Tutorial – Week1

Q1. Simplify $(\frac{(x^9)(9^2)}{x^{-12}})^{\frac{1}{2}}$.

$= \frac{(x^{9/2})(9^{\frac{2}{2}})}{(x^{-\frac{12}{2}})} = (x^{\frac{9}{2}})(x^{\frac{12}{2}})(9)$

Answer $=9(x^{\frac{21}{2}})$

Q2. Given the set of numbers:
$\{1, -678, -\sqrt{2}, 0, -5, -\frac{1}{6}, 19, -9\frac{3}{4}, \pi, 0.3333\cdots, 0.06, e\}$, list those that belong to the set of

a. Natural numbers
b. Integers
c. Rational numbers
d. Irrational numbers
e. Real numbers

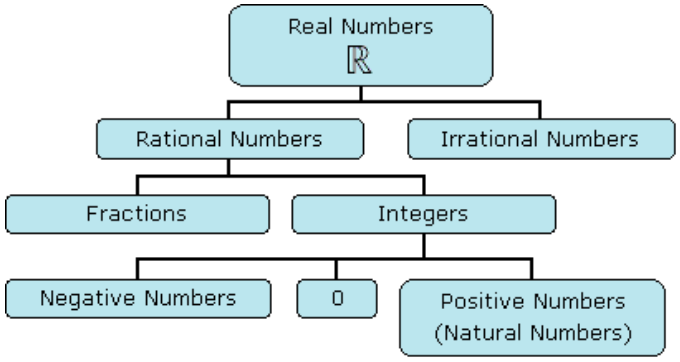
Answer: **be careful 0 is not a natural number**

a. Natural numbers: $\{1,\ 19\}$
b. Integers: $\{1, -678, 0, -5, 19\}$
c. Rational numbers: $\{1, -678, 0, -5, \frac{1}{6}, 19, -9\frac{3}{4}, 0.3333\cdots, 0.06\}$
d. Irrational numbers: $\{-\sqrt{2}, \pi, e\}$
f. Real numbers: $\{1, -678, -\sqrt{2}, 0, -5, -\frac{1}{6}, 19, -9\frac{3}{4}, \pi, 0.3333\cdots, 0.06, e\}$

Explanation:

$-\sqrt{2}$ is an irrational number. It is irrational because it cannot be written as a ratio (or fraction). Similar reasons for π and e.

$0.3333\cdots$ is a rational number. It can be written as the ratio $\frac{1}{3}$.

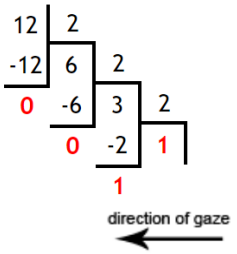


Q3.

a. Use 8 bits to represent the binary equivalent of $(-12)_{10}$ in a form of sign bit.
b. Use 6 bits to represent the binary equivalent of $(-12)_{10}$ in a form of sign bit.

Answer:

Step 1: The Integer part of the number is divided by 2, the base of the binary number system:



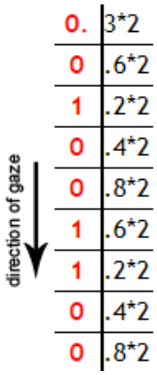
8 bits format 1000 1100 MSB is sign bit

6 bits format 10 1100

c. Also use as many bits as you would like to represent -12.3 in a sign bit format

: Use MSB as a negative sign bit:

$(1\ 1100)_2$ for -12 1 is the sign bit



Step 1: The Fractional part of the number is multiplied by 2, the base of the binary number system (left figure).

The result of the binary equivalent is:

$$(12.3)_{10} \cong (1\ 1100.0100\ 1100)_2$$

Since it is an approximate result, $(1\ 1100.0100\ 11)_2$ is good enough.

Q4.

a. In a 6 bits format, find the 2's complement of -11.
b. In a 8 bits format, find the 2's complement of -11

Answer:

a. 6 bits

Step 1: $(11)_{10} = (00\ 1011)_2$ (6 bit format)

Step 2: invert all bits, $(\ 11\ 0100)_2$

Step 4: Add 1 to the LSB of $(\ 11\ 0101)_2$ check -32 (msb) + 16 + 4 + 1 = -11

Thus the 2's complement in 6 bits for -11 is $(11\ 0101)_2$.

b. 8 bits: 11= 0000 1011
Invert all bits: 1111 0100 + 1 at LSB becomes 1111 0101
Check: -128 + 64 + 32 +16 + 4 + 1 = -128 + 117 = -11