

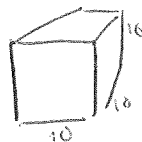
1. Sketch models to represent the following:

a) 7^2



$$7 \times 7 = 49$$

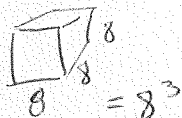
b) 1000 cm^3



$$10 \times 10 \times 10 = 1000 \text{ cm}^3$$

2. A cube has a volume of 512 cm^3 .

a) Write the dimensions as powers with the lowest base.



$$8 = 2^3$$

$$= (2^3)^3 = 2^9$$

b) Write the surface area as a power

$$(2^3)^2 \times 6 = 2^6 \times 6 = 2^7 \times 3$$

3. Find a number that can be shown as both a square and a cube

$$(64)$$

$$\sqrt{64} = 8$$

$$\sqrt[3]{64} = 4$$

4. Evaluate

a) -5^2

$$-5 \times 5$$

$$= -25$$

b) $(-3)^4$

$$(-3) \times (-3) \times (-3) \times (-3)$$

$$= 81$$

c) $-(-4)^3$

~~$$-(-4)^3$$~~

$$-1(-4)(-4)(-4)$$

$$= 64$$

5. Arrange in order from least to greatest

$$(-3)^2, -3^2, (-1)^{50}, (-1)^{27}, (-3)^4$$

$$= 9, = -9, = 1, = -1, = 81$$

$$-3^2, (-1)^{27}, (-1)^{50}, (-3)^2, (-3)^4$$

6. Express the following as a single power

a) $(5^4)^3 \div (5^2)^2$

$$5^{4 \cdot 3} \div 5^{2 \cdot 2}$$

$$5^{12} \div 5^4$$

$$= 5^{12-4}$$

$$= (5^8)$$

b) $(7^4)^2 (7^3)^3$

$$7^{4 \cdot 2} \times 7^{3 \cdot 3}$$

$$7^8 \times 7^9$$

$$= 7^{8+9}$$

$$= (7^{17})$$

7. Complete the following

a) $2^{10} = 4^?$

b) $125^4 = 5^?$

c) $9^6 = 27^?$

$(2^2)^5 = (4^5)$

$(5^3)^4 = (5^{12})$

$(3^2)^6 = (3^3)^?$

$3^{12} = 3^{3 \cdot 4}$

$= 27^4$

8. Simplify as a power

a) $\frac{(x^3)(x^6)}{x^5} = \frac{x^9}{x^5} = (x^4)$

b) $(a^4)^2 \cdot a^2$

$a^8 \cdot a^3$

(a^5)

9. Express $(2^6 \times 2^2)^3$ as a power with a single base

$(2^6 \times (2^2)^2)^3 = (2^6 \times 2^4)^3 = (2^{10})^3 = 2^{30}$

10. A cube has sides 5.04 cm.

a) Show the volume as a power

b) Show the surface area as a power

$\sqrt[3]{128} = 5.04$

$6(5.04)^2$

$V = (5.04)^3$

11. Evaluate the following

a) 7^{-2}

b) $(3^{-4})^2 (3^3)^{-3}$

c) $2^{-1} + 2^{-2}$

$\frac{1}{7^2} = \frac{1}{49}$

$3^{-8} \times 3^{-9}$

$\frac{1}{2^1} + \frac{1}{2^2}$

$3^{-17} = \frac{1}{3^{17}}$

$\left(\frac{1}{12}\right) \frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$

12. Simplify $9^2 \times 32^5$ as a product of powers with the lowest base

9
 $3 \quad 3$
 $(3^2)^2$
 3^4

32
 $2 \quad 16$
 $2 \quad 2 \quad 8$
 $2 \quad 2 \quad 2 \quad 4$
 $2 \quad 2 \quad 2 \quad 2 \quad 2$
 $= (2^5)^5 = 2^{25}$

$= 3^4 \cdot 2^{25}$

13. Simplify without using your calculator

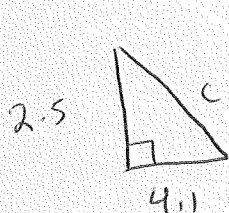
$$\begin{aligned} \text{a) } & (-7)^2 - 4^2 \div 8 + (2-6)^2 \\ & 49 - 16 \div 8 + 16 \\ & 49 - 2 + 16 = 63 \end{aligned}$$

$$\begin{aligned} \text{b) } & 6^3 \div 3^2 + 2^4 - 2^3 \\ & 216 \div 9 + 16 - 8 \\ & 24 + 16 - 8 \\ & = 32 \end{aligned}$$

$$\text{c) } \frac{(\sqrt{6^2+8^2}) + \sqrt{5^2-4^2} + 2^6}{2^4-3^2 \times 4^0}$$

$$\frac{6+8+5-64 \div 64}{16-9 \times 1} = \frac{6+8+5-1}{16-9} = \frac{18}{7}$$

14. The 2 legs of a right triangle measure 2.5 cm and 4.1 cm, respectively. Use the Pythagoras property to find the length of the hypotenuse to 2 decimal places. Sketch and label an appropriate model.



$$2.5^2 + 4.1^2 = c^2$$

$$6.25 + 17.64 = c^2$$

$$\sqrt{23.89} = \sqrt{c^2}$$

$$c = 4.89 \text{ cm}$$

15. Simplify the following without the use of your calculator

$$\text{a) } \sqrt{\frac{36}{49}}$$

$$\text{b) } \sqrt{\frac{121}{9}}$$

$$\frac{\sqrt{36}}{\sqrt{49}} = \frac{6}{7}$$

$$\frac{\sqrt{121}}{\sqrt{9}} = \frac{11}{3}$$

16. How would you verify that $\sqrt{6.25} = 2.5$, without using your square root ($\sqrt{\quad}$) button on your calculator?

$$\begin{array}{r} 12 \\ 2.5 \\ \times 2.5 \\ \hline 1.25 \\ 5.00 \\ \hline 6.25 \end{array}$$

$$2.5 \times 2.5 = 6.25$$

Name: _____

Score: _____

Exponent Rules

Use laws of exponents and simplify. Write your answers in positive exponents.

$$1) \left(\frac{x^7 y^3}{x^2 y} \right)^4 (x^5 y^2)^4$$

$$x^{20} y^8$$

$$2) (a^3 b)^4 (ab^6)^2$$

$$(a^{12} b^4)(a^2 b^{12})$$

$$a^{14} b^{16}$$

$$3) \left(\frac{8m^5 n^7}{2mn^5} \right)^3$$

$$(4m^4 n^2)^3$$

$$64m^{12} n^6$$

$$4) (5p^3 q^2)(2p^4 q)^2$$

$$20 p^8 q^4$$

$$5) \frac{(8k^{-5})(2k^3)}{4k^{-6}}$$

$$4k^4$$

$$6) (b^{-3} c^{-7})^{-2} (b^3 c^{-2})^{-3}$$

$$\frac{c^{20}}{b^3}$$

$$7) \left(\frac{6lm^2}{3l^3 m^6} \right)^2$$

$$\frac{4}{l^4 m^8}$$

$$8) \left(\frac{2r^{-5} s^6}{r^3 s^4} \right) (3r^9 s^{-4})$$

$$\frac{6r}{s^2}$$

$$9) (u^{-3} v^5) \left(\frac{9u^{-5} v^2}{3u^6 v^{-8}} \right)$$

$$\frac{3v^{15}}{u^{14}}$$

$$10) \frac{8v^5 w^{-6}}{(2v^{-3} w^2)(v^6 w)}$$

$$\frac{4v^2}{w^9}$$

$$11) \left(\frac{3s^{-2} t^7}{6s^3 t^{-5}} \right)^{-4}$$

$$\frac{16 s^{20}}{t^{48}}$$

$$12) (3l^{-2} m^3)(2m^{-5})^2 (lm^4)^{-3}$$

$$\frac{12}{l^5 m^{19}}$$

$$13) (4u^2 v)^{-3} (u^{-5} v^6)^2 (u^{-8} w^{-9})$$

$$\frac{v^9}{64 u^{24} w^9}$$

$$14) \left(\frac{6x^{-3} y^5}{2xy^2 z^6} \right)^5$$

$$\frac{243 y^{15}}{x^{20} z^{30}}$$

$$15) \frac{(2a^{-3} b)(6b^5 c^{-7})}{4c^{-9}}$$

$$\frac{3 b^6 c^2}{a^3}$$