The following formulas may or may not be useful:

$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$ $\qquad$ $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

1. Given the number $\sqrt[3]{-27}$, circle all of the following that describe the number. real, rational, integer

real irrational rational natural integer

2. Sketch the following intervals on the number line and write the answer in interval notation.

(a). $-3 \le x < 2$ $[-3, 2)$

(b). $(-\infty, 5) \cup (0, 6]$ $(-\infty, 6]$

3. Evaluate the following. Simplify and reduce fractions, when possible.

(a). $2.8 + (-5.8)$ -3.0

(b). $\dfrac{(-2)(3)}{(-4)(-9)}$ $-\dfrac{1}{6}$

(c). $\dfrac{6 - 4 \cdot 2}{-2^3 + 1}$ $\dfrac{2}{7}$

(d). $6 - (9 - (5 - 3))$ -1

(e). $|4 + 6| - |4 - 6|$ 8

(f). $1 - \dfrac{2}{5}$ $\dfrac{3}{5}$

(g). $\dfrac{1}{2} - \dfrac{2}{3} + \dfrac{5}{8}$ $\dfrac{11}{24}$

(h). $2 \div \dfrac{4}{9}$ $\dfrac{9}{2}$

(i). $\dfrac{1}{3} \cdot 2\dfrac{1}{2}$ $\dfrac{5}{6}$

(j). -2^4 -16

(k). $\dfrac{2^3}{2^{-3}2^4}$ 4

(l). $\dfrac{3 \cdot |3 - 4| + |-5|}{|3^2 - 2^2|}$ $\dfrac{8}{5}$

4. Evaluate the following powers and roots. If it is not a real number, clearly state so.

(a). $\sqrt{-81}$ Not Real

(b). $\sqrt[5]{-32}$ -2

(c). $36^{1/2}$ 6

(d). $(-8)^{-2/3}$ $\dfrac{1}{4}$

5. Simplify the following. Use only positive exponents (i.e. no radicals, no negative exponents).

(a). $x^{-4}x^{7}$ x^{3}

(b). $\left(\dfrac{2x^{2}}{y^{5}}\right)^{-3}$ $\dfrac{y^{15}}{8x^{6}}$

(c). $\left(\dfrac{3x^{2}y^{-1}}{3^{3}x^{-1}y^{3}}\right)^{-2}$ $\dfrac{81y^{8}}{x^{6}}$

(d). $[(a^{-3}b^{-5})^{-1}]^{2}$ $a^{6}b^{10}$

(e). $\dfrac{(2u^{-2}v^{4})^{3}}{(10u^{3}v^{2})^{2}}$ $\dfrac{2v^{8}}{25u^{12}}$

(f). $\left(2x^{3}y^{2}z^{0}\right)^{2}\left(5x^{-2}yz^{6}\right)$ $20x^{4}y^{5}z^{6}$

(g). $\left(7^{-1/2}\right)^{-2/3}$ $7^{1/3}$

(h). $\dfrac{2x^{3/2}}{5x^{1/2}y^{-2/3}}$ $\dfrac{2}{5}xy^{2/3}$

6. Simplify the following expressions and leave the radical sign in your answer. [Assume nonnegative variables.]

(a). $\sqrt{27a^{4}b^{7}}$ $3a^{2}b^{3}\sqrt{3b}$

(b). $\sqrt[4]{2x^{3}y^{4}}\sqrt[4]{32xy^{2}}$ $2xy\sqrt[4]{4y^{2}}$

7. Rewrite the following in exponential form and simplify.

(a). $2x^{2}\sqrt{x}$ $2x^{5/2}$

(b). $\sqrt[3]{m^{4}n^{2}}$ $m^{4/3}n^{2/3}$

8. Write the following in radical form.

(a). $5x^{2/3}$ $5\sqrt[3]{x^{2}}$

(b). $2x^{-1/2}$ $\dfrac{2}{\sqrt{x}}$

9. Write the following in the form cx^{n} where c is a constant and n is a rational number (which may be negative).

$\dfrac{3}{2x\sqrt{x}}$ $\dfrac{3}{2}x^{-3/2}$

10. Rationalize the denominator and simplify. $\dfrac{x}{\sqrt{2x^{3}}}$ $\dfrac{\sqrt{2x}}{2x}$

11. Perform the indicated operations and simplify.

(a). $a - 1 + [3x - 2y - (4a - 3y + 4)]$ $-3a + 3x + y - 5$

(b). $(a + b + c)(x + y)$ $ax + bx + cy + ay + by + cy$

(c). $(x - 2y)(x + 2y)$ $x^2 - 4y^2$

(d). $(4a + 3b)^2$ $16a^2 + 24ab + 9b^2$

(e). $(x - 2)^3$ $x^3 - 6x^2 + 12x - 8$

(f). $2x(x - 3)(4x - 1)$ $8x^3 - 26x^2 + 6x$

(g). $\left(x^{1/3} + 1\right)\left(x^{2/3} - 4\right)$ $x - 4x^{1/3} + x^{2/3} - 4$

12. A rental boat costs \$65 per day plus \$5 per gallon of gasoline. If x is the number of gallons used, write an expression for the total cost of renting the boat for a day. $\text{Cost} = 65 + 5x$

13. Factor *completely*.

(a). $2x^3y + 2xy - 3x^2 - 3$ [Grouping] $(x^2 + 1)(2xy - 3)$

(b). $2x^3 - 8x$ $2x(x + 2)(x - 2)$

(c). $x^2 + 3x - 4$ $(x + 4)(x - 1)$

(d). $3x^2 - 10x + 8$ $(3x - 4)(x - 2)$

(e). $x^4 + 12x^2 + 36$ $(x^2 + 6)^2$

(f). $6x^2 - 7x - 5$ $(2x + 1)(3x - 5)$

14. Use one of the factorization formulas involving cubes to factor $8x^3 + 1$ $(2x + 1)(4x^2 - 2x + 1)$

15. Determine the missing factor: $3x^{1/2} + 6x^{5/2} = 3x^{1/2}(?)$ $3x^{1/2} + 6x^{5/2} = 3x^{1/2}(1 + 2x^2)$