Unit 1: Extending the Number System

PRE-TEST

For each of the following answer:

a) Tell what subset best describes the given number.

b) What other subsets of the number system does the number fall into?

1. -5 **a.** Integers **b.** Rational #'s, Real #'s, & Complex #'s.
2. e **a.** Irrational #'s **b.** Real #'s & Complex #'s
3. 0 **a.** Whole #'s **b.** Integers, Rational #'s, Real #'s, & Complex #'s
4. 3.121212... **a.** Rational #'s **b.** Real #'s & Complex #'s

5. When you add a rational number to an irrational number, what would the result be? Explain.

Irrational

If Rational decimal terminates, adding a # that doesn't without a pattern makes no pattern or end.

If Rational decimal repeats, adding a # that doesn't end without a pattern messes up the pattern.

6. When you add a rational number to a rational number, what would the result be? Explain.

Rational

Fraction + Fraction = Fraction.

Using the properties of exponents, simplify each of the following expressions.

7. $(3a^3b^5)^{-3}$

$= 3^{(-3)(1)}\ a^{(-3)(3)}\ b^{(-3)(5)}$

$= 3^{-3}\ a^{-9}\ b^{-15}$

$= \frac{1}{3^3\ a^9\ b^{15}} = \boxed{\frac{1}{27\,a^9\,b^{15}}}$

8. $\frac{4r^4s^5}{24r^4s^{-5}}$

$= \frac{4^{\div 4}\ r^{4-4}\ s^{5-(-5)}}{24_{\div 4}}$

$= \frac{1r^0s^{10}}{6} = \boxed{\frac{s^{10}}{6}}$

9. $\left(8x^{3/5}y^{6/5}\right)^{1/3}$

$= 8^{1(\frac{1}{3})}\ x^{\frac{3}{5}(\frac{1}{3})}\ y^{\frac{6}{5}(\frac{1}{3})}$

$= 8^{\frac{1}{3}}\ x^{\frac{3}{15}}\ y^{\frac{6}{15}}$

$= \sqrt[3]{8}\ x^{\frac{1}{5}}\ y^{\frac{2}{5}} = \boxed{2x^{\frac{1}{5}}y^{\frac{2}{5}}}$

10. $\left(\frac{192s^{8/3}t^{-5/2}}{3s^{-4/3}t^{3/2}}\right)^{-1/4}$

$= \left(\frac{64\,s^{8/3-(-4/3)}}{t^{3/2-(-5/2)}}\right)^{-1/4}$

$= \left(\frac{64\,s^{12/3}}{t^{8/2}}\right)^{-1/4} = \frac{64^{1(-\frac{1}{4})}\ s^{4(-\frac{1}{4})}}{t^{4(-1/4)}} = \frac{64^{-\frac{1}{4}}s^{-1}}{t^{-1}}$

$= \boxed{\frac{t}{64^{1/4}\,s}}$

Error Analysis:

a) Describe the error that has occurred in the given expression.

b) What would the correct answer be?

11. $(-3)^2(-3)^4 = 9^6$

Ⓐ Can't multiply the bases.

Ⓑ $(-3)^2(-3)^4 = (-3)^{2+4} = (-3)^6 = \boxed{729}$

Write an expression that will make the statement true.

12. $(a^5b^4)^2 = a^{14}b^{-1} \cdot ?$

$a^{5(2)}\ b^{4(2)} = a^{14}\ b^{-1} \cdot a^?\ b^?$

$a^{10}\ b^8 = a^{14+?}\ b^{-1+?}$

So $10 = 14 + ?$, $-14\ \ -14$

-4 = power on a.

$8 = -1 + ?$, $+1\ \ +1$

9 = power on b

$\boxed{a^{-4}\ b^9}$

Rewrite each of the radical notations in exponent notation.

13. $\left(\sqrt[4]{5}\right)^5$

$\boxed{5^{5/4}}$ ← Root, ← Power

14. $\left(\sqrt[3]{5^8}\right)$

$\boxed{5^{8/3}}$ ← Root, ← Power

Rewrite each of the exponent notations in radical notation.

15. $14^{2/5}$ ← Root, ↑ Power

$\boxed{\sqrt[5]{(14)^2}}$

16. $21^{9/4}$ ← Root, ↑ Power

$\boxed{\sqrt[4]{(21)^9}}$

17. A family is a food vendor at the local fair and sells their corndogs for $4 each. Constant rate = linear

a. If it costs the family $300 to set up at the fair, write an equation that will model the families profit, p, if they sell n corndogs. Paid out not getting it back

p = Total Profit, n = # of corndogs sold.

$$p = 4n - 300$$

b. How many corndogs will the family have to sell in order to start making a profit?

To start making a profit we must match the $300 fee, implying the profit is $0

$$0 = 4n - 300$$
$$+300 \quad +300$$
$$\frac{300}{4} = \frac{4n}{4}$$

$$n = 75$$

18. The population of staphylococcus aureaus doubles in size every 30 minutes without treatment. If the population was 235 micrometers when the doctor first checked the patient: multiplied twice PER hr.

a. Write an equation that would model the population in micrometers after t hours.

multiplier

Beginning Amount, P

$$p = 235(2)^{\frac{2}{1}t} \quad \text{or} \quad p = 235(2)^{2t}$$

b. How many micrometers are there after 10 hours without treatment?

$$p = 235(2)^{2(10)}$$
$$p = 235(2)^{20}$$
$$p = 235(1,048,576) = 246,415,360 \text{ micrometers}$$

19. The height of an object thrown or dropped can be found by plugging into the equation

$h(t) = -16t^2 + v_o t + h_o$

a. Write the equation that would model the height of a ball dropped from the roof of a thirty foot tall building.

v_o = initial velocity. Dropped means 0 velocity. h_o = initial height

$$h(t) = -16t^2 + 0t + 30$$
$$h(t) = -16t^2 + 30$$

b. How long will it take for the ball to hit the ground?

height = 0, So $h(t) = 0$

$$0 = -16t^2 + 30$$
$$-30 \quad -30$$
$$\frac{-30}{-16} = \frac{-16t^2}{-16}$$
$$\sqrt{1.875} = \sqrt{t^2}$$