# 2. Exponents of Real Numbers

#### Exercise 2.1

#### 1. Question

Assuming that x, y, z are positive real numbers, simplify each of the following:

(i) 
$$\left(\sqrt{x^{-3}}\right)^5$$
 (ii)  $\sqrt{x^3y^{-2}}$  (iii)  $(x^{-2/3}y^{-1/2})^2$  (iv)  $(\sqrt{x})^{-2/3}\sqrt{y^4} \div \sqrt{xy^{-1/2}}$  (v)  $\sqrt[5]{243x^{10}y^5z^{10}}$  (vi)  $\left(\frac{x^{-4}}{y^{-10}}\right)^{5/4}$ 

#### Answer

(i) 
$$(\frac{\sqrt{1}}{\sqrt{3}})^5 = (1 / x^{3/2})^5$$
  
=  $(1 / x^{3/2} \times 5) = (1 / x^{15/2})$   
(ii)  $(\sqrt{x}^3 / y^2) = (x^3 / y^2)^{1/2}$   
=  $x^{3 \times 1/2} / y^{2 \times 1/2}$   
=  $x^{3/2} / y$   
(iii)  $1 / (x^{2/3} y^{1/2})^2$   
=  $1 / (x^{2/3} \times 2 y^{1/2} \times 2)$   
=  $1 / (x^{4/3} y)$   
(iv)  $(x^{1/2})^{-2/3} (y)^2 / (xy^{-1/2})^{1/2}$   
=  $x^{-1/3}y^2 / (x^{1/2}y^{-1/2} \times 1/2)$   
=  $(x^{-5/6}) (y^{9/4})$   
=  $(y^{9/4}) / (x^{5/6})$   
(v)  $(243x^{10} y^5 z^{10})^{1/5}$   
=  $(3^5)^{1/5} x^2yz^2$   
=  $3x^2yz^2$   
(vi)  $(y^{10} / x^4)^{5/4}$   
=  $y^{10 \times 5/4} / x^4 \times 5/4$   
=  $y^{25/2} / x^5$   
2. Question

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Simplify:

(i) 
$$(16^{-1/5})^{5/2}$$
 (ii)  $\sqrt[3]{(343)^{-2}}$  (iii)  $(0.001)^{1/3}$  (iv)  $\frac{(25)^{3/2} \times (243)^{3/5}}{(16)^{5/4} \times (8)^{4/3}}$  (v)  $\left(\frac{\sqrt{2}}{5}\right)^8 \div \left(\frac{\sqrt{2}}{5}\right)^{13}$  (vi)  $\left(\frac{5^{-1} \times 7^2}{5^2 \times 7^{-4}}\right)^{7/2} \times \left(\frac{5^{-2} \times 7^3}{5^3 \times 7^{-5}}\right)^{-5/2}$ 

Answer

(i) 
$$\left(16^{-\frac{1}{5}}\right)^{\frac{5}{2}}$$

We know for any non-zero number a,

 $(a^m)^n = a^{mn}$ 

So, 
$$\left(16^{-\frac{1}{5}}\right)^{\frac{5}{2}} = 16^{-\frac{1}{2}}$$

As we know  $4^2 = 16$ 

Therefore,  $\left(16^{-\frac{1}{5}}\right)^{\frac{5}{2}} = (4^2)^{-\frac{1}{2}}$ 

= 4<sup>-1</sup>

As we know for any non-zero number a,

 $a^{-1} = 1/a$ 

So  $4^{-1} = 1/4$ 

(ii) [(343)<sup>-2</sup>]<sup>1/3</sup>

$$(343^{-2})^{\frac{1}{3}}$$

We know for any non-zero number a,

$$(a^m)^n = a^{mn}$$

So, 
$$(343^{-2})^{\frac{1}{3}} = 343^{-\frac{2}{3}}$$

As we know  $7^3 = 343$ 



Therefore, 
$$(343^{-2})^{\frac{1}{3}} = (7^3)^{-\frac{2}{3}}$$

As we know for any non-zero number a,

$$a^{-1} = 1/a$$
  
So  $7^{-2} = 1/7^{2}$   
= 1/49  
(iii)  $(\frac{1}{1000})^{1/3} = (1 / 10^{3})^{1/3}$   
=  $\frac{1}{10} = 0.1$   
(iv)  $\frac{(25)^{3/2} \times (243)^{3/5}}{(16)^{5/4} \times (8)^{4/3}}$   
We know 25 = 5<sup>2</sup>  
243 = 3<sup>5</sup>  
16 = 2<sup>4</sup>  
8 = 2<sup>3</sup>  
So,  $\frac{(5^{2})^{\frac{3}{2}} \times (3^{5})^{\frac{3}{5}}}{5}$ 

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

We know for any non-zero number a,

 $(a^m)^n = a^{mn}$ 

So,

$$= \frac{5^{3} \times 3^{3}}{2^{5} \times 2^{4}}$$
$$= \frac{125 \times 27}{32 \times 16}$$
$$= \frac{3375}{512}$$





$$(v)\left(\frac{\sqrt{2}}{5}\right)^{8} \div \left(\frac{\sqrt{2}}{5}\right)^{13}$$

We know that for any non-zero number a,

 $a^m \div a^n = a^{m-n}$ 

So,

$$\frac{\left(\frac{\sqrt{2}}{5}\right)^8}{\left(\frac{\sqrt{2}}{5}\right)^{13}} = \left(\frac{\sqrt{2}}{5}\right)^{8-13} = \left(\frac{\sqrt{2}}{5}\right)^{-5}$$

As we know for any non-zero number a,

$$a^{-1} = 1/a \left(\frac{5}{\sqrt{2}}\right)^5 = \frac{3125}{4\sqrt{2}}$$

(vi) 
$$\left(\frac{5^{-1} \times 7^2}{5^2 \times 7^{-4}}\right)^{7/2} \times \left(\frac{5^{-2} \times 7^3}{5^3 \times 7^{-5}}\right)^{-5/2}$$

We know for any non-zero number a,

 $(a^m)^n = a^{mn}$ 

So,

$$\begin{pmatrix} \frac{(5^{-1})^{\frac{7}{2}} \times (7^2)^{\frac{7}{2}}}{(5^2)^{\frac{7}{2}} \times (7^{-4})^{\frac{7}{2}}} \end{pmatrix} \times \begin{pmatrix} \frac{(5^{-2})^{\frac{-5}{2}} \times (7^3)^{\frac{-5}{2}}}{(5^3)^{\frac{-5}{2}} \times (7^{-5})^{\frac{-5}{2}}} \end{pmatrix} = \\ = \begin{pmatrix} \frac{5^{-\frac{7}{2}} \times 7^7}{5^7 \times 7^{-14}} \end{pmatrix} \times \begin{pmatrix} \frac{5^5 \times 7^{-\frac{15}{2}}}{5^{-\frac{15}{2}} \times 7^{\frac{25}{2}}} \end{pmatrix}$$

We know for any non-zero number a,

 $a^m \times a^n = a^{m+n}$ 



$$= \left(5^{\frac{7}{2}-7} \times 7^{7+14}\right) \times \left(5^{5+\frac{15}{2}} \times 7^{-\frac{15}{2}-\frac{25}{2}}\right)$$
$$= \left(5^{\frac{-7-14}{2}} \times 7^{7+14}\right) \times \left(5^{\frac{10+15}{2}} \times 7^{\frac{-15-25}{2}}\right)$$
$$= \left(5^{\frac{-21}{2}} \times 7^{21}\right) \times \left(5^{\frac{25}{2}} \times 7^{\frac{-40}{2}}\right)$$
$$= \left(5^{\frac{-21+25}{2}} \times 7^{21-20}\right)$$
$$= \left(5^{\frac{4}{2}} \times 7^{1}\right)$$
$$= (5^{2} \times 7^{1})$$

Prove that:

(i)  $\sqrt{3 \times 5^{-3}} \div \sqrt[3]{3^{-1}} \sqrt{5} \times \sqrt[6]{3 \times 5^{6}} = \frac{3}{5}$ (ii)  $9^{3/2} - 3 \times 5^{0} - (\frac{1}{81})^{-1/2} = 15$ (iii)  $(\frac{1}{4})^{-2} - 3 \times 8^{2/3} \times 4^{0} + (\frac{9}{16})^{-1/2} = \frac{16}{3}$ (iv)  $\frac{2^{1/2} \times 3^{1/3} \times 4^{1/4}}{10^{-1/5} \times 5^{3/5}} \div \frac{3^{4/3} \times 5^{-7/5}}{4^{-3/5} \times 6} = 10$ (v)  $\sqrt{\frac{1}{4}} + (0.01)^{-1/2} - (27)^{2/3} = \frac{3}{2}$ (vi)  $\frac{2^{n} + 2^{n-1}}{2^{n+1} - 2^{n}} = \frac{3}{2}$ (vii)  $(\frac{64}{125})^{-2/3} + \frac{1}{(\frac{256}{625})^{1/4}} + (\frac{\sqrt{25}}{\sqrt[3]{64}}) = \frac{65}{16}$ (viii)  $\frac{3^{-3} \times 6^{2} \times \sqrt{98}}{5^{2} \times \sqrt[3]{1/25} \times (15)^{-4/3} \times 3^{1/3}} = 28 \sqrt{2}$ (ix)  $\frac{(0.6)^{0} - (0.1)^{-1}}{(\frac{3}{8})^{-1}(\frac{3}{2})^{3}} + (-\frac{1}{3})^{-1}} = -\frac{3}{2}$ 



```
(i) (3^{1/2+1/6}.5^{-3/2}+1) / (3^{-1/3}.5^{1/2})
_{=(3}^{2/3}.5^{-1/2}) \ / \ (3^{-1/3}.5^{1/2})
=(3^{2/3} + 1/3) / (5^{1/2} + 1/2)
=3/5
(ii) (3^2)^{3/2} - 3.1 - (1/9^2)^{-1/2}
= 3<sup>3</sup> -3 -9
=27 -3 -9
=27-12
=15
(iii) 2^{(-2)(-2)} - 3.8^{2/3} + (3/4)^{-1}
_{=2}^{4} -3.2<sup>2</sup> + 4/3
=16 -12 + 4/3
=16/3
(iv) [(2.3^{1/3})/(2^{-1/5} 5^{2/5})] \times (2^{-1/5}.3)/(3^{4/3}.5^{7/5})
= 2.3^{1/3} + 1 - 4/3 / 5^{2/5 - 7/5}
= 2.5
=10
(v) 1/2 + 1/(0.01)^{1/2} - 3^2
=1/2 + 10 - 9
=1/2 + 1
=3/2
(vi) (2^{n} + 2^{n-1})/) (2^{n+1} - 2^{n})
_{=2}^{n}(1 + 2^{-1}) / 2^{n} (2 - 1)
= [1 + (1/2)]/1
=1 + 1/2
=3/2
(vii) (125/64)<sup>2/3</sup> + (625/256)<sup>1/4</sup> + ( 5/4)
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$$=(5/4)^{2} + 5/4 + 5/4$$

$$=25/16 + 5/4 + 5/4$$

$$=65/16$$
(viii) (3<sup>-3</sup>.6<sup>2</sup>.7(2)<sup>1/2</sup>)/ (5<sup>4/3</sup>.(15)<sup>-4/3</sup>.3<sup>1/3</sup>) =28(2)<sup>1/2</sup>  
(3<sup>-3</sup>.36.7(2)<sup>1/2</sup>)/ (5<sup>4/3-4/3</sup>.(3)<sup>-1</sup>)  
(3<sup>-2</sup>.36.7(2)<sup>1/2</sup>)/ (5<sup>0</sup>)  
1/9.36.7(2)<sup>1/2</sup>  
28  $\sqrt{2}$   
(ix) {1- 1/0.1}/ { (3/8)<sup>-1</sup>(3/2)<sup>3</sup> + (-1/3)<sup>-1</sup>}  
=1-10/{ (8/3)(3/2)<sup>3</sup> + (-3)}  
=-9/(3<sup>2</sup>-3)  
= -3/2

If  $27^{x} = \frac{9}{3^{x}}$ , find *x*.

#### Answer

We have,

 $(27)^{x} = 9 / 3^{x}$   $(3^{3})^{x} = 3^{2} / 3^{x}$   $3^{3x} = 3^{2-x}$  3x = 2 - x {On equating exponents} 3x + x = 24x = 2

$$x = \frac{2}{4} = \frac{1}{2}$$

Hence, the value of x is  $\frac{1}{2}$ 

#### 5. Question

Find the values of x in each of the following:

(i)  $2^{5x} \div 2^x = \sqrt[5]{2^{20}}$ 



(ii) 
$$(2^3)^4 = (2^2)^x$$
  
(iii)  $\left(\frac{3}{5}\right)^x \left(\frac{5}{3}\right)^{2x} = \frac{125}{127}$   
(iv)  $5^{x-2} \times 3^{2x-3} = 135$   
(v)  $2^{x-5} \times 5^{x-4} = 5$   
(vi)  $2^{x-7} \times 5^{x-4} = 1250$ 

(i) we have,

- $2^{5x} \div 2^x = \sqrt[5]{2^{20}}$
- $2^{5x}/2^x = 2^{20/5}$

- $2^{5x-x} = 2^4$
- 4x = 4

- x=1
- (ii) We have,
- $2^{3.4} = 2^{2.x}$

12 = 2x

X=6

x=3

- $(2^3)^4 = (2^2)^x$

(iii) We have,

 $\left(\frac{3}{5}\right)^{x} \left(\frac{5}{3}\right)^{2x} = \frac{125}{127}$ 

 $5^{x}/3^{x} = (\frac{5}{3})^{3}$ 

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

(iv) We have,

 $5^{x-2} \times 3^{2x-3} = 135$ 

 $5^{x-2} \times 3^{2x-3} = 5 \times 27$ 

 $5^{x-2} \times 3^{2x-3} = 5^1 \times 3^3$ 

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 $5^{2x-x}/3^{2x-x} = (\frac{5}{3})^3$ 

x-2 =1 ; 2x-3 =3 x=3 ; x= 3 (v) We have,  $2^{x-5} \times 5^{x-4} = 5$   $2^{x-5} \times 5^{x-4} = 5^1 \times 2^0$ x-5=0 ; x-4 = 1 x= 4 ; x=1 +4 =5 (vi) We have,  $2^{x-7} \times 5^{x-4} = 1250$   $2^{x-7} \times 5^{x-4} = 2^1 \times 5^4$ x - 7=1; x-4 = 4 x= 8; x= 4+4 = 8

# **CCE - Formative Assessment**

#### 1. Question

Write  $(625)^{-1/4}$  in decimal form.

#### Answer



= 0.2

#### 2. Question

State the product law of exponents.

#### Answer

The product law of exponent states that while multiplying two parts having same base, you can add the exponents.

#### 3. Question

State the quotient law of exponents.

#### Answer

The quotient law of exponent states that to divide two exponents with the same base, you keep the base and subtract the powers.

#### 4. Question





State the power law of exponents.

#### Answer

The power law of exponents states that:

 $(a^n)^m = a^{n.m}$ 

Example:  $(2^3)^2 = 2^{3.2}$ 

 $= 2^6 = 64$ 

#### 5. Question

For any positive real number x, find the value of  $\left(\frac{x^a}{x^b}\right)^{a+b} \times \left(\frac{x^b}{x^c}\right)^{b+c} \times \left(\frac{x^c}{x^a}\right)^{c+a}$ 

#### Answer

 $x^{(a-b)} (a+b) \times x^{(b-c)} (b+c) \times x^{(c-a)} (c+a)$   $= x^{a.a-b.b} \times x^{b.b-c.c} \times x^{c.c-a.a}$   $= x^{a.a-b.b+b.b-c.c+c.c-a.a}$   $= x^{0} = 1$ 

#### 6. Question

Write the value of  $\{5(8^{1/3} + 27^{1/3})^3\}^{1/4}$ 

#### Answer

$$\{5(8^{1/3} + 27^{1/3})^3\}^{1/4}$$
  
=  $\{5(2 + 3)^3\}^{1/4}$   
=  $(5^4)^{1/4} = 5$ 

# 7. Question

Simplify 
$$[\{(625)^{\frac{1}{2}}\}^{-\frac{1}{4}}]^2$$

#### Answer

 $[\{(625)^{\frac{1}{2}}\}^{-\frac{1}{4}}]^2$  $= 625^{\frac{1}{2}} \cdot -\frac{1}{4} \cdot 2$ 





$$= 625^{-\frac{1}{4}} = \frac{1}{5^4}^{\frac{1}{4}}$$
$$= \frac{1}{5}^{-\frac{1}{4}}$$

For any positive real number x, write the value of  $\{(x^*)^b\}^{\frac{1}{2b}}\{(x^b)^c\}^{\frac{1}{2c}}\{(x^c)^*\}^{\frac{1}{2c}}$ 

#### Answer

 $(x)^{ab \times 1/ab} \cdot (x)^{bc \cdot 1/bc} \cdot x^{ca \cdot 1/ca}$ = x · x · x =  $x^3$ 

### 9. Question

If  $(x-1)^3 = 8$ , what is the value of  $(x+1)^2$ 

#### Answer

 $(x - 1)^3 = 8$ x - 1 = 2 x = 3  $(x + 1)^2 = (3 + 1)^2$ 

 $= 4^2 = 16$ 

#### **10.** Question

If  $2^4 \times 4^2 = 16x$ , then find the value of x.

#### Answer

 $2^4 \times 2^4 = 16x$ 

 $2^8 = 2^4 \times x$ 

 $x = 2^4 = 16$ 

# 11. Question

If  $3^{x-1}=9$  and  $4^{y+2}=64$ , What is the value of  $\frac{x}{y}$ .

#### Answer

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





x - 1 = 2 x = 3  $4^{y + 2} = 4^{3}$  y + 2 = 3y = 1

x / y = 3/1 = 3

#### 12. Question

Write the value of  $\sqrt[3]{7}\times\sqrt[3]{49}$  .

#### Answer

∛7×∛49 = (7.7<sup>2</sup>)<sup>1/3</sup>

$$= (7)^{3 \times 1/3}$$

# 13. Question

Write  $\left(\frac{1}{9}\right)^{-1/2} \times (64)^{-1/3}$  as a rational number.

# Answer

$$\left(\frac{1}{9}\right)^{1/2} \times (64)^{-1/3}$$
$$= (3^2)^{1/2} \times (1/4^3)^{-1/3}$$
$$= 3 \times 1/4 = 3/4$$

# 14. Question

Write the value of  $\sqrt[3]{125\times27}$  .

#### Answer

∛125×27

 $= (5^3 \times 3^3)^{1/3}$ 

= 5 × 3

= 15

# 1. Question

The value of  $\{2-3(2-3)^3\}^3$  is





- A. 5
- B. 125
- C. 1/5
- D. -125

- $\{2-3(2-3)^3\}^3$ =  $\{2 - 3 (-1)^3\}^3$
- $= \{2 + 3\}^3$
- $= 5^3 = 125$

# 2. Question

 $(256)^{0.16} \times (256)^{0.09}$ 

A. 4

B. 16

C. 64

D. 256.25

# Answer

 $(256)^{0.16} \times (256)^{0.09}$ 

= (256) <sup>0.16</sup> + <sup>0.09</sup>

= (256) <sup>0.25</sup>

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

# 3. Question

If  $10^{2y} = 25$ , then  $10^{-y}$  equals

A. 
$$-\frac{1}{5}$$
  
B.  $\frac{1}{50}$   
C.  $\frac{1}{625}$ 

D. <u>-</u> 5

Answer



 $10^{2y} = 25$ =  $10^{y} = x$ =  $x^{2} = 5^{2}$ = x = 5=  $1/x = 10^{-y}$ = 1/5

#### 4. Question

The value of  $x - y^{x-y}$  when x = 2 and y = -2 is

A. 18

B. -18

C. 14

D. -14

#### Answer

 $x - y^{x - y} = 2 - (-2)^{(2 + 2)}$ 

# = 2 - 16 = - 14

#### 5. Question

The product of the square root of *x* with the cube root of *x* is

- A. Cube root of the square root of x
- B. Sixth root of the fifth power of x
- C. Fifth root of the sixth power of x
- D. Sixth root of *x*

#### Answer

 $\sqrt{x} \times \sqrt[3]{x}$ 

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

 $= x^{5/6}$ 

# 6. Question

If  $9^{x+2} = 240 + 9^x$ , then x =

A. 0.5



B. 0.2

C. 0.4

D. 0.1

#### Answer

 $9^{x + 2} = 240 + 9^{x}$   $9^{x} \times 9^{2} = 240 + 9^{x}$ Let  $9^{x} = y$  81y = 240 + y 80y = 240  $y = \frac{240}{80}$   $9^{x} = 3$   $3^{2x} = 3$  2x = 1 $x = \frac{1}{2} = 0.5$ 

#### 7. Question

The seventh root of x divided by the eighth root of x is

A. *x* 

B. √<u>x</u>

C. *∿*√*x* 

D.  $\frac{1}{\sqrt[55]{\chi}}$ 

#### Answer

 $x^{1/7} / x^{1/8}$ = (x)<sup>1/7 - 1/8</sup> = (x)<sup>1/56</sup>

= <sup>56</sup>√X

# 8. Question

The square root of 64 divided by the cube root of 64 is

A. 64





B. 2 C. <u>1</u>2

D. 64<sup>2/3</sup>

### Answer

### 9. Question

Which of the following is (are) not equal to  $\left\{\left(\frac{5}{6}\right)^{1/5}\right\}^{1/6}$ ?



#### Answer

$$\left\{ \left(\frac{5}{6}\right)^{1/5} \right\}^{-1/6}$$

 $= 1 / \{ (5/6)^{1/5} \}^{1/5}$ 

= (5/6) <sup>-1/30</sup>

= (6/5) <sup>1/30</sup>

# 10. Question

When simplified  $(x^{-1} + y^{-1})^{-1}$  is equal to

A. *xy* 

B. *x* + *y* 

C.  $\frac{xy}{x+y}$ 

D. 
$$\frac{x+y}{xy}$$





$$(x^{-1} + y^{-1})^{-1}$$
  
=  $(\frac{1}{x} + \frac{1}{y})^{-1}$   
=  $(\frac{x+y}{xy})^{-1}$   
=  $(\frac{xy}{x+y})$ 

#### 11. Question

If  $8^{x+1} = 64$ , what is the value of  $3^{2x+1}$ ?

A. 1

B. 3

C. 9

D. 27

#### Answer

8 <sup>x</sup> + <sup>1</sup> - 64

 $= 8 \times + 1 = 8^2$ 

On equating powers, we get

x + 1 = 2x = 1

 $= 3^{2x + 1}$ 

 $= 3^3 = 27$ 

#### 12. Question

If 0 < y < x, which statement must be true?

- A.  $\sqrt{x} \sqrt{y} = \sqrt{x y}$
- B.  $\sqrt{x} + \sqrt{x} = \sqrt{2x}$
- C.  $x\sqrt{y} = y\sqrt{x}$
- D.  $\sqrt{xy} = \sqrt{x}\sqrt{y}$

#### Answer

Since, it is the property of square roots.

#### 13. Question





If x is a positive real number and  $x^2 = 2$ , then  $x^3 =$ 

- A. √2
- B. 2√2
- C. 3 √2
- D. 4

#### Answer

 $x^2 = 2$ 

$$x = \sqrt{2}$$

 $x^3 = (2)^{1/2 \times 3}$ 

# 14. Question

If (2<sup>3</sup>)<sup>2</sup> = 4<sup>x</sup>, then 3<sup>x</sup> = A. 3 B. 6 C. 9 D. 27 **Answer** 

 $(2^3)^2 = 2^{2x}$ 

2x = 6

x = 3

# 15. Question

If  $10^{x} = 64$ , what is the value of  $10^{\frac{x}{2}+1}$ ?

- A. 18
- B. 42
- C. 80
- D. 81

# Answer

 $10^{\frac{x}{2}+1}$  can be written as:  $(10^{x})^{1/2} \times 10^{1/2}$ 

 $= (64)^{1/2} \times 10$ 



 $= 8 \times 10$ 

= 80

#### 16. Question

If  $\frac{x}{x^{1} \cdot 5} = 8x^{-1}$  and x > 0, then x =A.  $\frac{\sqrt{2}}{4}$ B.  $2\sqrt{2}$ C. 4 D. 64

#### Answer

 $\frac{x}{x^{1.5}} = 8x^{-1}$   $\Rightarrow \frac{x}{x^{1.5}} = \frac{8}{x}$   $\Rightarrow x^{1+1-1.5} = 8$   $\Rightarrow x^{\frac{1}{2}} = 64^{\frac{1}{2}}$   $\Rightarrow x = 64$ 

#### 17. Question

If  $g = t^{2/3} + 4t^{-1/2}$ , what is the value of *g* when t = 64?

- A.  $\frac{31}{2}$
- B.  $\frac{33}{2}$
- 2
- C. 16
- D.  $\frac{257}{16}$

#### Answer

$$g = t^{2/3} + 4t^{-1/2}$$
$$= (64)^{2/3} + 4 (64)^{-1/2}$$



$$= [(64)^{1/3}]^3 + 4 \left(\frac{1}{64}\right)^{1/2}$$
$$= 4^2 + 4 \left(\frac{1}{8}\right)$$
$$= 16 + \frac{1}{2} = \frac{33}{2}$$

If  $x^{-2} = 64$ , then  $x^{1/3} + x^0 =$ 

A. 2

B. 3

C. 3/2

D. 2/3

### Answer

 $(\frac{1}{x})^2 = (8)^2$  $\frac{1}{x} = 8$  $x = \frac{1}{8}$  $x^{1/3} + x^0$  $= (\frac{1}{8})^{1/3} + (\frac{1}{8})^0$  $= \frac{1}{2} + 1 = \frac{3}{2}$ 

#### 19. Question

If  $4^x - 4^{x-1} = 24$ , then  $(2x)^x$  equals

A. 5.√5

B. √5

C. 25 √5

D. 125

# Answer

 $4^{x} - 4^{x - 1} = 24$ 

Let 4x = y

$$y - \frac{y}{4} = 24$$

4y - y = 96

# y = 32 4<sup>x</sup> = 32 2<sup>2x</sup> = 2<sup>5</sup> (2x)<sup>x</sup> = $(2 \times \frac{5}{2})^{5/2}$ = $(5)^{5/2} = 25\sqrt{5}$

### 20. Question

When simplified  $\left(-\frac{1}{27}\right)^{-2/3}$  is

A. 9

B. -9

C.  $\frac{1}{9}$ 

D.  $-\frac{1}{9}$ 

#### Answer

(-27) <sup>2/3</sup>

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

= 9

# 21. Question

Which one of the following is not equal to  $(\sqrt[3]{8})^{-1/2}$  ?

A. (∛2)<sup>-1/2</sup>

B. 8<sup>-1/6</sup>

C. 
$$\frac{1}{(\sqrt[3]{8})^{1/2}}$$

D. 
$$\frac{1}{\sqrt{2}}$$

# Answer

 $1 / (8)^{-1/2} \times \frac{1}{3}$  $= 2^{-1/2}$  $= \frac{1}{\sqrt{2}}$ 



Which one of the following is not equal to  $\left(\frac{100}{9}\right)^{-3/2}$  ?

A. 
$$\left(\frac{100}{9}\right)^{3/2}$$
  
B.  $\frac{1}{\left(\frac{100}{9}\right)^{3/2}}$   
C.  $\frac{3}{10} \times \frac{3}{10} \times \frac{3}{10}$   
D.  $\sqrt{100 \times 100}$ 

$$\mathsf{D.} \quad \sqrt{\frac{100}{9} \times \frac{100}{9} \times \frac{100}{9}}$$

# Answer

 $1 / (100/9)^{3/2}$ 

 $= (10/3)^{-3/2} \times 2$ 

$$=\frac{3}{10}\times\frac{3}{10}\times\frac{3}{10}$$

### 23. Question

When simplified  $(256)^{-(4^{-2/3})}$  is

#### A. 8

B.  $\frac{1}{8}$ 

C. 2

D.  $\frac{1}{2}$ 

#### Answer

1 / 256<sup>1/8</sup>

=  $1/2 \times 1/8$ 

= 1/2

# 24. Question

 $\frac{5^{n+2} - 6 \times 5^{n+1}}{13 \times 5^n - 2 \times 5^{n+1}}$  is equal to A.  $\frac{5}{3}$ B.  $-\frac{5}{3}$ 





C. 
$$\frac{3}{5}$$
  
D.  $-\frac{3}{5}$ 

5<sup>n</sup> (25 - 30) / 5<sup>n</sup> (13 - 10)

= -5 / 3

#### 25. Question

If a, b, c are positive real numbers, then  $\sqrt{a^{-1}b} \times \sqrt{b^{-1}c} \times \sqrt{c^{-1}a}$  is equal to

A. 1

В. *аbс* 

C. √abc

D. 
$$\frac{1}{abc}$$

#### Answer

 $(b/a)^{1/2} \times (c/b)^{1/2} \times (a/c)^{1/2}$ =  $(b/a \times c/b \times a/c)^{1/2}$ = 1

#### 26. Question

If  $\frac{3^{2x-8}}{225} = \frac{5^3}{5^x}$ , then x =A. 2 B. 3

C. 5

D. 4

# Answer

 $\frac{3^{2\times-8}}{225} = \frac{5^3}{5^{\times}}$ 

=  $5^{x} \times 3^{2x-8} = 5^{5} \times 3^{3}$ Comparing the coefficient of x we get,

= x = 5

# 27. Question

If  $\left(\frac{2}{3}\right)^{x}\left(\frac{3}{2}\right)^{2x}$  =  $\frac{81}{16}$  , then x =





- A. 2
- В. З
- C. 4
- D. 1

 $(3/2)^{-x} (3/2)^{2x} = (3/2)^4$ =  $(3/2)^{-x} + 2x = (3/2)^4$ = -x + 2x = 4= x = 4

# 28. Question

The value of  $\left\{8^{\text{-}4/3}\div2^{\text{-}2}\right\}^{1/2}$  is

- A.  $\frac{1}{2}$
- В. 2
- C.  $\frac{1}{4}$
- D. 4

# Answer

 $\{8^{4/3} \div 2^{-2}\}^{1/2}$   $= \{2^{-4} \div 2^{-2}\}^{1/2}$   $= \{1/16 \times 2^2\}^{1/2}$  1

 $=\frac{1}{2}$ 

# 29. Question

If a, b, c are positive real numbers, then  $\sqrt[5]{3125a^{10}b^5c^{10}}$  is equal to

- A. 5*a<sup>2</sup>bc<sup>2</sup>*
- В. 25*аb<sup>2</sup>с*
- C. 5*a<sup>3</sup>bc<sup>3</sup>*
- D. 125*a*<sup>2</sup>*bc*<sup>2</sup>

# Answer

 $(3125a^{10}b^5c^{10})^{1/5}$ 





 $= 5a^2bc^2$ 

# 30. Question

The value of  $64^{-1/3}$  ( $64^{1/3} - 64^{2/3}$ ), is

A. 1

B.  $\frac{1}{3}$ 

C. -3

D. -2

# Answer

 $64^{-1/3} (64^{1/3} - 64^{2/3})$ = 4<sup>-1</sup> (4 - 4<sup>2</sup>) =  $\frac{1}{4} (4 - 16)$ =  $\frac{-12}{4} = -3$ 

# 31. Question

If  $\sqrt{5^{n}} = 125$ , then  $5\sqrt[n]{64} =$ 

A. 25

B.  $\frac{1}{125}$ 

C. 625

D. 10

# Answer

<u>√5°</u> = 125

 $5^{n/2} = 5^3$ 

n/2 = 3

n = 6

 $5\sqrt[6]{64} = 5 (64)^{1/6}$ 

 $= 5 (2)^{6/6} = 10$ 

# 32. Question

```
If (16)^{2x+3} = (64)^{x+3}, then 4^{2x-2} =
A. 64
```



B. 256

C. 32

D. 512

#### Answer

 $4^{4x + 6} = 4^{3x + 9}$ = 4x + 6 = 3x + 9 = x = 3  $4^{2x - 2} = 4^{4}$ = 256

#### 33. Question

If *a*, *m*, *n* are positive integers, then  $\left\{m\sqrt{n\sqrt{a}}\right\}^{mn}$  is equal to

A. *a<sup>mn</sup>* 

В. а

C. *a<sup>m/n</sup>* 

D. 1

#### Answer

$$\left\{m\sqrt{n\sqrt{a}}\right\}^{mn}$$

We know for any non-zero number a,

 $a^m \times a^n = a^{m+n}$ 

$$= \left\{ \left(a^{\frac{1}{n}}\right)^{\frac{1}{m}} \right\}^{mn}$$

Again using  $(a^m)^n = a^{mn}$  we get,  $= \left\{ a^{\frac{1}{mn}} \right\}^{mn}$ 

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#### =a

#### 34. Question

If  $2^{-m} \times \frac{1}{2^{m}} = \frac{1}{4}$ , then  $\frac{1}{14} \left\{ (4^{m})^{1/2} + \left(\frac{1}{5^{m}}\right)^{-1} \right\}$  is equal to A.  $\frac{1}{2}$ B. 2 C. 4 D.  $-\frac{1}{4}$ 

#### Answer

 $2^{-m} \times 1 / 2^{m} = 1/4$ =  $1/2^{m} \times 1/2^{m} = 1/4$ =  $1/4^{m} = 1/4$ = m = 1 $1/14 \{(4^{m})^{1/2} + (1/5^{m})^{-1}\}$ =  $1/14 \{2 + 5\}$ =  $1/14 \times 7$ =  $\frac{1}{2}$ 

#### 35. Question

If x = 2 and y = 4, then  $\left(\frac{x}{y}\right)^{x-y} + \left(\frac{y}{x}\right)^{y-x} =$ A. 4 B. 8 C. 12 D. 2 **Answer**   $(2/4)^{2-4} + (4/2)^{4-2}$   $= (1/2)^{-2} + 2^{2}$  $= 2^{2} + 2^{2}$ 

= 8





The value of *m* for which 
$$\left[\left\{\left(\frac{1}{7^2}\right)^{-2}\right\}^{-1/3}\right]^{1/4} = 7^m$$
, is

A. 
$$-\frac{1}{3}$$

B. 
$$\frac{1}{4}$$

- C. -3
- D. 2

#### Answer

 $[{7^4}^{-1/3}]^{1/4}$ =  $(1/7^4)^{1/3} \times 1/4$ =  $(1/7)^{1/3} = 7^m$ =  $7^{-1/3} = 7^m$ = m = -1/3

# 37. Question

If 
$$\frac{2^{m+n}}{2^{n-m}} = 16$$
, and  $a = 2^{1/10}$ , then  $\frac{a^{2^{m+n-p}}}{(a^{m-2n+2p})^{-1}} =$   
A. 2  
B.  $\frac{1}{4}$   
C. 9  
D.  $\frac{1}{8}$ 

#### Answer

$$\frac{2^{m+n}}{2^{n-m}} = 2^4 \quad 2^{m+n-n+m} = 2^4 2^{2m} = 2^4 2^m = 4^m = 2^{4} 2^{1/10}$$

$$\frac{a^{2m+n-p}}{\left(a^{m-2n+2p}\right)^{-1}} = a^{2m+n-p} \times a^{m-2n+2p}$$
  
=  $a^{2m+m+n-2n-p+2p} = a^{3m-n+p}$ 

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$$= \left(\frac{1}{2^{10}}\right)^{3m-n+p}$$
$$= \left(\frac{1}{2^{10}}\right)^{3(2)-n+p}$$
$$= \left(\frac{1}{2^{10}}\right)^{6-n+p}$$

The value of  $\{(23+2^2)^{2/3}+(140 - 19)^{1/2}\}^2$ , is

A. 196

B. 289

C. 324

D. 400

### Answer

$$[(23 + 2^2)^{\frac{2}{3}} + (140 - 19)^{\frac{1}{2}}]^2$$
  
=  $[27^{\frac{2}{3}} + 121^{\frac{1}{2}}]^2$   
=  $\{3^2 + 11\}^2$   
=  $(9 + 11)^2$   
=  $(20)^2 = 400$   
**39. Question**  
If  $\sqrt{2^2} = 1024$ , then  $3^{\frac{2}{3}-4} =$   
A. 3  
B. 9  
C. 27  
D. 81

Answer





$$\sqrt{2^{n}} = 2^{10}$$

$$2^{n/2} = 2^{10}$$

$$\frac{n}{2} = 10$$

$$n = 20$$

$$= 3^{2} (n / 4 - 4)$$

$$= 3^{2} (20 / 4 - 4)$$

 $= 3^2 = 9$ 

#### 40. Question

If  $\frac{3^{5x} \times 81^2 \times 6561}{3^{2x}} = 3^7$ , then x =A. 3 B. -3 C.  $\frac{1}{3}$ D.  $-\frac{1}{3}$ 

#### Answer

 $\frac{3^{5x} \times 81^{2} \times 6561}{3^{2x}} = 3^{7}$ =  $3^{5x} \times 3^{8} \times 3^{8}/3^{2x} = 3^{7}$ =  $3^{5x} + 16 - 2x = 3^{7}$ = 3x + 16 - 2x = 7= 3x + 16 = 7= 3x = -9x = -3





