Exercise 1.5

Question 1:
Classify the following numbers as rational or irrational:

(i) $2-\sqrt{5}$ **(ii)** $(3-\sqrt{23})-\sqrt{23}$ **(iii)** $\frac{2\sqrt{7}}{7\sqrt{7}}$

(iv) $\frac{1}{\sqrt{2}}$ **(v)** 2π

Answer 1:
(i) $2-\sqrt{5}$ Irrational number.
(ii) $(3-\sqrt{23})-\sqrt{23}=3$ Rational number.
(iii) $\frac{2\sqrt{7}}{7\sqrt{7}}=\frac{2}{7}$ Rational number.
(iv) $\frac{1}{\sqrt{2}}$ Irrational number.
(v) 2π Irrational number.

Question 2:
Simplify each of the following expressions:

(i) $(3+\sqrt{3})(2+\sqrt{2})$ **(ii)** $(3+\sqrt{3})(3-\sqrt{3})$

(iii) $(\sqrt{5}+\sqrt{2})^2$ **(iv)** $(\sqrt{5}-\sqrt{2})(\sqrt{5}+\sqrt{2})$

Answer 2:
(i) $(3+\sqrt{3})(2+\sqrt{2})=6+3\sqrt{2}+2\sqrt{3}+\sqrt{6}$

(ii) $(3+\sqrt{3})(3-\sqrt{3})=3^2-(\sqrt{3})^2$ $[\because (a+b)(a-b)=a^2-b^2]$
$=9-3=6$

(iii) $(\sqrt{5}+\sqrt{2})^2=(\sqrt{5})^2+(\sqrt{2})^2+2\times\sqrt{5}\times\sqrt{2}=7+2\sqrt{10}$
$[\because (a+b)^2=a^2+b^2+2ab]$

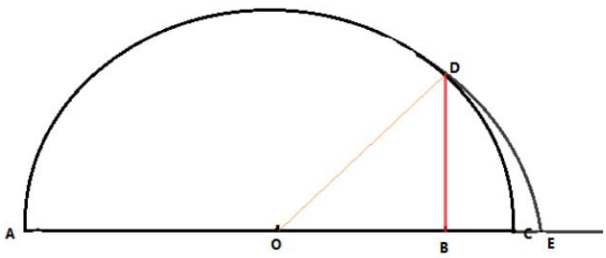
(iv) $(\sqrt{5}-\sqrt{2})(\sqrt{5}+\sqrt{2})=(\sqrt{5})^2-(\sqrt{2})^2=5-2=3$
$[\because (a-b)(a+b)=a^2-b^2]$

Question 3:
Recall, π is defined as the ratio of the circumference (say c) of a circle to its diameter (say d). That is $\pi=\frac{c}{d}$. This seems to contradict the fact that π is irrational. How will you resolve this contradiction?

Answer 3:
With a scale or tape we get only an approximate rational number as the result of our measurement. That is why π can be approximately represented as a quotient of two rational numbers. As a matter of mathematical truth it is irrational.

Question 4:
Represent $\sqrt{9.3}$ on the number line.

Answer 4:
To represent $\sqrt{9.3}$ on the number line, draw AB = 9.3 units. Now produce AB to C, such that BC = 1 unit. Draw the perpendicular bisector of AC which intersects AC at O. Taking O as centre and OA as radius, draw a semi-circle which intersects D to the perpendicular at B. Now taking O as centre and OD as radius, draw an arc, which intersects AC produced at E. Hence, OE = $\sqrt{9.3}$.



Question 5:
Rationalise the denominators of the following:

(i) $\frac{1}{\sqrt{7}}$ **(ii)** $\frac{1}{\sqrt{7}-\sqrt{6}}$ **(iii)** $\frac{1}{\sqrt{5}+\sqrt{2}}$ **(iv)** $\frac{1}{\sqrt{7}-2}$

Answer 5:
(i) $\frac{1}{\sqrt{7}} = \frac{1}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{7}}{7}$

(ii) $\frac{1}{\sqrt{7}-\sqrt{6}} = \frac{1}{\sqrt{7}-\sqrt{6}} \times \frac{\sqrt{7}+\sqrt{6}}{\sqrt{7}+\sqrt{6}} = \frac{\sqrt{7}+\sqrt{6}}{(\sqrt{7})^2-(\sqrt{6})^2} = \frac{\sqrt{7}+\sqrt{6}}{7-6} = \sqrt{7}+\sqrt{6}$

(iii) $\frac{1}{\sqrt{5}+\sqrt{2}} = \frac{1}{\sqrt{5}+\sqrt{2}} \times \frac{\sqrt{5}-\sqrt{2}}{\sqrt{5}-\sqrt{2}} = \frac{\sqrt{5}-\sqrt{2}}{(\sqrt{5})^2-(\sqrt{2})^2} = \frac{\sqrt{5}-\sqrt{2}}{5-2} = \frac{\sqrt{5}-\sqrt{2}}{3}$

(iv) $\frac{1}{\sqrt{7}-2} = \frac{1}{\sqrt{7}-2} \times \frac{\sqrt{7}+2}{\sqrt{7}+2} = \frac{\sqrt{7}+2}{(\sqrt{7})^2-(2)^2} = \frac{\sqrt{7}+2}{7-4} = \frac{\sqrt{7}+2}{3}$