EXERCISE 6.1

1. (*i*) $3 \times 3 \times 3 \times 3 \times 3 = 3^5$

(*ii*) $(-2) \times (-2) \times (-2) \times (-2) \times (-2) \times (-2) = (-2)^6$

(*iii*) $\left(\frac{-3}{2}\right)\times\left(\frac{-3}{2}\right)\times\left(\frac{-3}{2}\right) = \left(\frac{-3}{2}\right)^3$

(*iv*) $a \times a \times b \times b \times b \times c = a^2b^3c$

(*v*) $1,00,000 = 10^5$

(*vi*) $-8000 = (-20) \times (-20) \times (-20) = (-20)^3$

(*vii*) $3 \times 2 \times 2 \times 3 \times a \times a = 2^23^2a^2$

(*viii*) $\left(\frac{-2}{3}\right)\times\left(\frac{-2}{3}\right)\times a \times c = \left(\frac{-2}{3}\right)^2 ac$

2. (*i*) $-\frac{1}{343} = \left(-\frac{1}{7}\right)\times\left(-\frac{1}{7}\right)\times\left(-\frac{1}{7}\right) = \left(-\frac{1}{7}\right)^3$

(*ii*) $\frac{64}{729} = \frac{2\times2\times2\times2\times2\times2}{3\times3\times3\times3\times3\times3}$

$= \left(\frac{2}{3}\right)\times\left(\frac{2}{3}\right)\times\left(\frac{2}{3}\right)\times\left(\frac{2}{3}\right)\times\left(\frac{2}{3}\right)\times\left(\frac{2}{3}\right)$

$= \left(\frac{2}{3}\right)^6$

(*iii*) $-\frac{125}{8} = -\frac{5\times5\times5}{2\times2\times2}$

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

$= \left(-\frac{5}{2}\right)^3$

3. (*i*) $\left(\frac{2}{5}\right)^3 = \frac{2}{5}\times\frac{2}{5}\times\frac{2}{5} = \frac{2\times2\times2}{5\times5\times5} = \frac{8}{125}$

(*ii*) $\left(-\frac{2}{3}\right)^3 = \left(-\frac{2}{3}\right)\times\left(-\frac{2}{3}\right)\times\left(-\frac{2}{3}\right)$

$= -\frac{2\times2\times2}{3\times3\times3} = -\frac{8}{27}$

(*iii*) $\left(-\frac{3}{5}\right)^4 = \left(-\frac{3}{5}\right)\times\left(-\frac{3}{5}\right)\times\left(-\frac{3}{5}\right)\times\left(-\frac{3}{5}\right)$

$= \frac{3\times3\times3\times3}{5\times5\times5\times5} = \frac{81}{625}$

4. (*i*) $(-1)^3 \times (-2)^3 = (-1) \times (-1) \times (-1) \times (-2) \times (-2) \times (-2)$

$= (-1) \times (-8) = 8$

(*ii*) $(-2)^4 \times (-10)^2 = (-2) \times (-2) \times (-2) \times (-2) \times (-10) \times (-10)$

$= 16 \times 100 = 1600$

(*iii*) $(-3)^3 \times (-5)^2 = (-3) \times (-3) \times (-3) \times (-5) \times (-5)$

$= (-27) \times 25$

$= -675$

5. (*i*) $(-9)^3 = (-9) \times (-9) \times (-9) = -729$

(*ii*) $\left(-\frac{21}{2}\right)^3 = \left(-\frac{21}{2}\right)\times\left(-\frac{21}{2}\right)\times\left(-\frac{21}{2}\right) = -\frac{9261}{8}$

(*iii*) $(-4)^3 = (-4) \times (-4) \times (-4) = -64$

(*iv*) $2^7 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 128$

(*v*) $(-5)^5 = (-5) \times (-5) \times (-5) \times (-5) \times (-5) = -3125$

6. $\left(\frac{2}{5}\right)^3 = \frac{2}{5}\times\frac{2}{5}\times\frac{2}{5} = \frac{2\times2\times2}{5\times5\times5} = \frac{8}{125}$

and $\frac{2^3}{5} = \frac{2\times2\times2}{5} = \frac{8}{5}$

Now, in $\frac{8}{125}$ and $\frac{8}{5}$ the numerator are same. So,

$\frac{8}{125} < \frac{8}{5}$ (since, $125 > 5$)

Hence, $\frac{2^3}{5}$ is greater than $\left(\frac{2}{5}\right)^3$

7. (*i*) $\left(\frac{1}{2}\right)^5 - \left(\frac{3}{2}\right)^3 = \frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2}\times\frac{1}{2} - \frac{3}{2}\times\frac{3}{2}\times\frac{3}{2}$

$= \frac{1}{32} - \frac{27}{8} = \frac{1-108}{32} = -\frac{107}{32}$

(*ii*) $(-3)^2 \times \left(\frac{4}{3}\right)^3 = (-3)\times(-3)\times\frac{4}{3}\times\frac{4}{3}\times\frac{4}{3}$

$= 9 \times \frac{4\times4\times4}{3\times3\times3}$

$= \frac{\cancel{9}^1 \times 64}{\cancel{27}_3} = \frac{64}{3}$

8. (*i*) 2^3 or 3^2

$2^3 = 2 \times 2 \times 2 = 8$

and $3^2 = 3 \times 3 = 9$

since, $9 > 8$

So, $3^2 > 2^3$

(*ii*) 5^2 or 2^5

$5^2 = 5 \times 5 = 25$

$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

since, $32 > 25$

So, $2^5 > 5^2$

(*iii*) $(-2)^6$ or $(-6)^2$

$(-2)^6 = (-2) \times (-2) \times (-2) \times (-2) \times (-2) \times (-2)$

$= 64$

and $(-6)^2 = (-6) \times (-6)$

$= 36$

since, $64 > 36$

Hence, $(-2)^6 > (-6)^2$

9. (*i*) $3^2 \times 10^3 = 3 \times 3 \times 10 \times 10 \times 10$

$= 9 \times 1000 = 9000$

(*ii*) $5^2 \times 2^4 = 5 \times 5 \times 2 \times 2 \times 2 \times 2$

$= 25 \times 16 = 400$

(*iii*) $5 \times 4^3 = 5 \times 4 \times 4 \times 4 = 5 \times 64 = 320$

(*iv*) $3^3 \times 5^2 = 3 \times 3 \times 3 \times 5 \times 5$

$= 27 \times 25 = 675$

10. (*i*) $\frac{9}{64} = \frac{3\times3}{8\times8} = \left(\frac{3}{8}\right)^2$

(*ii*) $\frac{-8}{27} = \frac{(-2)\times(-2)\times(-2)}{3\times3\times3} = \left(\frac{-2}{3}\right)^3$

(*iii*) $\frac{256}{625} = \frac{4\times4\times4\times4}{5\times5\times5\times5} = \left(\frac{4}{5}\right)^4$

(*iv*) $\frac{-243}{3125} = \frac{(-3)\times(-3)\times(-3)\times(-3)\times(-3)}{5\times5\times5\times5\times5}$

$= \left(\frac{-3}{5}\right)^5$

(*v*) $\frac{121}{256} = \frac{11\times11}{16\times16} = \left(\frac{11}{16}\right)^2$

(*vi*) $125 = 5 \times 5 \times 5 = (5)^3$

11. (*i*) $(-2)^x = -32$

2	32
2	16
2	8
2	4
2	2
	1

$(-2)^x = (-2) \times (-2) \times (-2) \times (-2) \times (-2)$

$\Rightarrow (-2)^x = (-2)^5$

$\Rightarrow x = 5$

(Base are same, powers will be equal)

(*ii*) $5^x = 125$

$5^x = 5 \times 5 \times 5$

$\Rightarrow 5^x = 5^3$

$\Rightarrow x = 3$

(Base are same, powers will be equal)

(*iii*) $(-4)^x = -1024$

$\Rightarrow (-4)^x = (-4)^5$

$\Rightarrow x = 5$

12. If $a = 3$, $b = 2$

(*i*) $(a - b)^a = (3 - 2)^3 = 1^3 = 1$

(*ii*) $(a + b)^b = (3 + 2)^2 = 5^2 = 5 \times 5 = 25$

(*iii*) $(ab)^a = (3 \times 2)^3 = 6^3 = 6 \times 6 \times 6 = 216$

(*iv*) $\left(\frac{a}{b}\right)^2 = \left(\frac{3}{2}\right)^2 = \frac{3}{2}\times\frac{3}{2} = \frac{9}{4}$

13. (*i*) $\left(-\frac{2}{3}\right)^4 \times \left(-\frac{3}{4}\right)^3 = \left(-\frac{2}{3}\right)\times\left(-\frac{2}{3}\right)\times\left(-\frac{2}{3}\right)\times\left(-\frac{2}{3}\right)\times\left(-\frac{3}{4}\right)\times\left(-\frac{3}{4}\right)\times\left(-\frac{3}{4}\right)$

$= \frac{16}{81}\times\left(-\frac{27}{64}\right)$

$= -\frac{\cancel{16}^1 \times \cancel{27}^1}{\cancel{81}_3 \times \cancel{64}_4} = -\frac{1}{12}$

(*ii*) $\left(-\frac{2}{5}\right)^3 \times \left(-\frac{1}{4}\right)^3 = \left(-\frac{2}{5}\right)\times\left(-\frac{2}{5}\right)\times\left(-\frac{2}{5}\right)\times\left(-\frac{1}{4}\right)\times\left(-\frac{1}{4}\right)\times\left(-\frac{1}{4}\right)$

$= -\frac{8}{25}\times\left(-\frac{1}{64}\right)$

$= \frac{\cancel{8}^1 \times 1}{125 \times \cancel{64}_8} = \frac{1}{1000}$

(*iii*) $\left(-\frac{1}{2}\right)^3 \times 3^2 \times \left(\frac{3}{4}\right)^2$

$= \left(-\frac{1}{2}\right)\times\left(-\frac{1}{2}\right)\times\left(-\frac{1}{2}\right)\times3\times3\times\frac{3}{4}\times\frac{3}{4}$

$= \left(-\frac{1}{8}\right)\times9\times\frac{9}{16}$

$$= -\frac{1\times 9\times 9}{8\times 16} = -\frac{81}{128}$$

(*iv*) $\left(-\frac{3}{5}\right)^2 \times \left(\frac{2}{3}\right)^4 \times \left(-\frac{5}{6}\right)^2$

$$= \left(-\frac{3}{5}\right)\times\left(-\frac{3}{5}\right)\times\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}$$

$$\times\left(-\frac{5}{6}\right)\times\left(-\frac{5}{6}\right)$$

$$= \frac{\cancel{9}^{1}}{\cancel{25}_{1}}\times\frac{\cancel{16}^{4}}{81}\times\frac{\cancel{25}^{1}}{\cancel{36}_{3}}$$

$$= \frac{1\times 4\times 1}{1\times 81\times 1} = \frac{4}{81}$$

14. (*i*) $\left(\frac{3}{4}\right)^2 \times \left(\frac{2}{3}\right)^3 \times \left(\frac{1}{2}\right)^2$

$$= \frac{3}{4}\times\frac{3}{4}\times\frac{2}{3}\times\frac{2}{3}\times\frac{2}{3}\times\frac{1}{2}\times\frac{1}{2}$$

$$= \frac{\cancel{9}^{1}}{\cancel{16}_{2}}\times\frac{\cancel{8}^{1}}{\cancel{27}_{3}}\times\frac{1}{4}$$

$$= \frac{1\times 1\times 1}{2\times 3\times 4} = \frac{1}{24}$$

(*ii*) $\left[\left(\frac{1}{2}\right)^2 - \left(\frac{1}{4}\right)^3\right]\times 2^3$

$$= \left[\frac{1}{4}-\frac{1}{64}\right]\times 8$$

$$= \left[\frac{16-1}{64}\right]\times 8$$

$$= \frac{15}{\cancel{64}_{8}}\times\cancel{8}^{1} = \frac{15\times 1}{8}$$

$$= \frac{15}{8}$$

EXERCISE 6.2

1. (*i*) $-\frac{343}{1331} = -\frac{7\times 7\times 7}{11\times 11\times 11}$

7	343
7	49
7	7
	1

11	1331
11	121
11	11
	1

$$= \left(\frac{-7}{11}\right)\times\left(\frac{-7}{11}\right)\times\left(\frac{-7}{11}\right)$$

$$= \left(\frac{-7}{11}\right)^3$$

(*ii*) $-\frac{32}{243} = -\left(\frac{2\times 2\times 2\times 2\times 2}{3\times 3\times 3\times 3\times 3}\right)$

$$= \left(-\frac{2}{3}\right)\times\left(-\frac{2}{3}\right)\times\left(-\frac{2}{3}\right)\times\left(-\frac{2}{3}\right)\times\left(-\frac{2}{3}\right)$$

$$= \left(-\frac{2}{3}\right)^5$$

3	6561
3	2187
3	729
3	243
3	81
3	27
3	9
3	3
	1

(*iii*) $\frac{1}{6561} = \frac{1}{3\times 3\times 3\times 3\times 3\times 3\times 3\times 3}$

$\frac{1}{3^8} = 3^{-8}$ $\left(\because \frac{1}{a^n} = a^{-n}\right)$

2. (*i*) $9\times 9\times 9\times 9$

$= (3\times 3)\times(3\times 3)\times(3\times 3)\times(3\times 3)$

$= 3\times 3\times 3\times 3\times 3\times 3\times 3\times 3$

$= 3^8$

(*ii*) $8\times 8\times 8 = (2\times 2\times 2)\times(2\times 2\times 2)\times(2\times 2\times 2)$

$= 2^3\times 2^3\times 2^3$

$= 2^{3+3+3} = 2^9$ $[\because a^m\times a^n = a^{m+n}]$

3. (*i*) $(2^3\times 2)^2 = (2^3\times 2)\times(2^3\times 2)$

$= 2^{3+1}\times 2^{3+1}$ $[\because a^m\times a^n = a^{m+n}]$

$= 2^4\times 2^4 = 2^{4+4}$ $[\because a^m\times a^n = a^{m+n}]$

$= 2^8$

(*ii*) $\frac{5^8}{5^5\times 5^3} = \frac{5^8}{5^{5+3}}$ $[\because a^m\times a^n = a^{m+n}]$

$= \frac{5^8}{5^8} = 5^{8-8}$ $[\because a^m\div a^n = a^{m-n}]$

$= 5^0 = 1$

(*iii*) $(3^{20}\div 3^{15})\times 3^3$

$= 3^{20-15}\times 3^3$ $[\because a^m\div a^n = a^{m-n}]$

$= 3^5\times 3^3 = 3^{5+3}$ $[a^m\times a^n = a^{m+n}]$

$= 3^8$

4. (*i*) $\left(\frac{2^7}{2^3}\right)\times 2^5 = 2^{7-3}\times 2^5$ $[\because a^m\div a^n = a^{m-n}]$

$= 2^4\times 2^5$

$= 2^{4+5}$ $[\because a^m\times a^n = a^{m+n}]$

$= 2^9$

(*ii*) $[(2^2)^4\times 3^8]5^8 = [2^{2\times 4}\times 3^8]5^8$

$= [2^8\times 3^8]5^8$ $[\because (a^m)^n = a^{mn}]$

$= (2\times 3)^8\times 5^5$ $[\because a^m\times b^m = (ab)^m]$

$= (6\times 5)^8$ $[\because a^m\times b^m = (ab)^m]$

$= 30^8$

(*iii*) $[(5^2)^3\times 5^4]\div 5^7$

$= [5^{2\times 3}\times 5^4]\div 5^7$ $[\because (a^m)^n = a^{mn}]$

$= [5^6\times 5^4]\div 5^7$

$= 5^{6+4}\div 5^7$ $[\because a^m\times a^n = a^{m+n}]$

$= 5^{10}\div 5^7$

$= 5^{10-7} = 5^3$ $[\because a^m\div a^n = a^{m-n}]$

(*iv*) $\frac{4\times 3^4\times 2^3}{2\times 2^5} = \frac{2^2\times 3^4\times 2^3}{2\times 2^5}$ $[\because 4 = 2^2]$

$= \frac{2^{2+3} \times 3^4}{2^{5+1}}$ [$\because$ $a^m \times a^n = a^{m+n}$]

$= \frac{2^5 \times 3^4}{2^6}$

$= 2^{5-6} \times 3^4$ [$\because$ $a^m \div a^n = a^{m-n}$]

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

$= \frac{3^4}{2}$ $\left[\because \quad a^{-n} = \frac{1}{a^n}\right]$

$= \frac{81}{2}$

(*v*) $\frac{7^2 \times 11^6 \times 3}{11^3 \times 21} = \frac{7^2 \times 11^6 \times 3}{11^3 \times 7 \times 3}$

$= 7^{2-1} \times 11^{6-3} \times 3^{1-1}$ [$\because a^m \div a^n = a^{m-n}$]

$= 7^1 \times 11^3 \times 3^0$

$= 7 \times 1331 \times 1]$

$= 9317$

$\therefore \frac{7^2 \times 11^6 \times 3}{11^3 \times 21} = 9317$

(*vi*) $\frac{3^7 \times a^5}{9^2 \times a^3} = \frac{3^7 \times a^5}{(3^2)^2 \times a^3}$ [$\because (a^m)^n = a^{mn}$]

$= 3^{7-4} \times a^{5-3}$

$= 3^3 \times a^2$

$= 27a^2$

$\therefore \frac{3^7 \times a^5}{9^3 \times a^3} = 27a^2$

5. (*i*) $\left(\frac{2}{7}\right)^{-3} \times \left(\frac{2}{7}\right)^{-11} = \left(\frac{2}{7}\right)^{7x}$

$\Rightarrow \left(\frac{2}{7}\right)^{-3+(-11)} = \left(\frac{2}{7}\right)^{7x}$ [$\because$ $a^m \times a^n = a^{m+n}$]

$\Rightarrow \left(\frac{2}{7}\right)^{-14} = \left(\frac{2}{7}\right)^{7x}$

$\Rightarrow$ $-14 = 7x$ (Base are same, powers will equal)

$\Rightarrow$ $x = \frac{-14}{7}$

$\Rightarrow$ $x = -2$

(*ii*) $\left(\frac{1}{5}\right)^{-3} \times \left(\frac{1}{5}\right)^{-5} = \left(\frac{1}{5}\right)^{x}$

$\Rightarrow \left(\frac{1}{5}\right)^{-3+(-5)} = \left(\frac{1}{5}\right)^{x}$ [$\because$ $a^m \times a^n = a^{m+n}$]

$\Rightarrow \left(\frac{1}{5}\right)^{-8} = \left(\frac{1}{5}\right)^{x}$

$\Rightarrow$ $-8 = x$

(Base are same, powers will equal)

$\Rightarrow$ $x = -8$

6. $\left(\frac{3}{5}\right)^3 \times \left(\frac{3}{5}\right)^{-2} \times \left[\left(\frac{1}{2}\right)^2\right]^{-2} \times \frac{1}{24}$

$= \left(\frac{3}{5}\right)^{3+(-2)} \times \left[\left(\frac{1}{2}\right)^2\right]^{(-2)} \times \frac{1}{24}$

[$\because$ $a^m \times a^n = a^{m+n}$]

$= \left(\frac{3}{5}\right)^1 \times \left(\frac{1}{2}\right)^{2\times(-2)} \times \frac{1}{24}$

[$\because$ $(a^m)^n = a^{mn}$]

$= \frac{3}{5} \times \left(\frac{1}{2}\right)^{-4} \times \frac{1}{24}$

$= \frac{3}{5} \times \frac{1}{2^{-4}} \times \frac{1}{24}$

$= \frac{3}{5} \times 2^4 \times \frac{1}{24}$ $\left[\because \quad \frac{1}{a^{-n}} = a^n\right]$

$= \frac{\cancel{3}^1}{5} \times \cancel{16}^2 \times \frac{1}{\cancel{24}\ \cancel{8}_1}$

$= \frac{2}{5}$

7. Let the required number be x. Therefore,

$(-8)^{-1} \times x = 12^{-1}$

$\Rightarrow \left(\frac{1}{-8}\right) \times x = \frac{1}{12}$ $\left[\because \quad a^{-n} = \frac{1}{a^n}\right]$

$\Rightarrow$ $x = \frac{1}{12} \div \left(\frac{1}{-8}\right)$

$x = \left(\frac{1}{12}\right) \times (-8)$

$= \frac{-8}{12} = \frac{-2}{3}$

The required number is $\left(-\frac{2}{3}\right)$.

8. Let the required number be x. Therefore,

$(3)^{-3} \times x = 5$

$\Rightarrow$ $x = 5 \div 3^{-3}$

$\Rightarrow$ $x = 5 \times \frac{1}{3^{-3}}$

$\Rightarrow$ $x = 5 \times 3^3$ $\left[\because \quad \frac{1}{a^{-n}} = a^n\right]$

$= 5 \times 27$

$x = 135$

9. Let the required number be x. Therefore,

$$(-7)^{-1} \times x = \left(\frac{6}{7}\right)^{-1}$$

$$\Rightarrow \quad \frac{1}{-7} \times x = \frac{7}{6} \qquad \left(\because \ a^{-n} = \frac{1}{a^n}\right)$$

$$\Rightarrow \quad x = \frac{7}{6} \div \left(\frac{1}{-7}\right)$$

$$= \frac{7}{6} \times \left(\frac{-7}{1}\right) = -\frac{49}{6}$$

Hence, the required number is $-\frac{49}{6}$.

10. (*i*) $$\frac{25 \times 5^2 \times x^8}{10^3 \times x^5} = \frac{5^2 \times 5^2 \times x^8}{(2 \times 5)^3 \times x^5}$$

$$= \frac{5^2 \times 5^2 \times x^8}{2^3 \times 5^3 \times x^5} \qquad [\because \ (ab)^m = a^m \times b^m]$$

$$= \frac{5^4 \times x^8}{2^3 \times 5^3 \times x^5} \qquad [\because \ a^m \times a^n = a^{m+n}]$$

$$= \frac{5^{4-3} \times x^{8-5}}{2^3} \qquad [\because \ a^m \div a^n = a^{m-n}]$$

$$= \frac{5 \times x^3}{2^3} = \frac{5}{8}x^3$$

(*ii*) $$\frac{3^5 \times 10^5 \times 25}{5^7 \times 6^5} = \frac{3^5 \times (2 \times 5)^5 \times 5^2}{5^7 \times (2 \times 3)^5} \ [\because (ab)^m = a^m \times b^m]$$

$$= \frac{3^5 \times 2^5 \times 5^5 \times 5^2}{5^7 \times 2^5 \times 3^5}$$

$$= \frac{3^5 \times 2^5 \times 5^7}{5^7 \times 2^5 \times 3^5} \qquad [\because \ a^m \times a^n = a^{m+n}]$$

$= 3^{5-5} \cdot 2^{5-5} \cdot 5^{7-7}$ $\qquad [\because \ a^m \div a^n = a^{m+n}]$

$= 3^0 \cdot 2^0 \cdot 5^0$

$= 1 \times 1 \times 1 = 1$

(*iii*) $$\frac{(2^5)^3 \times 7^3}{8^3 \times 7} = \frac{(2^5)^3 \times 7^3}{(2^3)^3 \times 7}$$

$$= \frac{2^{15} \times 7^3}{2^9 \times 7} \qquad [\because (a^m)^n = a^{mn}]$$

$= 2^{15-9} \times 7^{3-1}$ $\qquad [\because (a^m)^n = a^{mn}]$

$= 2^6 \times 7^2$

$= 3136$

(*iv*) $$\left[\left\{\left(-\frac{1}{3}\right)^2\right\}^{-2}\right]^{-1} = \left[\left(-\frac{1}{3}\right)^{2\times(-2)}\right]^{-1} [\because \ (a^m)^n = a^{mn}]$$

$$= \left[\left(-\frac{1}{3}\right)^{-4}\right]^{-1} = \left(-\frac{1}{3}\right)^{-4\times(-1)} \quad [\because \ (a^m)m = a^m]$$

$$= \left(-\frac{1}{3}\right)^4 = \frac{1}{81}$$

11. (*i*) Reciprocal of $6^0 \times 9^0 = \frac{1}{6^0 \times 9^0}$

$$= \frac{1}{1 \times 1} = 1 \qquad (\because \ 6^0 = 1 \text{ and } 9^0 = 1)$$

(*ii*) Reciprocal of $\left(-\frac{5}{7}\right)^7 = \frac{1}{\left(-\frac{5}{7}\right)^7}$

$$= -\frac{1}{5^7/7^7}$$

$$= -\frac{7^7}{5^7} = \left(-\frac{7}{5}\right)^7$$

(*iii*) Reciprocal of $(-4)^3 = \frac{1}{(-4)^3} = \frac{1}{-64}$

12. (*i*) $$\left[7^{-1} + \left(\frac{3}{2}\right)^{-1}\right]^{-1} = \left[\frac{1}{7} + \frac{2}{3}\right]^{-1} \qquad \left[\because \ a^{-n} = \frac{1}{a^n}\right]$$

$$= \left[\frac{3+14}{21}\right]^{-1} = \left(\frac{17}{21}\right)^{-1}$$

$$= \frac{21}{17} \qquad \left(\because \ a^{-n} = \frac{1}{a^n}\right)$$

(*ii*) $(5^{-1} - 4^{-1}) + (2^{-1} - 3^{-1})^{-1}$

$$= \left(\frac{1}{5} - \frac{1}{4}\right)^{-1} + \left(\frac{1}{2} - \frac{1}{3}\right)^{-1} \left(\because \ a^{-n} = \frac{1}{a^n}\right)$$

$$= \left(\frac{4-5}{20}\right)^{-1} + \left(\frac{3-2}{6}\right)^{-1}$$

$$= \left(\frac{-1}{20}\right)^{-1} + \left(\frac{1}{6}\right)^{-1}$$

$$= -20 + 6 = -14 \qquad \left(\because \ a^{-n} = \frac{1}{a^n}\right)$$

EXERCISE 6.3

1. (*i*) $6 \times 10^3 + 5 \times 10^2 + 0 \times 10 + 6 \times 10^0$

$= 6 \times 1000 + 5 \times 100 + 0 + 6 \times 1$

$= 6000 + 5000 + 6$

$= 6506$

(*ii*) $9 \times 10^4 + 6 \times 10^3 + 4 \times 10^2 + 5 \times 10 + 7$

$= 9 \times 10000 + 6 \times 1000 + 4 \times 100 + 5 \times 10 + 7$

$= 90000 + 6000 + 400 + 50 + 7$

$= 96457$

(*iii*) $8 \times 10^5 + 7 \times 10^4 + 5 \times 10^3 + 4 \times 10^2 + 6 \times 10^1 + 9 \times 10^0$

$= 8 \times 100000 + 7 \times 10000 + 5 \times 1000 + 4 \times 100 + 6 \times 10 + 9 \times 1$

$= 800000 + 70000 + 5000 + 400 + 60 + 9$

$= 875469$

(*iv*) $4 \times 10^6 + 8 \times 10^5 + 6 \times 10^4 + 4 \times 10^3 + 4 \times 10^2 + 6 \times 10 + 9 \times 10^0$

$= 4 \times 1000000 + 8 \times 100000 + 6 \times 10000 + 4 \times 1000 + 4 \times 100 + 6 \times 10 + 9 \times 1$

$= 4000000 + 800000 + 60000 + 4000 + 400 + 60 + 9$

$= 4864469$

2. (*i*) $34562 = 3 \times 10^4 + 4 \times 10^3 + 5 \times 10^2 + 6 \times 10^1 \times 2 \times 10^0$

(*ii*) $785965 = 7 \times 10^5 + 8 \times 10^4 + 5 \times 10^3 + 9 \times 10^2 + 6 \times 10^1 + 5 \times 10^0$

(*iii*) $54532 = 5 \times 10^4 + 4 \times 10^3 + 5 \times 10^2 + 3 \times 10^1 + 2 \times 10^0$

(*iv*) $755042 = 7 \times 10^5 + 5 \times 10^4 + 5 \times 10^3 + 0 \times 10^2 + 4 \times 10^1 + 2 \times 10^0$

3. (*i*) $80,00,000 = 8.000000 \times 10^6 = 8 \times 10^6$

(*ii*) $4,19,25,00000 = 4.192500000 \times 10^9 = 4.1925 \times 10^9$

(*iii*) $480767 = 4.80767 \times 10^5$

(*iv*) $93045.08 = 9.304508 \times 10^4$

(*v*) $5682.026 = 5.682026 \times 10^3$

(*vi*) $855970 = 8.55970 \times 10^5 = 8.5597 \times 10^5$

4. (*i*) The distance between Sun and Earth is 149,600, 000, 000 m.

i.e. $149,600,000,000$ m $= 1.49600000000 \times 10^{11}$ m

$= 1.496 \times 10^{11}$ m

(*ii*) Distance of Sun from centre of our galaxy is 300, 000,000,000,000,000,000 m

i.e.

$= 3.00000000000000000000 \times 10^{20}$

$= 3 \times 10^{20}$ m

(*iii*) Diameter of Earth = 1,2756000 m

$= 1.2756000 \times 10^7$ m

$= 1.2756 \times 10^7$ m

(*iv*) Speed of light in vacuum

$= 3,100,000,000$ m/sec

$= 3.1 \times 10^9$ m/sec

5. (*i*) $4.356 \times 10^7 = 4.356 \times 1000000$

$= 43560000$

(*ii*) $7.253 \times 10^{11} = 7.235 \times 100000000000$

$= 725300000000$

(*iii*) $7.5 \times 10^3 = 7.5 \times 1000$

$= 7500$

(*iv*) $20.345 \times 10^6 = 20.345 \times 1000000 = 20345000$

(*v*) $19.5021 \times 10^6 = 19.5021 \times 1000000 = 19502100$

MULTIPLE CHOICE QUESTIONS

1. $\left(\frac{2}{-3}\right)^{-4} = \frac{1}{(2/-3)^4}$ $\left(\because a^{-n} = \frac{1}{a^n}\right)$

$= \frac{1}{2^4/(-3)^4}$

$= \frac{(-3)^4}{2^4} = \frac{81}{16}$

Hence, option (*a*) is correct.

2. $\left(-\frac{1}{2}\right)^{-5} = \frac{1}{(-1/2)^5}$ $\left(\because a^{-n} = \frac{1}{a^n}\right)$

$= (-2)^5 = -32$

Hence, option (*b*) is correct.

3. Reciprocal of $\left(-\frac{1}{5}\right)^{-2} = \frac{1}{(-1)^{-2}/(5)^{-2}}$

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

$= \frac{1}{5^2} = \frac{1}{25}$

Hence, option (*a*) is correct.

4. $2^5 \times 5^4 = 2 \times 2^4 \times 5^4$

$= 2 \times (2 \times 5)^4$ $[\because a^m \times b^m = (ab)^m]$

$= 2 \times 10^4$

Hence, option (*b*) is correct.

5. $\left(\frac{7}{5}\right)^0 - \left(\frac{4}{5}\right)^0 - 1 = 1 - 1 - 1 = -1$

Hence, option (*c*) is correct.

6. $(2^{-1} - 3^{-1})^{-1} = \left(\frac{1}{2} - \frac{1}{3}\right)^{-1}$

$= \left(\frac{3-2}{6}\right)^{-1} = \left(\frac{1}{6}\right)^{-1} = 6$

Hence, option (*a*) is correct.

7. $(5^2)^3 \div (-5)^3 = 5^6 \div (-5)^3$

$= 5^6 \times \left(-\frac{1}{5^3}\right)$

$= -(5^{6-3}) = -5^3 = -125$ $[\because a^m \div a^n = a^{m-n}]$

Hence, option (*c*) is correct.

8. $(-3)^2 \times (-3)^4 \times (-3)^6 = (-3)^{2+4+6} = (-3)^{12}$

Hence, option (*b*) is correct.

9. $[(-6)^4]^3 = (-6)^{4\times3} = (-6)^{12} = 6^{12}$

Hence, option (*c*) is correct.

10. $\left(\frac{4}{5}\right)^{-2} = \left(\frac{5}{4}\right)^{2} = \frac{5\times5}{4\times4} = \frac{25}{16}$

Hence, option (*a*) is correct.

MENTAL MATHS CORNER

1. The reciprocal of $(-3)^0$ is **1**.
2. $(-2)^{-5}$ as a rational number is equal to $-\frac{\mathbf{1}}{\mathbf{32}}$.
3. $(-6)^{-1}$ should be divided by $-\frac{\mathbf{1}}{\mathbf{18}}$ so that quotient is 3.
4. $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{2}\right)^{-2} = 2^2 + 2^2$

$= 4 + 4 = 8$ $\left(\because\ a^{-n} = \frac{1}{a^n}\right)$

Thus, $\left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{2}\right)^{-2}$ is equal to **8**.

5. $\left(\frac{3}{2}\right)^{-3}$ should be multiplied by $\left(\frac{\mathbf{3}}{\mathbf{2}}\right)^{\mathbf{4}}$ to get $\frac{3}{2}$.
6. In $(-7)^3$ the base is **(– 7)** and the exponent is **3**.
7. 8 × 8 × 8 in exponent form with base 2 can be written as $\mathbf{2^9}$.
8. 8^2 should be divided by $\mathbf{2^3}$ to get quotient 2^3.
9. $(3^{19} \div 3^{16}) \times 3^{-3} = (3^{19-16}) \times 3^{-3}$ $[\because\ a^m \div a^n = a^{m-n}]$

$= 3^3 \times 3^{-3}$ $[\because\ a^m \times a^n = a^{m+n}]$

$= 3^{3-3}$

$= 3^0 = 1$

Thus, $(3^{19} \div 3^{16}) \times 3^{-3}$ is equal to **1**.

10. 62740000 in standard form is equal to $\mathbf{6.274 \times 10^7}$.

REVIEW EXERCISE

1. (*i*) $81 = 3 \times 3 \times 3 \times 3 = 3^4$

(*ii*) $343 = 7 \times 7 \times 7 = 7^3$

(*iii*) $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^5$

(*iv*) $1331 = 11 \times 11 \times 11 = 11^3$

2. (*i*) $1296 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3$

$= 2^4 \times 3^4 = (2 \times 3)^4 = 6^4$

(*ii*) $14641 = 11 \times 11 \times 11 \times 11 = 11^4$

(*iii*) $6561 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^8$

(*iv*) $4096 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

$= 2^{12}$

3. (*i*) $2^4 \times 5 = 16 \times 5 = 80$

(*ii*) $(-3)^2 \times (-2)^3 = (-3) \times (-3) \times (-2) \times (-2) \times (-2)$

$= 9 \times (-8) = -72$

(*iii*) $3^2 \times 10^3 = 3 \times 3 \times 10 \times 10 \times 10$

$= 9 \times 1000 = 9000$

4. (*i*) $7^{14} \div 7^{12} = 7^{14-12}$ $[\because\ a^m \div a^n = a^{m-n}]$

$= 7^2 = 49$

(*ii*) $(4^2)^2 = (4)^{2\times2} = 4^4$ $[\because\ (a^m)^n = a^{mn}]$

$= 256$

(*iii*) $(-2p)^3 = (-2)^3 \times p^3$ $[\because\ (ab)^m = a^m \times b^m]$

$= -8p^3$

(*iv*) $\left(-\frac{2}{3}\right)^3 = \left(-\frac{2}{3}\right)\times\left(-\frac{2}{3}\right)\times\left(-\frac{2}{3}\right) = -\frac{8}{27}$

5. (*i*) $(6^0 + 5^0) \times (11^0 + 1)\left(\frac{2}{3}\right)^{-2}$

$= (1+1)\times(1+1)\left(\frac{3}{2}\right)^2$

$\left[\because\ a^0 = 1 \text{ and } a^{-n} = \frac{1}{a^n}\right]$

$= 2\times2\times\frac{9}{4}$

$= \frac{\cancel{4}\times9}{\cancel{4}} = 9$

(*ii*) $(3^9 \div 3^6) \times (2^6 \div 2^4)$

$= 3^{9-6} \times 2^{6-4}$ $[\because\ a^m \div a^n = a^{m-n}]$

$= 3^3 \times 2^2$

$= 27 \times 4 = 108$

6. $-\frac{216}{343} = -\frac{2\times2\times2\times3\times3\times3}{7\times7\times7}$

$= -\frac{(2\times3)\times(2\times3)\times(2\times3)}{7\times7\times7}$

$= -\frac{6\times6\times6}{7\times7\times7} = \left(-\frac{6}{7}\right)\times\left(-\frac{6}{7}\right)\times\left(-\frac{6}{7}\right)$

$= \left(-\frac{6}{7}\right)^3$

7. (*i*) $p^3 = (5^2)^{-3}$

$\Rightarrow\ p^3 = (25)^{-3}$

$\Rightarrow\ p^3 = \frac{1}{(25)^3}$ $\left[\because\ a^{-n} = \frac{1}{a^n}\right]$

$\Rightarrow\ p^3 = \left(\frac{1}{25}\right)^3$

$\Rightarrow\ p = \frac{1}{25}$

(Powers are same, base will be equal)

(*ii*) $\left(\frac{4}{7}\right)^{12} \div \left(\frac{4}{7}\right)^{p} = \frac{64}{343}$

$$\Rightarrow \left(\frac{4}{7}\right)^{12} \div \left(\frac{4}{7}\right)^{p} = \left(\frac{4}{7}\right)^{3}$$

$$\Rightarrow \left(\frac{4}{7}\right)^{p} = \left(\frac{4}{7}\right)^{12} \div \left(\frac{4}{7}\right)^{3}$$

$$\Rightarrow \left(\frac{4}{7}\right)^{p} = \left(\frac{4}{7}\right)^{12-3}$$

$$\Rightarrow \left(\frac{4}{7}\right)^{p} = \left(\frac{4}{7}\right)^{9}$$

(Base are equal, powers will be equal)

$\Rightarrow \quad p = 9$

(*iii*) $$\left[\left\{\left(-\frac{3}{7}\right)^{-2}\right\}^{3}\right]^{p} = \left(-\frac{7}{3}\right)^{-18}$$

$$\Rightarrow \left[\left\{\left(-\frac{7}{3}\right)^{2}\right\}^{3}\right]^{p} = \left(-\frac{7}{3}\right)^{-18} \qquad \left(\because\ a^{-n} = \frac{1}{a^n}\right)$$

$$\Rightarrow \left[\left(-\frac{7}{3}\right)^{2\times 3}\right]^{p} = \left(-\frac{7}{3}\right)^{-18} \qquad [\because\ (a^m)^n = a^{mn}]$$

$$\Rightarrow \left(-\frac{7}{6}\right)^{6p} = \left(-\frac{7}{3}\right)^{-18}$$

$\Rightarrow \quad 6p = -18$

(Powers are same, base will be equal)

$\Rightarrow \quad p = -3$

8. Let the required number be x. Therefore,

$5^{-2} \times x = 5^2$

$$\Rightarrow \frac{1}{5^2} \times x = 5^2 \qquad \left(\because\ a^{-n} = \frac{1}{a^n}\right)$$

$$\Rightarrow x = 5^2 \div \frac{1}{5^2}$$

$\Rightarrow \quad x = 5^2 \times 5^2$

$\Rightarrow \quad x = 25 \times 25$

$x = 625$

Hence, the required number is 625.

9. Let the required number be x. Therefore,

$6^3 \div x = 3^4$

$\Rightarrow \quad x = 6^3 \div 3^4$

$\Rightarrow \quad x = (2 \times 3)^3 \div 3^4$

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

$$x = 2^3 \times 3^3 \times 3^{-4} \qquad \left[\because\ \frac{1}{a^n} = a^{-n}\right]$$

$x = 2^3 \times 3^{3-4}$

$x = 2^3 \times 3^{-1}$

$$x = \frac{2^3}{3} \qquad \left[a^{-n} = \frac{1}{a^n}\right]$$

$$x = \frac{2 \times 2 \times 2}{3} = \frac{8}{3}$$

Hence the required number is $\frac{8}{3}$.

10. (*i*) $27 \times 3^{p+1} = 729$

$\Rightarrow \quad 3^{p+1} = 729 \div 27$

$3^{p+1} = 3^6 \div 3^3$

$3^{p+1} = 3^{6-3} \qquad [\because\ a^m \div a^n = a^{m-n}]$

$3^{p+1} = 3^3$

$\Rightarrow \quad p + 1 = 3$

$\Rightarrow \quad p = 3 - 1 = 2$

$\Rightarrow \quad p = 2$

(*ii*) $$\left(-\frac{1}{5}\right)^{p+1} \times \left(-\frac{1}{5}\right)^{5} = \left(-\frac{1}{5}\right)^{9}$$

$$\Rightarrow \left(-\frac{1}{5}\right)^{p+1} = \left(-\frac{1}{5}\right)^{9} \div \left(-\frac{1}{5}\right)^{5}$$

$$\Rightarrow \left(-\frac{1}{5}\right)^{p+1} = \left(-\frac{1}{5}\right)^{9-4} \qquad [\because\ a^m \div a^n = a^{m-n}]$$

$$\Rightarrow \left(-\frac{1}{5}\right)^{p+1} = \left(-\frac{1}{5}\right)^{4}$$

$\Rightarrow \quad p + 1 = 4$

(Powers are same, base will be equal)

$\Rightarrow \quad p = 4 - 1 = 3$

11. (*i*) $4,12,57,00,000 = 4.125700000 \times 10^9$

$= 4.1257 \times 10^9$

(*ii*) $319 \times 10^8 = 3.19 \times 10^2 \times 10^8$

$= 3.19 \times 10^{10}$

(*iii*) $54601 \times 10^6 = 5.4601 \times 10^4 \times 10^6$

$= 5.4601 \times 10^{10}$

(*iv*) $24,000,000,000 = 2.4 \times 10^{10}$

(*v*) $9540689 = 9.540689 \times 10^6$

12. (*i*) $30405 = 3 \times 10^4 + 0 \times 10^3 + 4 \times 10^2 + 0 \times 10^1 + 5 \times 10^0$

(*ii*) $6804152 = 6 \times 10^6 + 8 \times 10^5 + 0 \times 10^4 + 4 \times 10^3 + 1 \times 10^2 + 5 \times 10^1 + 2 \times 10^0$

(*iii*) $729101 = 7 \times 10^5 + 2 \times 10^4 + 9 \times 10^3 + 1 \times 10^2 + 0 \times 10^1 + 1 \times 10^0$

HOT QUESTIONS

1. $$25^{x-1} + 100 = \frac{5^{2x}}{5}$$

$$(5^2)^{x-1} + 100 = 5^{2x} \times 5^{-1} \qquad \left(\because\ \frac{1}{a^n} = a^{-n}\right)$$

$5^{2x-2} + 100 = 5^{2x-1}$

$\Rightarrow 5^{2x-1} - 5^{2x-2} = 100$

$$\Rightarrow \frac{5^{2x}}{5} - \frac{5^{2x}}{5^2} = 100$$

$\Rightarrow 5^{2x}\left[\frac{1}{5}-\frac{1}{25}\right] = 100$

$\Rightarrow 5^{2x}\left[\frac{5-1}{25}\right] = 100$

$\Rightarrow 5^{2x} = \frac{100 \times 25}{4}$

$\Rightarrow 5^{2x} = 625 \quad \Rightarrow \quad 5^{2x} = 5^4$

$\Rightarrow 2x = 4$ (Base are equal, powers will be equal)

$\boxed{x = 2}$

2. (*i*) $\frac{(14)^7 \times 4^7 \times (25)^5 \times (81)^3}{(15)^7 \times (12)^5 \times (80)^3 \times 7^7}$

$= \frac{(7 \times 2)^7 \times 4^7 \times (5^2)^5 \times (3^4)^3}{(3 \times 5)^7 \times (3 \times 4)^5 \times (4^2 \times 5)^3 \times 7^7}$

[$\because \quad a^m \times b^m = (ab)^m$ and $(a^m)^n = a^{mn}$]

$= \frac{7^7 \times 2^7 \times 4^7 \times 5^{10} \times 3^{12}}{3^7 \times 5^7 \times 3^5 \times 4^5 \times 4^6 \times 5^3 \times 7^7}$

$= \frac{7^{7-7} \times 4^{7-5-6} \times 5^{10-7-3} \times 3^{12-7-5} \times 2^7}{1}$

$= \frac{7^0 \times 4^{-4} \times 5^0 \times 3^0 \times 2^7}{1}$

$= 1 \times (2^2)^{-4} \times 1 \times 1 \times 2^7 = 2^{-8+7} = 2^{-1} = \frac{1}{2}$

3. (*i*) $5^0 + 5^{-1} + 5^{-2} = 1 + \frac{1}{5} + \frac{1}{5^2}$

$= 1 + \frac{1}{5} + \frac{1}{25}$

$= \frac{25 + 5 + 1}{25}$

$= \frac{31}{25}$

$= 1\frac{6}{25}$

(*ii*) $(3^{-2} + 3^{-1}) \div (3^0 + 3^{-1})$

$= \left(\frac{1}{3^2} + \frac{1}{3}\right) \div \left(1 + \frac{1}{3}\right)$

$= \left(\frac{1}{9} + \frac{1}{3}\right) \div \left(1 + \frac{1}{3}\right)$

$= \left(\frac{1+3}{9}\right) \div \left(\frac{3+1}{3}\right)$

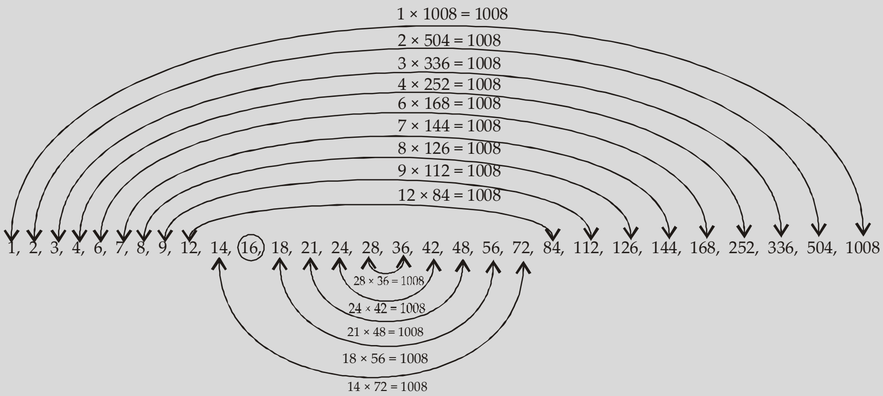
$= \frac{4}{9} \div \frac{4}{3}$

$= \frac{\cancel{4}^{1}}{\cancel{9}_{3}} \times \frac{\cancel{3}^{1}}{\cancel{4}_{1}} = \frac{1}{3}$

Puzzle

Arranging the given factors of 1008 in ascending order, 1, 2, 3, 4, 6, 7, 8, 9, 12, 14, 16, 18, 21, 24, 28, 36, 42, 48, 56, 72, 84, 112, 126, 144, 168, 252, 336, 504, 1008.

Look at the following illustration.



We found that the number 16 is unpaired. So, we have to find a number by which we multiply 16 to get 1008.

16 × 63 = 1008

Hence, the missing divisor is 63.

```
16)1008(63
   -96
    48
   -48
     0
```