Solutions

1. The rational numbers $\frac{1}{4}$ and $\frac{1}{2}$ can be written as $\frac{4}{16}$ and $\frac{8}{16}$, respectively. The numbers between them are $\frac{5}{16}$, $\frac{6}{16}$, and $\frac{7}{16}$. Thus, $\frac{1}{8}$ (which is $\frac{2}{16}$) does not lie between $\frac{1}{4}$ and $\frac{1}{2}$. **Answer:** $\boxed{D}$

2. A rational number $\frac{p}{q}$ is defined only if $q \neq 0$. Therefore, q cannot be 0. **Answer:** $\boxed{C}$

3. The reciprocal of $\frac{-3}{4}$ is $\frac{-4}{3}$. The sum is:

$$\frac{-3}{4} + \frac{-4}{3} = \frac{-9}{12} + \frac{-16}{12} = \frac{-25}{12}$$

Answer: $\boxed{A}$

4. The multiplicative inverse of a number a is $\frac{1}{a}$. However, $\frac{1}{0}$ is undefined. Therefore, the multiplicative inverse of 0 does not exist. **Answer:** $\boxed{D}$

5. A rational number $\frac{x}{y}$ is in standard form if y is positive and $\gcd(x, y) = 1$. **Answer:** $\boxed{B}$

6. To compare $\frac{-4}{5}$ and $\frac{-3}{4}$, find a common denominator (20):

$$\frac{-4}{5} = \frac{-16}{20}, \frac{-3}{4} = \frac{-15}{20}$$

Since $-16 < -15$, $\frac{-4}{5} < \frac{-3}{4}$. **Answer:** $\boxed{B}$

7.

$$\left(\frac{-2}{5}\right)^{-1} = \frac{5}{-2} = \frac{-5}{2}$$
$$\frac{-5}{2} \div \frac{5}{2} = \frac{-5}{2} \times \frac{2}{5} = -1$$

Answer: $\boxed{B}$

8. Rational numbers are closed under addition, subtraction, multiplication, and division (except by zero). **Answer:** $\boxed{D}$

9. $\frac{8}{3}$ is equivalent to $2\frac{2}{3}$. To represent this, each unit must be divided into 3 equal parts. **Answer:** $\boxed{B}$

10.

$$-(-x) = x = \frac{-4}{9}$$

Answer: $\boxed{B}$

11.

$$\frac{n}{-5} = \frac{21}{15} \implies n = \frac{21}{15} \times (-5) = -7$$

Answer: $\boxed{B}$

12. The distance between $\frac{1}{2}$ and $\frac{-1}{2}$ is:

$$\left|\frac{1}{2} - \left(\frac{-1}{2}\right)\right| = 1 \text{ unit}$$

Answer: $\boxed{B}$

13. The additive inverse of 2 is -2, and the multiplicative inverse of $\frac{1}{2}$ is 2. The product is:

$$-2 \times 2 = -4$$

Answer: $\boxed{C}$

14. The additive identity is 0, as $a + 0 = a$ for any rational number a. **Answer:** $\boxed{C}$

15. The average of $\frac{1}{3}$ and $\frac{1}{5}$ is:

$$\frac{\frac{1}{3} + \frac{1}{5}}{2} = \frac{\frac{5}{15} + \frac{3}{15}}{2} = \frac{\frac{8}{15}}{2} = \frac{4}{15}$$

Answer: $\boxed{B}$