To solve the questions from Exercise 1.1, we'll go through each part step-by-step, providing detailed explanations and reasons for each answer. After solving, we'll save the solutions as a PDF.

1. Identify each of the following as a rational or irrational number:

(i) 2.353535

- **Rational**: This is a terminating decimal, which can be expressed as a fraction.

(ii) $\frac{0}{6}$

- **Rational**: Any number that can be expressed as a fraction where the denominator is not zero is rational. Here, $0/6 = 0$, which is rational.

(iii) $2.236067\ldots$

- **Irrational**: This is a non-terminating, non-repeating decimal, which cannot be expressed as a simple fraction.

(iv) $\sqrt{7}$

- **Irrational**: The square root of a prime number is irrational.

(v) e

- **Irrational**: Euler's number e is a well-known irrational number.

(vi) π

- **Irrational**: Pi is an irrational number.

(vii) $5 + \sqrt{11}$

- **Irrational**: The sum of a rational number and an irrational number is irrational.

(viii) $\sqrt{3} + \sqrt{13}$

- **Irrational**: The sum of two irrational numbers is generally irrational.

(ix) $\frac{15}{4}$

- **Rational**: This is a fraction, hence rational.

(x) $(2-\sqrt{2})(2+\sqrt{2})$

- **Rational**: This simplifies to $4-2=2$, which is rational.

2. Represent the following numbers on a number line:

(i) $\sqrt{2}$

- **Approximately 1.414**: Place between 1.4 and 1.5 on the number line.

(ii) $\sqrt{3}$

- **Approximately 1.732**: Place between 1.7 and 1.8 on the number line.

(iii) $\frac{1}{3}$

- **Approximately 0.333**: Place between 0.3 and 0.4 on the number line.

(iv) $-2\frac{1}{7}$

- **Approximately -2.142**: Place between -2.2 and -2.1 on the number line.

(v) $\frac{5}{8}$

- **0.625**: Place between 0.6 and 0.7 on the number line.

(vi) $2\frac{3}{4}$

- **2.75**: Place between 2.7 and 2.8 on the number line.

3. Express the following as a rational number $\frac{p}{q}$:

(i) $\frac{0}{4}$

- **0**: $0/4=0$.

(ii) $\frac{0}{37}$

- **0**: $0/37=0$.

(iii) $\frac{0}{21}$

- **0**: $0/21=0$.

4. Name the property used in the following:

(i) $(a + 4) + b = a + (4 + b)$

- **Associative Property of Addition**: The grouping of numbers does not change the sum.

(ii) $x - x = 0$

- **Additive Inverse Property**: A number minus itself equals zero.

(v) $16 + 0 = 16$

- **Additive Identity Property**: Adding zero does not change the value.

(vii) $4 \times (5 \times 8) = (4 \times 5) \times 8$

- **Associative Property of Multiplication**: The grouping of numbers does not change the product.

5. Name the property used in the following:

(i) $-3 < -1 \Rightarrow 0 < 2$

- **Transitive Property**: If $-3 < -1$ and $-1 < 0$, then $-3 < 0$.

(ii) If $a < b$ **then** $a + c < b + c$

- **Additive Property of Inequality**: Adding the same number to both sides preserves the inequality.

(iii) If $a < b$ **then** $a + c < b + c$

- **Additive Property of Inequality**: Same as above.

(iv) If $ac < bc$ **and** $c > 0$ **then** $a < b$

- **Multiplicative Property of Inequality**: Multiplying both sides by a positive number preserves the inequality.

(v) If $ac < bc$ **and** $c < 0$ **then** $a > b$

- **Multiplicative Property of Inequality**: Multiplying both sides by a negative number reverses the inequality.

(vi) Either $a > b$ **or** $a = b$ **or** $a < b$

- **Trichotomy Property**: For any two real numbers, one and only one of these relations holds.

6. Insert two rational numbers between:

(i) $\frac{1}{3}$ **and** $\frac{1}{4}$

- **Example**: $\frac{5}{12}$ and $\frac{7}{24}$.

(ii) 3 **and** 4

- **Example**: 3.5 and 3.75.

(iii) $\frac{3}{5}$ **and** $\frac{4}{5}$

- **Example**: $\frac{7}{10}$ and $\frac{13}{20}$.

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(i) $\sqrt{2} + \sqrt{3} = \sqrt{3} + \sqrt{2}$

- **Commutative Property of Addition**: The order of addition does not change the sum.

(ii) $ab + c) = ab + ac$

- **Distributive Property**: Multiplication distributes over addition.

(vi) $100 \times 1 = 100$

- **Multiplicative Identity Property**: Multiplying by one does not change the value.

(viii) $ab = ba$

- **Commutative Property of Multiplication**: The order of multiplication does not change the product.

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