Exponents Practice   Name:_____

> Show all relevant work!

Yöu may use a calculator to verify solutions, but not to provide them.

1. Simplify (write without denominators).

(a) $(2x^4y^5)^3$

(b) $\dfrac{a^{-2}bc^4}{a^{-3}b^2c^{-1}}$

(c) $\left(\dfrac{x^{-12}y^8}{3x^2y^4}\right)^{-2}$

2. Simplify (write without negative exponents).

(a) $\dfrac{(t^{-6})^2}{t^4(t^3)^{-4}}$

(b) $\left(\dfrac{7x^{-3}}{2y^2}\right)^{-2}$

(c) $\left(\dfrac{16a^{-12}b^8}{b^2c^4}\right)^{0}$

3. $f(x) = \left(\frac{3}{5}\right)^x$, evaluate for the values below. Give exact answers, in fraction form rather than decimals.

(a) $f(2)$

(b) $f(0)$

(c) $f(-2)$

4. If $g(x) = 3^x$, does $g(a+b) = g(a) + g(b)$?
   If not, give an example showing it fails. If so, try to show why by using algebra.

5. Explore 0^0.

   (a) Simplify 5^0, 4^0, 3^0, 2^0, 1^0. Based on your results, what seems to be a reasonable answer for 0^0?

   (b) Simplify 0^5, 0^4, 0^3, 0^2, 0^1. Based on your results, what seems to be a reasonable answer for 0^0?

   (c) Based on your answers to (a) and (b), why is it reasonable that we should leave 0^0 undefined?

6. Simplify each expression.

   (a) $x^{-1} =$ _____

   (b) $\left(x^{-1}\right)^{-1} =$ _____

   (c) $\left(\left(x^{-1}\right)^{-1}\right)^{-1} =$ _____

   (d) $\left(\left(\left(x^{-1}\right)^{-1}\right)^{-1}\right)^{-1} =$ _____

   (e) $\underbrace{\left(\cdots\left(\left(\left(x^{-1}\right)^{-1}\right)^{-1}\right)^{-1}\cdots\right)^{-1}}_{n \text{ exponents}}$

7. Remember the nth root of a number, x is written $\sqrt[n]{x}$ and it means, what number times itself n times is x.
   e.g. $\sqrt[3]{125}$ means what number times itself three times is 125? Since $5 \cdot 5 \cdot 5 = 125$ then answer is $\sqrt[3]{125} = 5$.
   Find:
   (a) $\sqrt[3]{8}$: _____   (b) $\sqrt[5]{32}$: _____   (c) $\sqrt[4]{81}$: _____   (d) $\sqrt[2]{36}$: _____

8. Recall that for any number, $x^1 = x$ and remember the exponent property $(x^m)^n = x^{mn}$.
   Use these properties to help answer the questions below.

   (a) Fill in the blank: $(x^n)^{\overline{}} = x$.

   (b) Fill in the blank: $(3^2)^{\overline{}} = 3$.

   (c) Fill in the blank: $(2^3)^{\overline{}} = 2$.

   (d) What operation does your exponent seem to be performing in $(a-c)$?

Answers:

1. (a) $8x^{12}y^{15}$ (b) $ab^{-1}c^5$ (c) $9x^{28}y^{-8}$

2. (a) $\frac{1}{t^4}$ (b) $\frac{4}{49}x^6y^4$ (c) 1

3. (a) $\frac{9}{25}$ (b) 1 (c) $\frac{25}{9}$

4. Not. e.g. if $a = 2$ and $b = 3$ then $g(a+b) = g(5) = 3^5 = 243$.
But $g(2) = 3^2 = 9$ and $g(3) = 3^3 = 27$ and $243 \neq 9 + 27$.

5. (a) 1 (b) 0 (c) Since $1 \neq 0$ we can't decide what 0^0 should equal so leave it undefined.

6. (a) $\frac{1}{x}$ (b) x (c) $\frac{1}{x}$ (d) x (e) $\frac{1}{x}$ if n is odd and x if n is even.

7. (a) 2 (b) 2 (c) 3 (d) 6

8. (a) $\frac{1}{n}$ (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) See 7 above - looks like nth root.