

We have

(i) 
$$(25)^3 \div 5^3$$
  
=  $(5^2)^3 \div 5^3$   
=  $5^6 \div 5^3$   
=  $\frac{5^6}{5^3} = 5^{6-3} = 5^3$ 

(ii) 
$$(81)^5 \div (3^2)^5$$
  
=  $(3^4)^5 \div (3^2)^5$   
=  $(3)^{20} \div (3)^{10}$   
=  $\frac{3^{20}}{3^{10}} = 3^{20-10} = 3^{10}$ 

(iii)

$$\frac{9^{8} \times (x^{2})^{5}}{(27)^{4} \times (x^{3})^{2}} = \frac{(3^{2})^{8} \times (x^{2})^{5}}{(3^{3})^{4} \times (x^{3})^{2}} = \frac{3^{16} \times (x)^{10}}{3^{12} \times (x)^{6}} = 3^{16-12} \times (x)^{10-6} = 3^{4} \times x^{4} = (3x)^{4}$$

(iv)

$$\frac{3^{2} \times 7^{8} \times 13^{6}}{21^{2} \times 91^{3}} \\
= \frac{3^{2} \times 7^{2} \times 7^{6} \times 13^{6}}{21^{2} \times (13 \times 7)^{3}} \\
= \frac{(21)^{2} \times 7^{6} \times 13^{6}}{21^{2} \times 13^{3} \times 7^{3}} \\
= \frac{7^{6} \times 13^{6}}{13^{3} \times 7^{3}} \\
= \frac{91^{6}}{91^{3}} = 91^{6-3} = 91^{3}$$

We have

(i) 
$$(3^5)^{11} \times (3^{15})^4 - (3^5)^{18} \times (3^5)^5$$
  
=  $3^{55} \times 3^{60} - 3^{90} \times 3^{25}$   
=  $3^{(55+60)} - 3^{(90+25)}$   
=  $3^{115} - 3^{115}$   
= 0

(ii) 
$$\frac{16 \times 2^{n+1} - 4 \times 2^{n}}{16 \times 2^{n+2} - 2 \times 2^{n+2}} = \frac{2^{4} \times 2^{n+1} - 2^{2} \times 2^{n}}{2^{4} \times 2^{n+2} - 2^{n+1} \times 2^{2}} = \frac{2^{2} \times (2^{n+3} - 2^{n})}{2^{2} \times (2^{n+3} - 2^{n})} = \frac{2^{n} \times 2^{3} - 2^{n}}{2^{n} \times 2^{4} - 2^{n} \times 2} = \frac{2^{n} (2^{3} - 1)}{2^{n} (2^{4} - 2)} = \frac{8 - 1}{16 - 2} = \frac{7}{14} = \frac{1}{2}$$

(iii)

$$\frac{10 \times 5^{n+1} + 25 \times 5^{n}}{3 \times 5^{n+2} + 10 \times 5^{n+1}}$$

$$= \frac{10 \times 5^{n+1} + (5)^{2} \times 5^{n}}{3 \times 5^{n+2} + 2 \times 5 \times 5^{n+1}}$$

$$= \frac{10 \times 5^{n+1} + 5 \times 5^{n+1}}{3 \times 5^{n+2} + 2 \times 5 \times 5^{n+1}}$$

$$= \frac{5^{n+1} (10+5)}{3 \times 5 \times 5^{n+1} + 10 \times 5^{n+1}}$$

$$= \frac{5^{n+1} (15)}{5^{n+1} (15+10)} = \frac{5^{n+1} \times 15}{5^{n+1} \times 25} = \frac{15}{25} = \frac{3}{5}$$

We have

(i) 
$$5^{2n} \times 5^3 = 5^{11}$$
  
=  $5^{2n+3} = 5^{11}$ 

On equating the coefficients, we get

$$2n + 3 = 11$$

$$\Rightarrow$$
 n =  $\frac{8}{2}$  = 4

(ii) 
$$9 \times 3^n = 3^7$$

$$= (3)^2 \times 3^n = 3^7$$

$$=(3)^{2+n}=3^7$$

On equating the coefficients, we get

$$2 + n = 7$$

$$\Rightarrow$$
 n = 7 - 2 = 5

(iii) 
$$8 \times 2^{n+2} = 32$$

= 
$$(2)^3 \times 2^{n+2} = (2)^5$$
 [since  $2^3 = 8$  and  $2^5 = 32$ ]

$$=(2)^{3+n+2}=(2)^5$$

On equating the coefficients, we get

$$3+n+2=5$$

$$\Rightarrow$$
 n + 5 = 5

$$\Rightarrow n = 5 - 5$$
$$\Rightarrow n = 0$$

(iv) 
$$7^{2n+1} \div 49 = 7^3$$
  
=  $7^{2n+1} \div 7^2 = 7^3$  [since  $49 = 7^2$ ]  
=  $\frac{7^{2n+1}}{7^2} = 7^3$   
=  $7^{2n+1-2} = 7^3$  [since  $\frac{\mathbf{a}^m}{\mathbf{a}^n} = \mathbf{a}^{m-n}$ ]  
=  $7^{2n-1} = 7^3$ 

On equating the coefficients, we get

$$2n - 1 = 3$$

$$\Rightarrow$$
 2n = 3 + 1

$$\Rightarrow$$
 2n = 4

$$\Rightarrow$$
 n =  $\frac{4}{2}$  = 2

$$(\vee) \left(\frac{3}{2}\right)^{4} \times \left(\frac{3}{2}\right)^{5} = \left(\frac{3}{2}\right)^{2n+1}$$

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

$$= \left(\frac{3}{2}\right)^{9} = \left(\frac{3}{2}\right)^{2n+1}$$

On equating the coefficients, we get

$$2n + 1 = 9$$

$$\Rightarrow 2n = 9 - 1$$

$$\Rightarrow 2n = 8$$

$$\Rightarrow n = \frac{8}{2} = 4$$

$$(vi) \left(\frac{2}{3}\right)^{10} \times \left\{\left(\frac{3}{2}\right)^{2}\right\}^{5} = \left(\frac{2}{5}\right)^{2n-2}$$

$$= \left(\frac{2}{3}\right)^{10} \times \left(\frac{3}{2}\right)^{10} = \left(\frac{2}{5}\right)^{2n-2}$$

$$= \frac{2^{10} \times 3^{10}}{3^{10} \times 2^{10}} = \left(\frac{2}{5}\right)^{2n-2}$$

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

$$= \left(\frac{2}{5}\right)^{0} = \left(\frac{2}{5}\right)^{2n-2} \left[\text{since } \left(\frac{2}{5}\right)^{0} = 1\right]$$

On equating the coefficients, we get

$$\Rightarrow 0 = 2n - 2$$

$$\Rightarrow$$
 2n = 2

$$\Rightarrow$$
 n =  $\frac{2}{2}$  = 1

We have

$$\frac{9^{n} \times 3^{2} \times 3^{n} - (27)^{n}}{(3^{3})^{5} \times 2^{3}} = \frac{1}{27}$$

$$= \frac{(3^{2})^{n} \times 3^{2} \times 3^{n} - (3^{3})^{n}}{(3)^{15} \times 2^{3}} = \frac{1}{27}$$

$$= \frac{(3)^{2n+2+n} - (3)^{3n}}{(3)^{15} \times 2^{3}} = \frac{1}{27}$$

$$= \frac{(3)^{3n+2} - (3)^{3n}}{(3)^{15} \times 2^{3}} = \frac{1}{27}$$

$$= \frac{(3)^{3n} \times (3)^{2} - (3)^{3n}}{(3)^{15} \times 2^{3}} = \frac{1}{27}$$

$$= \frac{(3)^{3n} (3^{2} - 1)}{(3)^{15} \times 2^{3}} = \frac{1}{27}$$

$$= \frac{(3)^{3n} \times 8}{(3)^{15} \times 2^{3}} = \frac{1}{27}$$

$$= \frac{(3)^{3n} \times 2^{3}}{(3)^{15} \times 2^{3}} = \frac{1}{27}$$

$$= \frac{(3)^{3n} \times 2^{3}}{(3)^{15} \times 2^{3}} = \frac{1}{27}$$

$$= \frac{3^{3n} - 15}{3^{15}} = \frac{1}{27}$$

$$= 3^{3n-15} = \frac{1}{3^{3}}$$

$$= 3^{3n-15} = 3^{-3}$$

On equating the coefficients, we get 3n-15=-3

$$\Rightarrow 3n = -3 + 15$$

$$\Rightarrow 3n = 12$$

$$\Rightarrow n = \frac{12}{3} = 4$$

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