WORKSHEET 1

CHAPTER 1 – NUMBER SYSTEM

1. Represent each of the following rational numbers on the the number line.
   (*i*) 5 (*ii*) -2 (*iii*) $\frac{3}{7}$ (*iv*) $\frac{14}{5}$ (*v*) $-1\frac{1}{6}$ (*vi*) -2.3

2. Find five rational numbers between $\frac{2}{3}$ and $\frac{5}{3}$.

3. Find eight rational numbers between $\frac{1}{6}$ and $\frac{5}{2}$.

4. Locate each of the following on the number line.
   (*i*) $\sqrt{10}$ (*ii*) $\sqrt{13}$ (*iii*) $\sqrt{17}$

5. Represent $\sqrt{5.2}$ geometrically on the number line.

6. Express each of the following in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.
   (*i*) $0.\overline{7}$ (*ii*) $0.\overline{23}$ (*iii*) $0.4\overline{37}$ (*iv*) $0.25\overline{62}$ (*v*) 0.23171717 …

7. Classify the following as rational or irrational with justification.
   (*i*) $\frac{\sqrt{3}}{4}$ (*ii*) $\sqrt{225}$ (*iii*) $2\sqrt{12}$ (*iv*) $\sqrt{\frac{9}{45}}$ (*v*) $\frac{\sqrt{20}}{\sqrt{5}}$
   (*vi*) $\frac{3\sqrt{8}}{\sqrt{2}}$ (*vii*) 1.8925 (*viii*) 7.1232323 … (*ix*) $-\sqrt{0.16}$ (*x*) $\left(\sqrt{2}+\frac{1}{\sqrt{2}}\right)^2$

8. Rewrite $\sqrt[3]{12}, \sqrt[4]{20}, \sqrt[6]{25}, \sqrt{80}, \sqrt[12]{112}$ in ascending order.

9. Simplify:
   (*i*) $\frac{\sqrt{20}}{8}+\frac{\sqrt{45}}{9}$ (*ii*) $\sqrt{10}\times\sqrt{15}$ (*iii*) $4\sqrt{28}\div 3\sqrt{7}$
   (*iv*) $(2\sqrt{5}-3\sqrt{2})(3\sqrt{5}+2\sqrt{2})$ (*v*) $\sqrt[3]{2}\,\sqrt[4]{2}\,\sqrt[12]{32}$ (*vi*) $\sqrt{8+2\sqrt{15}}$

10. Simplify:
    (*i*) $\frac{\sqrt{5}+\sqrt{7}}{\sqrt{80}+\sqrt{175}-\sqrt{112}-\sqrt{45}}$ (*ii*) $2\sqrt{27}-\frac{3}{2}\sqrt{\frac{1}{3}}+5\sqrt{3}$
    (*iii*) $(\sqrt{3}+1)(1-\sqrt{12})+\frac{9}{\sqrt{3}+\sqrt{12}}$ (*iv*) $\sqrt{125}-4\sqrt{6}+\sqrt{294}-2\sqrt{\frac{1}{6}}$

11. Simplify:
    (*i*) $\frac{3\sqrt{2}}{\sqrt{3}+\sqrt{6}}-\frac{4\sqrt{3}}{\sqrt{6}+\sqrt{2}}+\frac{\sqrt{6}}{\sqrt{2}+\sqrt{3}}$ (*ii*) $\frac{7\sqrt{3}}{\sqrt{10}+\sqrt{3}}-\frac{2\sqrt{5}}{\sqrt{6}+\sqrt{5}}-\frac{3\sqrt{2}}{\sqrt{15}+3\sqrt{2}}$

12. Rationalise the denominator of $\frac{1}{\sqrt{2}+\sqrt{3}+\sqrt{10}}$.

13. Find the value of a and b in each of the following:
    (*i*) $\frac{\sqrt{2}+\sqrt{3}}{3\sqrt{2}-2\sqrt{3}} = 2 + b\sqrt{6}$ (*ii*) $\frac{7+\sqrt{5}}{7-\sqrt{5}}-\frac{7-\sqrt{5}}{7+\sqrt{5}} = -a-\frac{7}{11}\sqrt{5}b$

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14. If $\sqrt{2} = 1.414$ and $\sqrt{3} = 1.732$, find the value of $\frac{4}{3\sqrt{3}-2\sqrt{2}}+\frac{3}{3\sqrt{3}+2\sqrt{2}}$.

15. (*i*) If $a = 2 + \sqrt{3}$, find $a + \frac{1}{a}$.

(*ii*) If $x = \sqrt{2} + 1$, evaluate $\left(x-\frac{1}{x}\right)^2$.

(*iii*) If $x = 2-\sqrt{3}$, evaluate $\left(x+\frac{1}{x}\right)^3$.

16. If $x = 3 + 2\sqrt{2}$, $y=\frac{1}{x}$, find the value of $x^2 + y^2$.

17. If $x=\frac{\sqrt{a+b}+\sqrt{a-b}}{\sqrt{a+b}-\sqrt{a-b}}$, then find the value of $bx^2 - 2ax + b$. **[HOTS]**

18. Simplify:

(*i*) $\left[5(16^{\frac{1}{4}}+81^{\frac{1}{4}})^4\right]^{\frac{1}{5}}$ (*ii*) $\left(\frac{3}{5}\right)^4\times\left(\frac{8}{5}\right)^{-12}\times\left(\frac{32}{5}\right)^6$ (*iii*) $125^{-1/3}[125^{1/3}-125^{2/3}]$

(*iv*) $\frac{1}{(256)^{-3/4}}-\frac{4}{(243)^{-1/5}}-\frac{2}{(216)^{-1/3}}$ (*v*) $\left(\frac{x^a}{x^b}\right)^{\frac{1}{ab}}\left(\frac{x^b}{x^c}\right)^{\frac{1}{bc}}\left(\frac{x^c}{x^a}\right)^{\frac{1}{ca}}$

19. Find the value of p:

$$\frac{3^{2p-3}}{5^{2-p}} = 135$$

20. If $a=\frac{2-\sqrt{3}}{2+\sqrt{3}}$, $b=\frac{2+\sqrt{3}}{2-\sqrt{3}}$, find the value of $a^2 + b^2 + 6ab$.

ANSWERS

WORKSHEET 1

1. (*i*) Refer to page 1.7 of the book.
   (*ii*) Refer to page 1.8 of the book.
   (*iii*) Refer to page 1.8 of the book.
   (*iv*) $\frac{14}{5} = 2\frac{4}{5}$, page 1.8 of the book.
   (*v*) $-1\frac{1}{6} = -\frac{7}{6}$, page 1.8 of the book.
   (*vi*) −2.3, page 1.8 of the book.
2. Sample answer: $\frac{5}{6}$, 1, $\frac{7}{6}$, $\frac{4}{3}$, $\frac{3}{2}$. Answers may vary.
3. $\frac{22}{126}, \frac{23}{126}, \frac{24}{126}, \frac{25}{126}, \frac{26}{126}, \frac{27}{126}, \frac{28}{126}, \frac{29}{126}$ or $\frac{11}{63}, \frac{23}{126}, \frac{12}{63}, \frac{25}{126}, \frac{13}{63}, \frac{3}{14}, \frac{14}{63}, \frac{29}{126}$
4. (*i*) $\sqrt{10} = \sqrt{9+1} = \sqrt{(3)^2+(1)^2}$ Refer to page 1.10 of the book.
   (*ii*) $\sqrt{13} = \sqrt{9+4} = \sqrt{3^2+2^2}$ Refer to page 1.10 of the book.
   (*iii*) $\sqrt{17} = \sqrt{16+1} = \sqrt{4^2+1^2}$ Refer to page 1.10 of the book.
5. Figure: Refer to page 1.12 of the book.
6. (*i*) $\frac{7}{9}$ (*ii*) $\frac{23}{99}$ (*iii*) $\frac{437}{999}$ (*iv*) $\frac{2537}{9900}$ (*v*) $\frac{1147}{4950}$
7.

Number	*Justification*
(*i*) Irrational	$\frac{\sqrt{3}}{4}$ is of the form $\frac{p}{q}$ but p here is not an integer.
(*ii*) Rational	$\sqrt{225} = 15$, which is a rational number.
(*iii*) Irrational	$2\sqrt{12} = 2\sqrt{4\times3} = 2\times2\sqrt{3} = 4\sqrt{3}$ Since $4\sqrt{3}$ is the product of a rational and an irrational number, therefore $2\sqrt{12}(=4\sqrt{3})$ is an irrational number.
(*iv*) Irrational	$\sqrt{\frac{9}{45}} = \sqrt{\frac{9}{9\times5}} = \sqrt{\frac{1}{5}} = \frac{1}{5}$ Since $\frac{1}{\sqrt{5}}$ is a quotient of a rational number and an irrational number, therefore $\sqrt{\frac{9}{45}}(=1/\sqrt{5})$ is an irrational number.
(*v*) Rational	$\frac{\sqrt{20}}{\sqrt{5}} = \frac{\sqrt{5}\times\sqrt{4}}{\sqrt{5}} = \sqrt{4} = 2$, which is a rational number.
(*vi*) Rational	$\frac{3\sqrt{8}}{\sqrt{2}} = \frac{3\sqrt{4}\times\sqrt{2}}{\sqrt{2}} = 3\sqrt{4}$ = 3 × 2 = 6, which is a rational number.
(*vii*) Rational	1.8925 has a terminating decimal and so it is a rational number.
(*viii*) Rational	7.1232323 … = $7.1\overline{23}$ has a non-terminating repeating decimal expression and so it is a rational number.

Number	*Justification*
(*ix*) Rational	$-\sqrt{0.16} = -0.4 = -\frac{4}{10} = -\frac{2}{5}$ which is of the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$ and so, a rational number.
(*x*) Rational	$\left(\sqrt{2}+\frac{1}{\sqrt{2}}\right)^2 = (\sqrt{2})^2 + 2\times\sqrt{2}\times\frac{1}{\sqrt{2}} + \left(\frac{1}{\sqrt{2}}\right)^2 = 2+2+\frac{1}{2} = \frac{9}{2}$, which is of the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$ and so, a rational number.

8. $\sqrt[12]{112} < \sqrt[6]{25} < \sqrt[4]{20} < \sqrt[3]{12} < \sqrt{80}$

9. (*i*) $\frac{7\sqrt{5}}{12}$ (*ii*) $5\sqrt{6}$ (*iii*) $\frac{8}{3}$ (*iv*) $18-5\sqrt{10}$ (*v*) 2 (*vi*) $\sqrt{3}+\sqrt{5}$

10. (*i*) 1 (*ii*) $\frac{21\sqrt{3}}{2}$ (*iii*) -5 (*iv*) $5\sqrt{5}+\frac{8}{3}\sqrt{6}$

11. (*i*) 0 (*ii*) 1

12. $-11\sqrt{2}-9\sqrt{3}+5\sqrt{10}+4\sqrt{15}$

13. (*i*) $b=\frac{5}{6}$ (*ii*) $a = 0, b = -1$

14. 2.063 approx.

15. (*i*) 4 (*ii*) 4 (*iii*) 64

16. 34

17. 0

18. (*i*) 5 (*ii*) $\frac{2025}{64}$ (*iii*) -4 (*iv*) 40 (*v*) 1

19. $p = 3$

20. 200