



## MATHS

### BOOKS - CHHAYA PUBLICATION MATHS (BENGALI ENGLISH)

#### LAWS OF INDICES

##### Example

1.  $(\sqrt[5]{8})^{\frac{5}{2}} \times (16)^{-\frac{3}{8}}$



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2.  $\left\{ (125)^{-2} \times (16)^{-\frac{3}{2}} \right\}^{-\frac{1}{6}}$



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$$3. 4^{\frac{1}{3}} \times \left[ 2^{\frac{1}{3}} \times 3^{\frac{1}{2}} \right]^7 \div 9^{\frac{1}{4}}$$

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$$4. \left( \frac{a^2 b^{-2}}{a^{-2} b^2} \right)^3 \times \left( \frac{a b^{-1}}{a^{-1} b} \right)^{-2}$$

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$$5. \sqrt[5]{x^8} \cdot \sqrt{x^6} \cdot \sqrt{x^{-4}}$$

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$$6. \frac{2^n \cdot 6^{m+1} \cdot 10^{m-n} \cdot 15^{m+n-2}}{4^m \cdot 3^{2m+n} \cdot 25^{m-1}}$$

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$$7. \left\{ \frac{25^{m+\frac{1}{4}} \cdot \sqrt{5 \cdot 5^m}}{5 \cdot \sqrt{5^{-m}}} \right\}^{\frac{1}{m}}$$

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$$8. \left\{ (81)^{-\frac{3}{4}} \times \frac{16^{\frac{1}{4}}}{6^{-2}} \times \left( \frac{1}{27} \right)^{-\frac{4}{3}} \right\}^{\frac{1}{3}}$$

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$$9. \frac{(0.000008)^{-\frac{2}{3}} \times (0.0081)^{\frac{3}{4}} \times 10^{-2}}{(0.0256)^{-\frac{1}{2}} \times (0.125)^{\frac{1}{3}} \times (0.3)^2}$$

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$$10. \left( \frac{x^b}{x^c} \right)^{\frac{1}{bc}} \times \left( \frac{x^c}{x^a} \right)^{\frac{1}{ca}} \times \left( \frac{x^a}{x^b} \right)^{\frac{1}{ab}}$$

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11.  $\frac{1}{x^b + x^{-c} + 1} + \frac{1}{x^c + x^{-a} + 1} + \frac{1}{x^a + x^{-b} + 1}$  given  $a+b+c=0$

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12.  $\frac{1}{1 + x^{a-b} + x^{a-c}} + \frac{1}{1 + x^{b-c} + x^{b-a}} + \frac{1}{1 + x^{c-a} + x^{c-b}}$

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13.  $\frac{\left(P + \frac{1}{q}\right)^m \cdot \left(p - \frac{1}{q}\right)^n}{\left(q + \frac{1}{p}\right)^m \cdot \left(q - \frac{1}{p}\right)^n}$

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14. If  $y = x^{\frac{1}{3}} - x^{-\frac{1}{3}}$ , prove that  $y^3 + 3y = x - \frac{1}{x}$

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15. If  $a^x = m$ ,  $a^y = n$  and  $a^z = (m^y n^x)^z$  show that  $xyz=1$

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16. If  $a^x = b^y = c^z$  and  $b^2 = ac$  prove that  $\frac{1}{x} + \frac{1}{z} = \frac{2}{y}$

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17. if  $a = xy^{p-1}$ ,  $b = xy^{q-1}$ ,  $c = xy^{r-1}$  show that  $a^{q-r} \cdot b^{r-p} \cdot c^{p-q} = 1$

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18. If  $(a^{n^2})^n = (a^{2^n})^2$  show that  $\sqrt[n+1]{n^3} = 2$

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19. If  $x = 3 + 3^{\frac{2}{3}} + 3^{\frac{1}{3}}$  find the value of  $x^3 - 9x^2 + 18x - 12$



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20. Multiply  $\left(x^{\frac{2}{3}} + 3x^{\frac{1}{3}} \cdot y^{\frac{1}{3}} + 9y^{\frac{2}{3}}\right)$  by  $\left(x^{\frac{1}{3}} - 3y^{\frac{1}{3}}\right)$



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21. Divide :  $\left(a^{2^n} - b^{2^n}\right)$  by  $\left(a^{2^{n-1}} + b^{2^{n-1}}\right)$



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22. Factorise :  $x+y$



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23. If  $x^{p^q} = (x^p)^q$  find  $p$  in terms of  $q$



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24. Arrange in the ascending order of magnitude :  $2^{63}$ ,  $3^{45}$ ,  $5^{27}$ ,  $6^{18}$

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25. Given  $(256 + 0.25)^2 - (256 - 0.25)^2 = 2^{4x}$ , find the value of  $3^x$

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26. If  $8 \cdot 3^{4x+3} + 3^{11} = 3^{13}$  find  $3^{-x}$

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27. If  $3 \cdot 4^{x+1} - 2 \cdot 4^x = 160$  find the value of  $x^x$

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28. Solve:  $x^x \cdot \sqrt{x} = (x\sqrt{x})^x$



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29. Solve:  $9 \times 81^x = \frac{1}{27^{x-3}}$



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30. Solve :  $4^{x-1} = 3 \cdot 2^x - 8$



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31. Solve:  $2^{2x+1} \cdot 2^{3y+1} = 8, 2^{x+2} \cdot 2^{y+2} = 16$



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32. Solve :  $2^x + 3^y = 17, 2^{x+2} - 3^{y+1} = 5$



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33. Solve :  $a^{2x^2} + a^{2x+12} = 2 \cdot a^{x^2+x+6}$



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34. If  $pqr=1$  show that

$$\frac{1}{1+p+q^{-1}} + \frac{1}{1+q+r^{-1}} + \frac{1}{1+r+p^{-1}} = 1$$



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35. If  $ax^{10} = by^{10} = cz^{10}$  and  $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1$  then prove that

$$(ax^9 + by^9 + cz^9)^{\frac{1}{10}} = a^{\frac{1}{10}} + b^{\frac{1}{10}} + c^{\frac{1}{10}}$$



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## Multiple Choice Type Questions

1.  $\left(\frac{625}{81}\right)^{-3/4} = ?$



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$$2. 3\sqrt{\left(\frac{1}{64}\right)^{1/2}} =$$



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$$3. \text{ If } 2^x = 3^{-x} \text{ then } x = ?$$



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$$4. \text{ if } (27)^x = (81)^y \text{ then } x:y =$$



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$$5. \text{ If } x=5 \text{ and } y=3 \text{ then } (x + y)^{x/y} = ?$$



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6. If  $a \neq b \neq 0$  and  $a^x = b^x$  then  $x = ?$

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7. If  $4^x = 8^3$  then  $x =$

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8. If  $(5^5 + 0.01)^2 - (5^5 - 0.01)^2 = 5^x$  then  $x =$

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9. State which of the following is the value of  $(0.243)^{0.2} \times (10)^{0.6}$

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10. If  $\left(20^{-x} = \frac{1}{7}\right)$  then which of the following is the value of  $(20)^{2x}$  ?

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11. State the solution of the equation  $3 \cdot 27^x = 9^{x+4}$

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12. State the value of  $2^{1/2} \times 2^{-1/2} \times (32)^{1/5}$  is ?

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13. If  $4.5^x = 500$  then the value of  $x^x$  is?

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14. The solution of the equation  $2^{2x+1} + 2^9 = 2^{10}$  is?



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## Very Short Answer Type Questions

1. Simplify  $3\sqrt{x^4\sqrt{x^{-5}\sqrt{x^6}}}$



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2. Arrange in ascending order of magnitudes

$$\sqrt[3]{9}, \sqrt[4]{20}, 6\sqrt{25}$$



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3. Arrange in ascending order of magnitudes

$$5^{\frac{1}{2}}, 10^{\frac{1}{4}}, 6^{\frac{1}{3}}$$



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4. Arrange in ascending order of magnitudes

$$2^{60}, 3^{48}, 4^{36}, 5^{24}$$

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5. Which is greater  $3^{3^3}$  or  $(3^3)^3$  find the difference of their values

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6. Simply

$$\left\{ (a^{-5})^{\frac{3}{5}} \right\}^{-\frac{1}{3}}$$

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7. Simply

$$8x^{-\frac{3}{4}} \times \frac{1}{4}xy \div 3y^{\frac{2}{3}}$$

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### 8. Simply

$$(27)^{\frac{5}{3}} \div (125)^{-\frac{4}{3}} \times 9^{-\frac{3}{2}}$$



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### 9. Simply

$$(x^2y^2)^{-\frac{1}{6}} \div (y^3)^{\frac{1}{9}} \times (x^2)^{\frac{1}{3}}$$



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### 10. Simply

$$\sqrt[3a]{x^4} \div \sqrt[5a]{x^{-4}}$$



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### 11. Simply

$$3a\sqrt{x^4} \div 5a\sqrt{x^{-4}}$$



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### 12. Simply

$$x^{a-b} \cdot x^{b-c} \cdot x^{c-a}$$



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### 13. Simply

$$\left\{ (a^m)^{m - \frac{1}{m}} \right\}^{\frac{1}{m+1}}$$



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### 14. Simply

$$(a + b)^m \cdot (a - b)^m \cdot (a^2 + b^2)^m$$

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## Short Answer Type Questions

1. Simply

$$\left(\frac{x^m}{x^n}\right)^{m^2+mn+n^2} \times \left(\frac{x^n}{x^l}\right)^{n^2+nl+l^2} \times \left(\frac{x^l}{x^m}\right)^{l^2+lm+m^2}$$

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2. Simply

$$\left(\frac{a^p}{a^q}\right)^{p+q-r} \cdot \left(\frac{a^q}{a^r}\right)^{q+r-p} \cdot \left(\frac{a^r}{a^p}\right)^{r+p-q}$$

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3. Simply

$$\left(x^{\frac{1}{a-b}}\right)^{\frac{1}{a-c}} \times \left(x^{\frac{1}{b-a}}\right)^{\frac{1}{b-c}} \times \left(x^{\frac{1}{c-a}}\right)^{\frac{1}{c-b}}$$

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#### 4. Simply

$$\left(\frac{x^p}{x^q}\right)^{p+q} \div \left(\frac{x^{p+q}}{x^{p-q}}\right)^{\frac{p^2}{q}}$$



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#### 5. Prove

$$\left(\frac{1}{1 + x^{b-a} + x^{c-a}}\right) + \left(\frac{1}{1 + x^{a-b} + x^{c-b}}\right) + \left(\frac{1}{1 + x^{a-c} + x^{b-c}}\right) = 1$$



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#### 6. Prove

$$\sqrt[p+q]{\frac{x^{p^2}}{x^{q^2}}} \times \sqrt[q+r]{\frac{x^{q^2}}{x^{r^2}}} \times \sqrt[r+p]{\frac{x^{r^2}}{x^{p^2}}} = 1$$



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7. Prove

$$\sqrt[l]{\frac{x^l}{x^n}} \times \sqrt[m]{\frac{x^n}{x^m}} \times \sqrt[m]{\frac{x^m}{x^l}} = 1$$



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8. If  $x = 2^{\frac{2}{3}} + 2^{\frac{1}{3}}$  show that  $x^3 - 6x = 6$



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9. If  $a = 2^{\frac{1}{3}} - 2^{-\frac{1}{3}}$  show that  $2a^3 + 6a - 3 = 0$



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10. If  $x = 2 + 2^{\frac{2}{3}} + 2^{\frac{1}{3}}$  show that  $x^3 - 6x^2 + 6x - 2 = 0$



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11. If  $x^{\frac{1}{a}} = y^{\frac{1}{b}} = z^{\frac{1}{c}}$  and  $xyz = 1$  show that  $a+b+c=0$



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12. If  $a^{\frac{1}{3}} + b^{\frac{1}{3}} + c^{\frac{1}{3}} = 0$  show that  $(a + b + c)^3 = 27 abc$



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13. If  $x^a = y^b = (xy)^c$  prove that  $ab=c(a+b)$



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14. If  $x^a = c^b$  and  $x^c = c^a$  show that  $a^2 = bc$



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15. If  $x^y = y^x$  show that  $\left(\frac{x}{y}\right)^{\frac{x}{y}} = x^{\frac{x}{y}-1}$  if further  $x=2y$  then prove that  $y=2$

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16. If  $p^a = q^b = r^c$  and  $pqr=1$  show that  $ab+bc+ca=0$

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17. If  $2^x = 3^y = 12^z$  show that  $xy=z(x+2y)$

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18. If  $\left(a - \frac{1}{a}\right)^2 = 3$  show that  $a^6 + \frac{1}{a^6} = 110$

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19. If  $x^3 = y^4$  prove that  $\left(\frac{x}{y}\right)^{\frac{4}{3}} + \left(\frac{y}{x}\right)^{\frac{3}{4}} = x^{\frac{1}{3}} + y^{-\frac{1}{4}}$

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20. If  $a^x = b$ ,  $b^y = c$ ,  $c^z = a$

show that  $xyz = 1$  (a,b,c positive numbers)

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21. If  $(x^{n^3})^n = (x^{3^n})^3$  show that  $\sqrt[n+1]{n^4} = 3$

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22. If  $x^{p^q} = (x^{\sqrt{p}})^q$  find p in terms of q

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23. If  $(56)^a = (5.6)^b = 10^c$  show that  $\frac{1}{a} = \frac{1}{b} + \frac{1}{c}$

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24.  $6^{2x+4} = 3^{3x} \cdot 2^{x+8}$

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25.  $4^x - 3 \cdot 2^{x+2} + 2^5 = 0$

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26.  $3^{2x} + 9 = 10 \cdot 3^x$

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27.  $3^x + 3^y = 4, 3^{-x} + 3^{-y} = \frac{4}{3}$



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$$28. 8^x \cdot 4^y = 128, 9^{x+y} = (27)^{xy}$$



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$$29. 5^x + 3^y = 14, 5^{x-1} + 3^{y-1} = 4$$



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$$30. x^y = y^x, x = 2y$$



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$$31. x^y = y^x, x^2 = y^3$$



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32.  $a^x = x^y, a^y = x^x$



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33.  $2^x + 2^y = 12, x + y = 5$



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34.  $5^{13-2x} + 2^{x-2} = 2^{x+2} + 5^{11-2x}$



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## Long Answer Type Questions

1.  $6(4^x + 9^x) = 13.6^x$



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2. Find the simplest value of  $\left[1 - \left\{1 - (1 - x^3)^{-1}\right\}^{-1}\right]^{-\frac{1}{3}}$  when  $x=0.1$

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3. Solve  $\frac{2^x + 2^{-x}}{2^x - 2^{-x}} = \frac{16^{\frac{1}{x}} + 16^{-\frac{1}{x}}}{16^{\frac{1}{x}} - 16^{-\frac{1}{x}}}$

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4. If  $a+b+c=0$  Prove that  $\sqrt[bc]{\frac{x^{a^2}}{x^{bc}}} \times \sqrt[ca]{\frac{x^{b^2}}{x^{ca}}} \times \sqrt[ab]{\frac{x^{c^2}}{x^{ab}}} = 1$

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5. If  $x^a \cdot x^b \cdot x^c = 1$  ( $x \neq 0$ ) show that  $x^{\frac{a^2}{bc}} \cdot x^{\frac{b^2}{ca}} \cdot x^{\frac{c^2}{ab}} = x^3$

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6. Find the value of  $x$ :  $(\sqrt{3} + \sqrt{2})^x + (\sqrt{3} - \sqrt{2})^x = 10$



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