm$

The length of the cube is 8cm

b) $x^3 = 1\,728$

$x^3 = 12^3$

$\therefore x = 12cm$

The length of the cube is 12cm

c) $\frac{1}{2}x^3 = 1\,687.5$

$x^3 = 3\,375$

$x^3 = 15^3$

$x = 15cm$ The length of the cube is 15cm

9. $3^x = 19\,683$

$3^x = 3^9$

$\therefore x = 9$

10. 1 000 000 000 nanometers in 1m

$\therefore$ 1 000 000 000 ÷ 400

= 2 500 000 viruses in a meter.

$\therefore$ 2 500 000 x 1 000m in 1km

= 2.5 x 10^9 viruses in a km.