Miscellaneous Exercise 1

Unit 1 · Real Numbers

1 Choose the correct option.

(i) $a(b + c - d)$ equals

$\therefore$ (b) $ab + ac - ad$

Multiply a by each term inside the brackets (distributive property).

(ii) $a^r \cdot a^{-s} \div a^s$ is

$\therefore$ (d) $\frac{a^r}{a^{2s}}$

$a^{r-s-s} = a^{r-2s} = \frac{a^r}{a^{2s}}$

(iii) $\sqrt[n]{ab}$ is equal to

$\therefore$ (d) $(ab)^{\frac{1}{n}}$

(iv) Which number is its own multiplicative inverse?

$\therefore$ (c) -1

$(-1) \times (-1) = 1$

(v) If $a > 0$, then $\sqrt{a}$ is

$\therefore$ (a) real

(vi) If $a + b = a$, what is the value of b?

$\therefore$ (d) 0

0 is the additive identity: $a + 0 = a$

(vii) If $a \cdot b = 1$, what is the value of b?

$\therefore$ (c) $\frac{1}{a}$

$a \cdot \frac{1}{a} = 1$

(viii) According to the reflexive property, $y^2 - 17 = ?$

$\therefore$ (c) $y^2 - 17$

Reflexive property: every quantity is equal to itself.

(ix) If $a \cdot b = a$, what is the value of b?

$\therefore$ (b) 1

1 is the multiplicative identity: $a \cdot 1 = a$

(x) If $a \cdot b = 1$, what is b called?

$\therefore$ (a) multiplicative inverse of a

(xi) The commutative property does not hold with respect to:

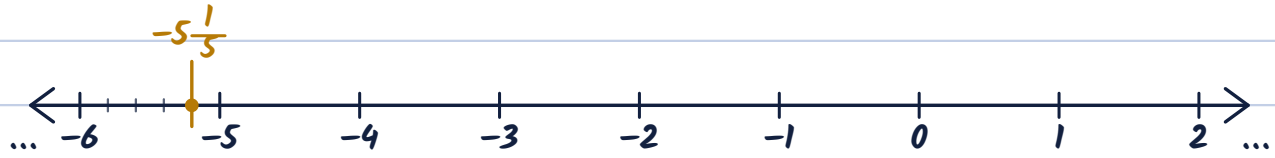
$\therefore$ (c) subtraction

For example, $5 - 3 = 2$ but $3 - 5 = -2$

2 **Represent each of the following on the number line.**

(i) $-5\frac{1}{5} = -5.2$, which lies between -6 and -5.

Split -5 to -6 into 5 equal parts; take 1 part to the left of -5.



(ii) $\frac{17}{3} = 5\frac{2}{3} = 5.\overline{6}$, which lies between 5 and 6.

Split 5 to 6 into 3 equal parts; take 2 parts to the right of 5.



(iii) $-2 < x < 4$

Hollow circles show that -2 and 4 are not included.



(iv) $x \geq 6$

A filled circle shows 6 is included; the arrow shows all numbers above 6.



3 Write each exponential expression as an equivalent radical expression and simplify if possible.

(i) $(-2)^{\frac{4}{5}}$

$= \left((-2)^4\right)^{\frac{1}{5}}$

$= \sqrt[5]{(-2)^4} = \sqrt[5]{16}$

$\therefore = \sqrt[5]{16}$

(ii) $(-27)^{\frac{1}{3}}$

$= \sqrt[3]{-27}$

$= \sqrt[3]{(-3)^3} = -3$

$\therefore = -3$

(iii) $\left(\sqrt{16}\right)^4$

$= \left(\sqrt{4^2}\right)^4$

$= 4^4 = 256$

$\therefore = 256$

(iv) $\left(\sqrt[3]{-8}\right)^9$

$= \left(\sqrt[3]{(-2)^3}\right)^9$

$= (-2)^9 = -512$

$\therefore = -512$

(v) $\left(x^{-2}\right)^3 \cdot \left(x^0\right)^5$

$= x^{-6} \cdot x^0 = x^{-6} \cdot 1$

$= \frac{1}{x^6}$ *In radical form:* $x^6 = x^{18 \times \frac{1}{3}} = \sqrt[3]{x^{18}}$

$\therefore = \frac{1}{x^6}$

so, $\frac{1}{x^6} = \frac{1}{\sqrt[3]{x^{18}}}$

4 Use the properties of exponents to simplify each of the following.

(i) $\dfrac{(-2)^3 \cdot (-2)^{-4} \cdot (-2)}{(-2)^{-3}}$

$= \dfrac{(-2)^{3-4+1}}{(-2)^{-3}} = \dfrac{(-2)^0}{(-2)^{-3}}$

$= (-2)^{0+3} = (-2)^3 = -8$

$\therefore = -8$

(ii) $\dfrac{2^{\frac{1}{2}} \cdot 2^{\frac{3}{4}}}{2^{\frac{1}{2}}} \times \dfrac{3 \cdot 3^{\frac{3}{2}}}{3^{\frac{-1}{2}}}$

$= 2^{\frac{1}{2}+\frac{3}{4}-\frac{1}{2}} \times 3^{1+\frac{3}{2}+\frac{1}{2}}$

$= 2^{\frac{3}{4}} \times 3^{3} = 27 \cdot 2^{\frac{3}{4}}$

$\therefore = 27 \cdot 2^{\frac{3}{4}}$

5 **Determine whether each statement is true or false. If false, give an example of a number that shows the statement is not true.**

(a) Every rational number is an integer.

False. Some rational numbers are not integers.

Example: $0.25 = \frac{1}{4}$ is a rational number, but it is not an integer.

(b) Every real number is an irrational number.

False. A real number can be rational or irrational.

Example: 5 is a real number, and it is rational ($5 = \frac{5}{1}$).

(c) Every irrational number is a real number.

True. Every irrational number (such as $\sqrt{2}$ or π) is a real number.

(d) Every integer is a rational number.

True. Every integer n can be written as $\frac{n}{1}$, e.g. $-3 = \frac{-3}{1}$.

(e) Every real number is either rational or irrational.

True. A real number is always one of the two, never neither.